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Technical Report Overview

Report: 2022 Greenhills Creek Aquatic Effects Assessment and Monitoring Program Report

Overview: This report presents the 2022 results of the Greenhills Creek Local Aquatic Effects Monitoring Program (GHC LAEMP) (formerly GGCAMP). The 2022 program was designed to monitor and evaluate site-specific indicators of aquatic ecosystem conditions within Greenhills and Gardine creeks, including within the Greenhills Creek Sedimentation Pond.

This report was prepared for Teck by Minnow Environmental Inc.

For More Information

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Future studies will be made available at **teck.com/elkvalley.**

2022 Greenhills Creek Aquatic Effects Assessment and Monitoring Program Report

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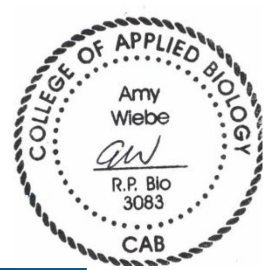
June 2023

2022 Greenhills Creek Aquatic Effects Assessment and Monitoring Program Report



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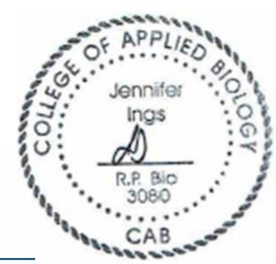

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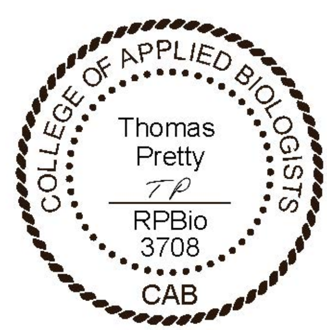

EXECUTIVE SUMMARY

This report presents the results of the 2022 Greenhills Creek Aquatic Effects Assessment and Monitoring Program (GC LAEMP), which monitors and evaluates site-specific indicators of aquatic ecosystem conditions within Greenhills and Gardine creeks and the Greenhills Creek Sedimentation Pond. Calcite (calcium carbonate precipitate) has been observed in creeks in the Elk River watershed and Greenhills Creek was selected as the first creek for calcite management. Application of antiscalant to Lower Greenhills Creek began in October 2017 and has been successful at preventing further calcite deposition. Consequently, to prevent calcite formation in additional parts of the creek, Teck relocated the antiscalant addition system (AAS) to Upper Greenhills Creek, where it began operating in November 2022.

Data collected as part of the GC LAEMP are expected to address three key questions, which are detailed below, along with summaries of the key study results associated with each question. The data collected in 2022 to support the GC LAEMP represented a seventh year of monitoring on Upper Greenhills Creek, a fourth year of monitoring on Gardine Creek, a fifth year of sampling in Greenhills Creek Sedimentation Pond, and a fifth year of aquatic effects monitoring following initiation of antiscalant addition in Lower Greenhills Creek.

Question 1 ("*What is the current status of aquatic health in Greenhills and Gardine creeks, as evidenced by physical, chemical, and biological conditions?*") was addressed by characterizing existing aquatic environmental conditions within the Greenhills Creek watershed in 2022.

Although Greenhills and Gardine creeks are mine-exposed, aqueous concentrations of most mine-related constituents were below relevant guidelines, screening values, benchmarks, and updated effect concentrations (EC) in 2022. Exceptions included concentrations of total dissolved solids (TDS), sulphate, total uranium, and dissolved cadmium and nickel. Concentrations of TDS and sulphate were often above applicable screening values or updated EC, respectively, in 2022, and were higher in Greenhills versus Gardine creek. Concentrations of total uranium were also above the British Columbia Water Quality Guideline (BC WQG) throughout Greenhills Creek. Concentrations of dissolved cadmium and dissolved nickel were above Elk Valley Water Quality Plan (EVWQP) benchmarks and proposed benchmarks, respectively, at upstream sampling locations on Upper Greenhills Creek, but exhibited patterns of dilution downstream from the confluence with Gardine Creek.

In 2022, calcite was present throughout Greenhills Creek and in lower Gardine Creek. The section of Lower Greenhills Creek downstream from the historical AAS had significantly lower calcite presence (C_p) and concretion (C_c) scores relative to biological monitoring areas upstream from treatment (i.e., on Upper Greenhills Creek).

Sediment chemistry analyses for Gardine Creek, Lower Greenhills Creek, and the Greenhills Creek Sedimentation Pond indicated concentrations of cadmium, nickel, and selenium in the potentially mobile[1] sediment fractions were frequently above the lower British Columbia Working Sediment Quality Guidelines (BC WSQG) in 2022. Additionally, a number of polycyclic aromatic hydrocarbons (PAHs) had concentrations that frequently exceeded the BC WSQG.

Upstream-to-downstream differences in benthic invertebrate communities were identified within Greenhills and Gardine creeks in 2022. These differences included higher benthic invertebrate biomass, percent (%) Ephemeroptera, Plecoptera, and Trichoptera (EPT), and family richness and lower %Diptera in Lower versus Upper Greenhills Creek. Additionally, %EPT was lower and %Diptera was higher in lower versus upper Gardine Creek, where C_p, C_c, and concentrations of TDS and sulphate were lower in 2022. Overall, %EPT and %Diptera were strongly negatively or positively correlated, respectively, with TDS and sulphate concentrations. Although the potential influence of TDS and sulphate cannot be ruled out, spatial patterns in benthic invertebrate communities are thought to be largely attributed to calcite conditions.

Selenium concentrations in benthic invertebrate tissues tended to reflect patterns in aqueous selenium speciation. Samples from Lower Greenhills Creek had relatively high (i.e., relative to other areas in the watershed, the reference area normal range, and EVWQP Level 2 Benchmarks) selenium concentrations in composite-taxa benthic invertebrate tissues in 2022. This was likely due to enhanced generation of organoselenium species in the Greenhills Creek Sedimentation Pond and carry-over effects downstream.

Westslope cutthroat trout (WCT; *Oncorhynchus clarkii lewisi*), are the only fish species in the Greenhills Creek watershed. Fish within Upper Greenhills and Gardine creeks and the Greenhills Creek Sedimentation Pond represent an isolated population. The WCT in Lower Greenhills Creek are considered part of the Upper Fording River (UFR) population and are unable to access habitats within and upstream from the pond.

In 2022, WCT population monitoring was completed upstream and downstream from the pond to characterize fish spawning, densities, and condition, as well as the size of age-0 fish. Redds were observed in Gardine Creek and Upper and Lower Greenhills creeks, but the estimated total number of unique nests was low. Estimated lineal densities[2] of age-1 and age-2+ WCT were higher in Lower Greenhills and Gardine creeks relative to Upper Greenhills Creek. Estimated differences (2%) in fish condition among Upper and Lower Greenhills and Gardine

[1] The potentially mobile sediment fractions represent a highly conservative estimate of the bioavailable constituent concentrations, given that it would take highly unusual/aggressive reducing and oxidizing conditions, respectively, to mobilize fractions 3 and 4 and these conditions are not likely to occur in Greenhills and Gardine creeks.

[2] I.e., densities calculated based on units of stream length, rather than stream area.

creeks in 2022 were not considered biologically meaningful, given the uncertainty in the estimates. The estimated mean length of age-0 WCT was larger in Lower Greenhills than all other monitored tributaries and the UFR main stem.

Answering question 2 ("*Have physical, chemical, and/or biological conditions indicative of aquatic health in Greenhills and Gardine creeks changed over time and are the changes unexpected based on the activities and projects occurring in the watershed?"*) required temporal evaluations of physical, chemical, and biological data to identify patterns that may be indicative of unexpected changes over time.

Overall, aqueous concentrations of mine-related constituents in Greenhills and Gardine creeks in 2022 were lower than or comparable to those reported for the base years of monitoring, and these results are generally as expected.[3]

The C_c scores collected from riffle habitats as part of the GC LAEMP were lower in Lower Greenhills Creek in 2022 relative to 2017. These results are supported by the results of the Regional Calcite Monitoring Program. The reduction in C_C observed for Lower Greenhills Creek is considered indicative of effective treatment with antiscalant.

Concentrations of metals in bulk sediment samples from Greenhills and Gardine creeks were generally lower than or comparable to previous years, whereas concentrations of PAHs in Gardine Creek sediments were higher in 2022 relative to 2019 and 2020. Results of Sequential Extraction Analysis (SEA) for Gardine Creek indicated that the distribution of metals among sediment fractions was generally consistent over time.

Benthic invertebrate community endpoints in 2022 were generally consistent with observations from previous years and few temporal patterns were identified. In samples from Lower Greenhills Creek (treated) %Ephemeroptera increased relative Upper Greenhills Creek (untreated) based on comparisons among years with and prior to initiation of water treatment on Lower Greenhills Creek.

Estimated densities and abundances of age-1 or age-2+ WCT, fish condition, and incidences of external anomalies changed over time within the Greenhills Creek watershed. Estimated densities and abundances were similar in 2022 compared to 2020 and 2021, but were lower compared to previous years (i.e., 2015 to 2019). Estimated fish condition decreased between 2017 and 2021 in Upper Greenhills Creek and between 2017 and 2020 in Lower Greenhills Creek, relative to a typical year and UFR sub-population. In 2022 however, fish

[3] E.g., based on activities within the watershed, the locations of individual monthly water quality monitoring stations relative to sources of dilution (e.g., Gardine Creek) or the AAS, stabilization of the east spoil (post-2014 failure), and cessation of pumping from the Cougar Phase 3 Pit after 2018.

condition in Upper and Lower Greenhills Creek was improved relative to 2020 and 2021, respectively, and was considered comparable to or better than a typical year and UFR sub-population, based on comparisons for a 100 mm fish. Finally, no external anomalies or parasites were reported for WCT captured from the Greenhills Creek watershed in 2022.

Question 3 ("*Can observed changes be linked to: antiscalant addition in Lower Greenhills Creek; activities to support relocation of the antiscalant addition facility to Upper Greenhills Creek; or initiation of antiscalant addition on Upper Greenhills Creek starting in October 2022?*") was addressed by comparing the treated area on Lower Greenhills Creek to untreated areas before and after initiation of antiscalant addition in 2017.

Overall, antiscalant addition has had limited influence on water quality in Lower Greenhills Creek; differences in aqueous concentrations of mine-related constituents upstream and downstream from treatment in 2022 did not differ significantly from pre-treatment. Total and dissolved molybdenum were the only exceptions as molybdenum is a component of the antiscalant compound. Elevated concentrations of organoselenium species in water from Lower Greenhills Creek appear to be attributed to the influence of the Greenhills Creek Sedimentation Pond, rather than water treatment.

The lower incidence of calcite concretion in Lower Greenhills Creek throughout 2020 to 2022 is primarily attributed to successful water treatment with antiscalant. Overall, it appears that the antiscalant addition has prevented further calcification of the stream bed in Lower Greenhills Creek, downstream from the historical AAS location.

The observed increases in %Ephemeroptera within Lower Greenhills Creek following initiation of antiscalant addition are considered indicative of improvements in calcite conditions downstream from the AAS (i.e., prevention of further calcite deposition and lower C_c scores).

The WCT captured from Lower Greenhills Creek in 2022 were in good condition and good external health. Therefore, it is concluded that antiscalant addition did not negatively impact these endpoints in 2022. Conditions of water quality, calcite concretion, and food availability have remained unchanged or improved relative to pre-treatment.

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ACRONYMS AND ABBREVIATIONS

AAS – Antiscalant Addition System

ADIT – Aquatic Data Integration Tool

ALS – ALS Environmental

AMP – Adaptive Management Plan

ANOVA – Analysis of Variance

BACI – Before-After-Control-Impact

BC – British Columbia

BC WQG – British Columbia Water Quality Guideline

BC WSQG – British Columbia Working Sediment Quality Guidelines

B-tool – Selenium Speciation Bioaccumulation Tool

CALA – Canadian Association for Laboratory Accreditation Inc.

C_c – Calcite Concretion Score

CCME – Canadian Council of Ministers of the Environment

CI – Calcite Index

CI' – Calcite Index Prime

CMm – Coal Mountain Operation

Cordillera – Cordillera Consulting

C_p – Calcite Presence Score

C_p' – Calcite Presence Score Prime

DQR – Data Quality Review

EC – Effect Concentration

EMA – *Environmental Management Act*

EMC – Environmental Monitoring Committee

ENV/BCMOECCS – British Columbia Ministry of Environment and Climate Change Strategy

EPT – Ephemeroptera, Plecoptera, and Trichoptera

EVO – Elkview Operation

EVWQP – Elk Valley Water Quality Plan

EWT – Early Warning Triggers

GC LAEMP – Greenhills Creek Aquatic Effects Assessment and Monitoring Program

GHO – Greenhills Operation

KU – Key Uncertainty

LAEMP – Local Aquatic Effects Monitoring Program

LPL – Lowest Practical Level

Minnow – Minnow Environmental Inc.

MOD – Magnitude of Difference

MQ – Management Question

NELAP – National Environmental Laboratory Accreditation Program

PAH – Polycyclic Aromatic Hydrocarbon

QA/QC – Quality Assurance/ Quality Control

QC – Quality Control

RAEMP – Regional Aquatic Effects Monitoring Program

SEA – Sequential Extraction Analysis

SPO – Site Performance Objective

SQI – Sediment Quality Indices

TDS – Total Dissolved Solids

Teck – Teck Coal Limited

TOC – Total Organic Carbon

Trich – TrichAnalytics Inc.

TSS – Total Suspended Solids

UFR – Upper Fording River

WCT – Westslope Cutthroat Trout

ZEAS – Zeas Inc.

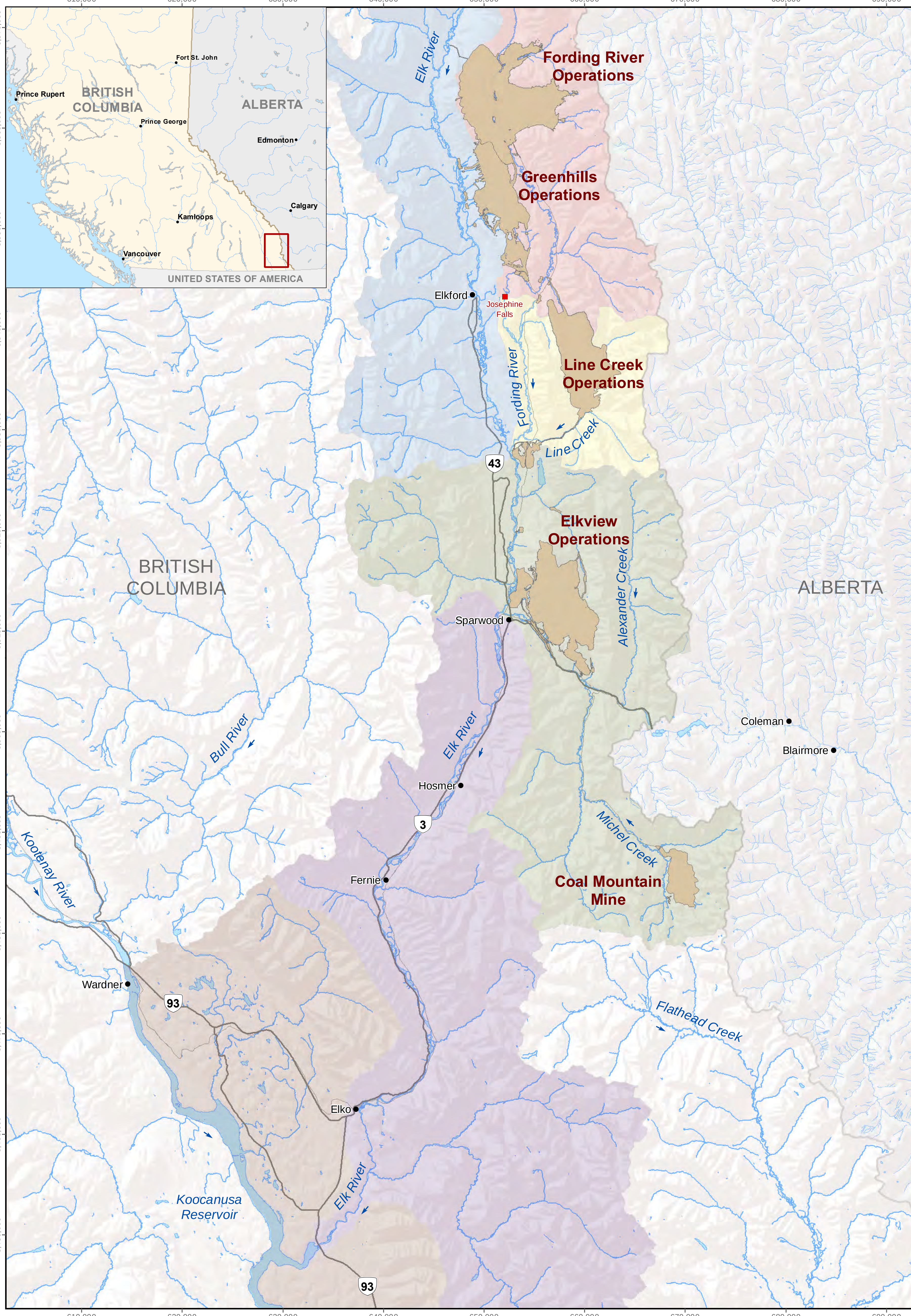
1 INTRODUCTION

1.1 Site Background

Teck Coal Limited (Teck) owns five open pit, metallurgical coal mines in the Elk River watershed in southeast British Columbia (BC; Figure 1.1). Calcite (calcium carbonate precipitate) has been observed in several creeks within the Elk River watershed downstream from Teck's mines and, to a lesser extent, in reference creeks unaffected by mining. In parts of some creeks, calcite precipitation completely covers portions of the creek bed, making the substrate largely immovable. The Elk Valley Water Quality Plan (EVWQP; Teck 2014) identified four priority creeks for calcite management: Greenhills Creek (Greenhills Operations [GHO]), Corbin Creek (Coal Mountain Mine [CMm]), Dry Creek (Elkview Operations [EVO]), and Erickson Creek (EVO). Permit 107517 (the Permit; *Environmental Management Act [EMA]*) and Permit C-137 (*Mines Act*) required that Teck initiate calcite management in at least one priority creek by October 31, 2017. Greenhills Creek was selected as the first creek for calcite management.

Focused pre-treatment studies were initiated in Greenhills Creek in 2016 to characterize the existing aquatic environment and support the evaluation of potential effects associated with proposed calcite management. Application of antiscalant to Lower Greenhills Creek (i.e., the portion of the creek from immediately downstream of Greenhills Creek Sedimentation Pond to the Fording River) was initiated on October 23, 2017. In 2018, the Lower Greenhills Creek Aquatics Effect Monitoring Program was initiated and separate baseline monitoring continued on Upper Greenhills Creek. In 2019, focused studies were initiated on Gardine Creek, a tributary to Greenhills Creek. Monitoring completed at Upper Greenhills and Gardine creeks and the aquatic effects monitoring completed at Lower Greenhills Creek in 2019 were combined into a single program and report (Minnow 2020a). In 2021, the program was renamed as the Greenhills and Gardine Creeks Aquatic Monitoring Program. However, as described below in Section 1.2, the June 30, 2022 Permit amendment designated the program as the Greenhills Creek Aquatic Effects Assessment and Monitoring Program (GC LAEMP).

Application of antiscalant to Lower Greenhills Creek has been successful at preventing further calcite deposition in the approximately 750 metre (m) section of creek downstream from the Greenhills Creek Sedimentation Pond to the confluence with the Upper Fording River (UFR) (Minnow 2020a, 2021a, 2022a). As such, Teck proposed implementing calcite management via antiscalant addition within Upper Greenhills Creek and the Permit was amended on June 30, 2022 to authorize discharge of effluent from the Upper Greenhills Creek antiscalant addition system (AAS). Antiscalant addition on Lower Greenhills Creek ceased on August 21, 2022 and the AAS



LEGEND

- Teck Coal Mine Operations
- Management Unit 1
- Management Unit 2
- Management Unit 3
- Management Unit 4
- Management Unit 5
- Management Unit 6

Teck's Coal Mine Operations within the Elk River Watershed, Southeast British Columbia

0 5 10 20 km

Projection: North American Datum 1983 UTM Zone 11U

Date: June 2023
Project 227202.0016

minnow environmental inc.

Figure 1.1

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 227202.0016 - 2022 GGCAMP\D - GIS\2022 Report\22-16 Figure 1.1 Teck Coal Limited Operation.mxd was moved to Upper Greenhills Creek where it has been operating intermittently since November 7, 2022.

1.2 Regulatory Background

This annual report for the GC LAEMP is being submitted to the Director of the Ministry of Environment and Climate Change Strategy (ENV/BCMOECCS) and the Environmental Monitoring Committee (EMC) by Teck to satisfy the requirements of amended Permit Sections 8.3.5 and 9.5 (last amended May 18, 2023). Section 8.3.5 of the amended Permit is as follows:

The permittee must implement the monitoring program as described in the approved monitoring program "Greenhills Creek Aquatic Effects Assessment and Monitoring Program" (Greenhills Creek LAEMP). Changes to the aquatic effects monitoring program must be outlined in a study design that is reviewed by the EMC. The permittee must submit the study design to the Director prior to implementation and must describe how EMC advice was considered."

Section 9.5 of the Permit is as follows:

"The LAEMP Annual Reports must be reported on in accordance with generally accepted standards of good scientific practice in a written report and submitted to the director of each year following the data collection calendar year on the following dates: v. Greenhills Creek LAEMP: June 30."

The original study design was submitted to satisfy requirements under Permit Appendix 5B and was approved on October 13, 2017. As part of a June 30, 2022 Permit amendment, Appendix 5B was revised such that the program was moved to Section 8.3 of the Permit (thereby rendering it a Local Aquatic Effects Monitoring Program [LAEMP]). Additionally, Appendix 5B was revised to include an approval for the AAS to operate on Upper Greenhills Creek.

The activities described in this GC LAEMP report for 2022 were completed in accordance with the study designs submitted in July 2021 and August 2022 (Minnow 2021b, 2022b).[4] The study design for the GC LAEMP is updated annually and is submitted to the EMC and the ENV/BCMOECCS Director. Study design updates that were incorporated into the 2022 field data collection and reporting cycle included the following:

[4] The sampling completed in February 2022 was completed in accordance with the 2021 GC LAEMP study design (Minnow 2021b) and the September 2022 sampling was completed in accordance with the 2022 study design (Minnow 2022b). Unlike the study designs, the reporting cycle for the GC LAEMP coincides with the calendar year (i.e., from January 1, 2022 to December 31, 2022, inclusive).

- cessation of winter benthic invertebrate tissue chemistry sampling (and supporting water quality data collection) at biological monitoring areas other than RG_GHBP on Lower Greenhills Creek;
- addition of a new biological monitoring area (RG_GHDT) on Upper Greenhills Creek downstream from the new AAS location and upstream from the Gardine Creek mouth;
- cessation of comparisons to regional reference area normal ranges, which are based on timed kick data, for benthic invertebrate community samples collected using area-based methods (see Minnow 2022a); and
- integration of Westslope cutthroat trout (WCT; *Oncorhynchus clarkii lewisi*) population monitoring activities within the framework of the UFR Fish Population Monitoring Program.

These updates were made following careful consideration of the advice and input received from the EMC during, and in the weeks following, engagement sessions held on May 5, 2021 and May 27, 2022.

1.3 Objectives

The overarching objective of the GC LAEMP is to monitor and evaluate site-specific indicators of aquatic ecosystem conditions within Greenhills and Gardine creeks, including within the Greenhills Creek Sedimentation Pond. The program is designed with a primary focus on monitoring aquatic conditions to support the assessment of mine-related effects and provide information for assessing future changes that may result from activities within the watershed (e.g., relocation of the AAS). By assessing site -specific conditions on a more focused basis, the 2022 GC LAEMP also supports the Regional Aquatic Effects Monitoring Program (RAEMP) and the Adaptive Management Plan (AMP). This is achieved by helping to answer questions around effectiveness of calcite management and achievement of site performance objectives (SPOs).

1.4 Key Questions

In early 2021, the study questions associated with previous iterations of the GC LAEMP were reviewed and updated to better reflect the aquatic monitoring needs for Greenhills and Gardine creeks, based on the activities that are ongoing or proposed in the watershed. Early versions of these study questions were presented to the EMC on May 5, 2021 and included in the 2021 study design for the program (Minnow 2021b). For 2022, study questions 1 and 2 were unchanged from 2021, and are as follows:

1. *What is the current status of aquatic health in Greenhills and Gardine creeks, as evidenced by physical, chemical, and biological conditions?*
2. *Have physical, chemical, and/or biological conditions indicative of aquatic health in Greenhills and Gardine creeks changed over time and are the changes unexpected based on the activities and projects occurring in the watershed?*

Study question 3 ("*Can observed changes be linked to antiscalant addition in Lower Greenhills Creek, specifically?*") from 2021 was revised slightly to reflect relocation of the AAS to Upper Greenhills Creek in 2022:

3. *Can observed changes be linked to: antiscalant addition in Lower Greenhills Creek; activities to support relocation of the antiscalant addition facility to Upper Greenhills Creek; or initiation of antiscalant addition on Upper Greenhills Creek starting in October[5] 2022?*

Study questions 1 and 2 were reviewed with the EMC on May 27, 2022. Study question 3 was updated following Teck's receipt of the June 30, 2022 approval to relocate the AAS from Lower Greenhills Creek to Upper Greenhills Creek.

The study questions were addressed by characterizing existing conditions within Greenhills and Gardine creeks and evaluating changes over time (i.e., since the initiation of focused monitoring in 2016) to identify any patterns that may be indicative of unexpected changes (i.e., relative to predictions or general expectations[6]). Endpoints related to water quality, selenium speciation, substrate condition (i.e., calcite index [CI] and calcite index prime [CI'], sediment characteristics, and sediment quality), and the status of aquatic organisms (i.e., benthic invertebrate abundance and community structure, benthic invertebrate biomass, and benthic invertebrate tissue chemistry) were evaluated, as data allowed. As indicated in Section 1.2, fish monitoring was completed as part of a unified, watershed-wide framework implemented by Teck's Fish Team (see Sections 2.6 and 3.5). Relevant data (e.g., flows and water temperatures, CI and CI') collected as part of other monitoring programs (e.g., the Regional Calcite Monitoring Program) were integrated into this 2022 report for the GC LAEMP, as appropriate, to address the study questions.

[5] Antiscalant addition on Upper Greenhills Creek commenced on November 7, 2022.

[6] "General expectations" may include predictions that were presented in approved plans in a narrative or semi-quantitative form or biological characteristics that are considered to be consistent with expectations based on observed chemical concentrations or calcite conditions, for example.

1.5 Linkages to Adaptive Management

As required in Section 10 of the Permit, Teck developed an AMP to support implementation of the EVWQP to achieve water quality targets and calcite targets, ensure that human health and the environment are protected, and where necessary, restored, and to facilitate continuous improvement of water quality in the Elk Valley. The AMP was most recently updated in December 2021 (Teck 2021). Adaptive management is a systematic, rigorous approach to environmental management that maximizes learning about uncertainties while simultaneously striving to meet multiple management objectives and adapt management actions based on what is learned. Six stages comprise the adaptive management cycle: assess, design, implement, monitor, evaluate, and adjust. The AMP identifies six Management Questions (MQs) that are re-evaluated at regular intervals. Evaluating these MQs collectively articulates whether Teck is on track to meet the environmental objectives of the EVWQP.

The GC LAEMP was designed to support the assessment of potential aquatic effects associated with antiscalant addition, provide existing conditions information for assessing future changes that may result from activities planned within the watershed, and answer other specific questions on an annual basis (Sections 1.3 and 1.4). Each annual LAEMP cycle (results are reported on June 30 of each year for the preceding calendar year) is also used for tracking issues for which a potential need for an adjustment, using the response framework, has been identified, including biological trigger assessments. Biological triggers are intended as a simple and consistent way to flag potential unexpected monitoring results that may require additional investigation and adjustment. In the current report, combined percentages (%) of Ephemeroptera, Plecoptera, and Trichoptera (EPT) and selenium concentrations in composite-taxa benthic invertebrate tissue samples were assessed against their respective biological triggers (see Sections 2.4.3, 2.5.3, 3.3.4, and 3.4.4).

In addition to addressing questions specific to the GC LAEMP on an annual basis, aquatic monitoring data from the LAEMP will contribute to the broader data set assessed every three years within the RAEMP. The RAEMP is designed to evaluation MQ 5: "*Does monitoring indicate that mine-related changes in aquatic ecosystem conditions are consistent with expectations*?" Data from the LAEMP and RAEMP also contribute to answering MQ 2: "*Will aquatic ecosystem health be protected by meeting the long-term SPOs?"*

Results from this report will also be used to determine whether a biological trigger has been reached. Reaching or exceeding a trigger may lead to an adjustment (Stage 6: Adjust) using the response framework. This is the main report for conveying biological trigger results under the AMP (Sections 3.3.4 and 3.4.4). Implementation of management actions is not constrained to the AMP or LAEMP annual reporting cycles but may be (and has been) triggered at any time during the monitoring and reporting cycle.

Identifying and reducing environmental management uncertainty is a foundational aspect of adaptive management. Therefore, the AMP identifies key uncertainties (KUs) that, as reduced, fill gaps in current understanding to support the achievement of the EVWQP objectives. Aquatic monitoring data assist in reducing KU 5.1: “*How will monitoring data be used to identify potentially important mine-related effects on the aquatic ecosystem?”* and KU 2.1 “*How will the science-based benchmarks be validated and updated?”* Progress on reducing these KUs, and associated learnings, are described in annual AMP reports.

Please refer to the 2021 AMP Update (Teck 2021) for more information on the adaptive management framework, including MQs, KUs, and continuous improvement; linkages between the AMP and other EVWQP programs; and AMP reporting. Progress on gaining new knowledge and reducing KUs is described in annual AMP reports (submitted July 31), and evaluating the answers to MQs are reported in MQ evaluation reports (various submission dates).

2 METHODS

2.1 Design Overview

The design of the 2022 GC LAEMP included the following core technical components (Table 2.1):

1. Water quality monitoring and selenium speciation sampling upstream and downstream from the historical (October 2017 to August 2022) AAS location on Lower Greenhills Creek, upstream and downstream from the current (November 2022 to present) AAS location on Upper Greenhills Creek, and in Greenhills Creek Sedimentation Pond;
2. Water quality monitoring, including selenium speciation sampling, in Gardine Creek, upstream and downstream from the seeps from the GHO Coarse Coal Rejects;
3. Calcite index measurements throughout Greenhills and Gardine creeks[7];
4. Sediment quality monitoring in Lower Greenhills and Gardine creeks, as well as in Greenhills Creek Sedimentation Pond;
5. Benthic invertebrate community and biomass sampling (i.e., area-based kick sampling) at areas (six stations per area) throughout Greenhills and Gardine creeks;
6. Timed benthic invertebrate community sampling at two biological monitoring areas (three stations each; RG_GHNF and RG_GHDT) on Upper Greenhills Creek (i.e., three-minute kicks)[8];
7. Benthic invertebrate community sampling at six stations within Greenhills Creek Sedimentation Pond; and
8. Benthic invertebrate tissue chemistry sampling at areas (three stations per area) throughout Greenhills and Gardine creeks and within Greenhills Creek Sedimentation Pond.

[7] Calcite index measurements were collected from habitats where benthic invertebrate community samples were collected. This was in addition to the CI and CI' measurements completed in Greenhills and Gardine creeks as part of the Regional Calcite Monitoring Program.

[8] Benthic invertebrate community data for the timed kick sampling on Lower Greenhills Creek (i.e., at RG_GHCKD, which is sampled as part of the RAEMP), are also interpreted in this 2022 report, as appropriate.

Table 2.1: Overview of the 2022 Greenhills Creek Aquatic Effects Assessment and Monitoring Program (GC LAEMP), 2022[a]

Location	Monitoring Area	Approximate UTMs (NAD 83, 11U)		River Kilometre (km) [b]	Area Description	Teck - Routine Water Quality	February 2022				September 2022						
							Water Quality			Benthic Invertebrates	Water Quality			Calcite Index Measurements	Sediment Quality	Benthic Invertebrates	
		Easting	Northing				Chemistry	Selenium Speciation	*In situ* Quality	Composite-taxa Tissue	Chemistry	Selenium Speciation	*In situ* Quality			Community Structure	Composite-taxa Tissue
Gardine Creek	**GARD1-75**	653316	5549076	1.94	Regional Calcite Monitoring Program Station in Reach 5 of Gardine Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-
	RG_GAUT	653451	5548928	1.71	Biological Monitoring Area in Reach 4 of Gardine Creek Upstream from GHO Coarse Coal Rejects Seeps	-	-	-	-	-	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	6 (1 at each benthic invertebrate community station)	6 (1 at each benthic invertebrate community station)	5 stations	6 stations	3 stations
	GARD1-50	653641	5548601	1.24	Regional Calcite Monitoring Program Station in Reach 2 of Gardine Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-
	GARD1-25	653928	5548090	0.64	Regional Calcite Monitoring Program Station in Reach 1 of Gardine Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-
	RG_GANF	654277	5547746	0.15	Biological Monitoring Area in Reach 1 of Gardine Creek Upstream from the Confluence with Upper Greenhills Creek and Downstream from the GHO Coarse Coal Rejects Seeps	-	-	-	-	-	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	6 (1 at each benthic invertebrate community station)	6 (1 at each benthic invertebrate community station)	5 stations	6 stations	3 stations
	GH_GC1	654271	5547734	0.06	Permitted Water Quality Station on Gardine Creek Upstream from the Confluence with Upper Greenhills Creek	✓	Teck - routine	-	Teck - routine	-	Teck - routine	-	Teck - routine	-	-	-	-
Upper Greenhills Creek	**RG_GHUT**	654134	5549945	6.03	Biological Monitoring Area in Reach 10 of Upper Greenhills Creek	-	-	-	-	-	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	6 (1 at each benthic invertebrate community station)	6 (1 at each benthic invertebrate community station)	-	6 stations	3 stations
	GREE4-75	654152	5549910	5.98	Regional Calcite Monitoring Program Station in Reach 10 of Upper Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-
	GH_CTF	654165	5549540	5.59	Permitted Water Quality Station in Reach 10 of Upper Greenhills Creek	✓	Teck - routine	-	Teck - routine	-	Teck - routine	-	Teck - routine	-	-	-	-
	GREE4-50	654336	5549133	5.12	Regional Calcite Monitoring Program Station in Reach 9 of Upper Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-
	RG_GHNF	654367	5549052	5.03	Biological Monitoring Area in Reach 9 of Upper Greenhills Creek	-	-	-	-	-	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	6 (1 at each benthic invertebrate community station)	6 (1 at each benthic invertebrate community station)	-	6 stations (area-based); 3 stations (CABIN)	3 stations
	GREE4-25	654512	5548365	4.28	Regional Calcite Monitoring Program Station in Reach 8 of Upper Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-

Notes: UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; - = sampling not included in program design; CABIN = Canadian Aquatic Biomonitoring Network; TBD = to be determined; GHO = Greenhills Operation; RAEMP = Regional Aquatic Effects Monitoring Program.
[a] Fish monitoring in Greenhills and Gardine creeks was completed as part of the Upper Fording River Westslope Cutthroat Trout Population Monitoring Program in 2022.
[b] Distance from the confluence with the Upper Fording River (Greenhills Creek) or Greenhills Creek (Gardine Creek).
[c] No stratification was observed at the time of sampling, therefore a single surface level water grab was collected from RG_GHP according to the Study Design.
[d] Data were collected from this location as part of the RAEMP and were used, as appropriate, to support the Greenhills Creek Aquatic Effects Assessment and Monitoring Program.

Table 2.1: Overview of the 2022 Greenhills Creek Aquatic Effects Assessment and Monitoring Program (GC LAEMP), 2022 [a]

Location	Monitoring Area	Approximate UTMs (NAD 83, 11U)		River Kilometre (km) [b]	Area Description	Teck - Routine Water Quality	February 2022				September 2022						
							Water Quality			Benthic Invertebrates	Water Quality			Calcite Index Measurements	Sediment Quality	Benthic Invertebrates	
		Easting	Northing				Chemistry	Selenium Speciation	*In situ* Quality	Composite-taxa Tissue	Chemistry	Selenium Speciation	*In situ* Quality			Community Structure	Composite-taxa Tissue
Upper Greenhills Creek	GH_USAAS	654461	5548151	4.05	Water Quality Station in Reach 7 of Upper Greenhills Creek, Upstream from Treatment (November 2022)	✓	Teck - routine	-	Teck - routine	-	Teck - routine	-	Teck - routine	-	-	-	-
Upper Greenhills Creek	GH_HWGH_BRB	654435	5548079	3.96	Water Quality Station in Reach 7 of Upper Greenhills Creek, Downstream from Treatment (November 2022)	✓	Teck - routine	-	Teck - routine	-	Teck - routine	-	Teck - routine	-	-	-	-
Upper Greenhills Creek	RG_GHDT	654288	5547720	3.52	Biological Monitoring Area in Reach 7 of Upper Greenhills Creek Downstream from Treatment (November 2022)	-	-	-	-	-	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	6 (1 at each benthic invertebrate community station)	6 (1 at each benthic invertebrate community station)	-	6 stations (area-based); 3 stations (CABIN)	3 stations
Upper Greenhills Creek	GREE3-75	654172	5547243	2.97	Regional Calcite Monitoring Program Station in Reach 6 of Upper Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-
Upper Greenhills Creek	RG_GHFF	654135	5547185	2.90	Biological Monitoring Area in Reach 6 of Upper Greenhills Creek Downstream from Gardine Creek	-	-	-	-	-	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	6 (1 at each benthic invertebrate community station)	6 (1 at each benthic invertebrate community station)	-	6 stations (area-based)	3 stations
Upper Greenhills Creek	GREE3-50	653990	5546883	2.52	Regional Calcite Monitoring Program Station in Reach 6 of Upper Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-
Upper Greenhills Creek	GREE3-25	653918	5546481	2.05	Regional Calcite Monitoring Program Station in Reach 5 of Upper Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-
Upper Greenhills Creek	GH_GH1B	653740	5546142	1.62	Permitted Water Quality Station at the Inlet of Greenhills Sediment Pond	✓	Teck - routine	-	Teck - routine	-	Teck - routine	-	Teck - routine	-	-	-	-
Greenhills Creek Sedimentation Pond	RG_GHP	653445	5546033	-	Greenhills Sediment Pond - Depositional Area	-	-	-	-	-	1 or 2 (concurrent with biological monitoring) [c]	1 or 2 (concurrent with biological monitoring) [c]	6 (concurrent with biological monitoring) and a profile at the deepest area of the pond	-	6 stations	6 stations	3 stations
Lower Greenhills Creek	GH_GH1	653577	5545871	0.60	Permitted Water Quality Station Downstream from Greenhills Sediment Pond and the Stilling Basin V-notch (Upstream of Historical [2017 to 2022] Antiscalant Addition)	✓	Teck - routine	-	Teck - routine	-	Teck - routine	-	Teck - routine	-	-	-	-
Lower Greenhills Creek	GREE1-75	653534	5545668	0.38	Regional Calcite Monitoring Program Station in Reach 2 of Lower Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-
Lower Greenhills Creek	RG_GHBP	653521	5545623	0.33	Biological Monitoring Area in Reach 2 of Lower Greenhills Creek Downstream from the Fording Mine Road	-	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	3 (1 at each benthic invertebrate tissue chemistry station)	3 stations	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	6 (1 at each benthic invertebrate community station)	6 (1 at each benthic invertebrate community station)	5 stations	6 stations	3 stations

Notes: UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; - = sampling not included in program design; CABIN = Canadian Aquatic Biomonitoring Network; TBD = to be determined; GHO = Greenhills Operation; RAEMP = Regional Aquatic Effects Monitoring Program.

[a] Fish monitoring in Greenhills and Gardine creeks was completed as part of the Upper Fording River Westslope Cutthroat Trout Population Monitoring Program in 2022.

[b] Distance from the confluence with the Upper Fording River (Greenhills Creek) or Greenhills Creek (Gardine Creek).

[c] No stratification was observed at the time of sampling, therefore a single surface level water grab was collected from RG_GHP according to the Study Design.

[d] Data were collected from this location as part of the RAEMP and were used, as appropriate, to support the Greenhills Creek Aquatic Effects Assessment and Monitoring Program.

Table 2.1: Overview of the 2022 Greenhills Creek Aquatic Effects Assessment and Monitoring Program (GC LAEMP), 2022 [a]

Location	Monitoring Area	Approximate UTMs (NAD 83, 11U)		River Kilometre (km) [b]	Area Description	Teck - Routine Water Quality	February 2022				September 2022						
							Water Quality			Benthic Invertebrates	Water Quality			Calcite Index Measurements	Sediment Quality	Benthic Invertebrates	
		Easting	Northing				Chemistry	Selenium Speciation	*In situ* Quality	Composite-taxa Tissue	Chemistry	Selenium Speciation	*In situ* Quality			Community Structure	Composite-taxa Tissue
Lower Greenhills Creek	**RG_GHCKD** [d]	653537	5545602	0.32	Greenhills Creek Downstream from the Greenhills Creek Sedimentation Pond	-	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	3 stations	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	-	3 stations	3 stations
Lower Greenhills Creek	**GREE1-50**	653494	5545590	0.28	Regional Calcite Monitoring Program Station in Reach 2 of Lower Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-
Lower Greenhills Creek	**GREE1-25**	653386	5545504	0.13	Regional Calcite Monitoring Program Station in Reach 1 of Lower Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-
Lower Greenhills Creek	**GH_GH2**	653325	5545481	0.05	Permitted Water Quality Station in Reach 1 of Lower Greenhills Creek Downstream from the Fording Mine Road	✓	Teck - routine	-	Teck - routine	-	Teck - routine	-	Teck - routine	-	-	-	-

Notes: UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; - = sampling not included in program design; CABIN = Canadian Aquatic Biomonitoring Network; TBD = to be determined; GHO = Greenhills Operation; RAEMP = Regional Aquatic Effects Monitoring Program.

[a] Fish monitoring in Greenhills and Gardine creeks was completed as part of the Upper Fording River Westslope Cutthroat Trout Population Monitoring Program in 2022.

[b] Distance from the confluence with the Upper Fording River (Greenhills Creek) or Greenhills Creek (Gardine Creek).

[c] No stratification was observed at the time of sampling, therefore a single surface level water grab was collected from RG_GHP according to the Study Design.

[d] Data were collected from this location as part of the RAEMP and were used, as appropriate, to support the Greenhills Creek Aquatic Effects Assessment and Monitoring Program.

The 2022 field programs were implemented according to the 2021 and 2022 study designs (Minnow 2021b, 2022b) and sampling was completed in February and September 2022.[9] Results from other monitoring programs (e.g., the Regional Calcite Monitoring Program and Selenium Speciation Monitoring Program) were integrated into this 2022 annual report, where appropriate, to support data interpretation. Additionally, this 2022 GC LAEMP report summarizes the results of WCT monitoring completed in Greenhills and Gardine creeks under the umbrella of the UFR WCT Population Monitoring Program.

2.2 Water Quality

2.2.1 Field Sampling

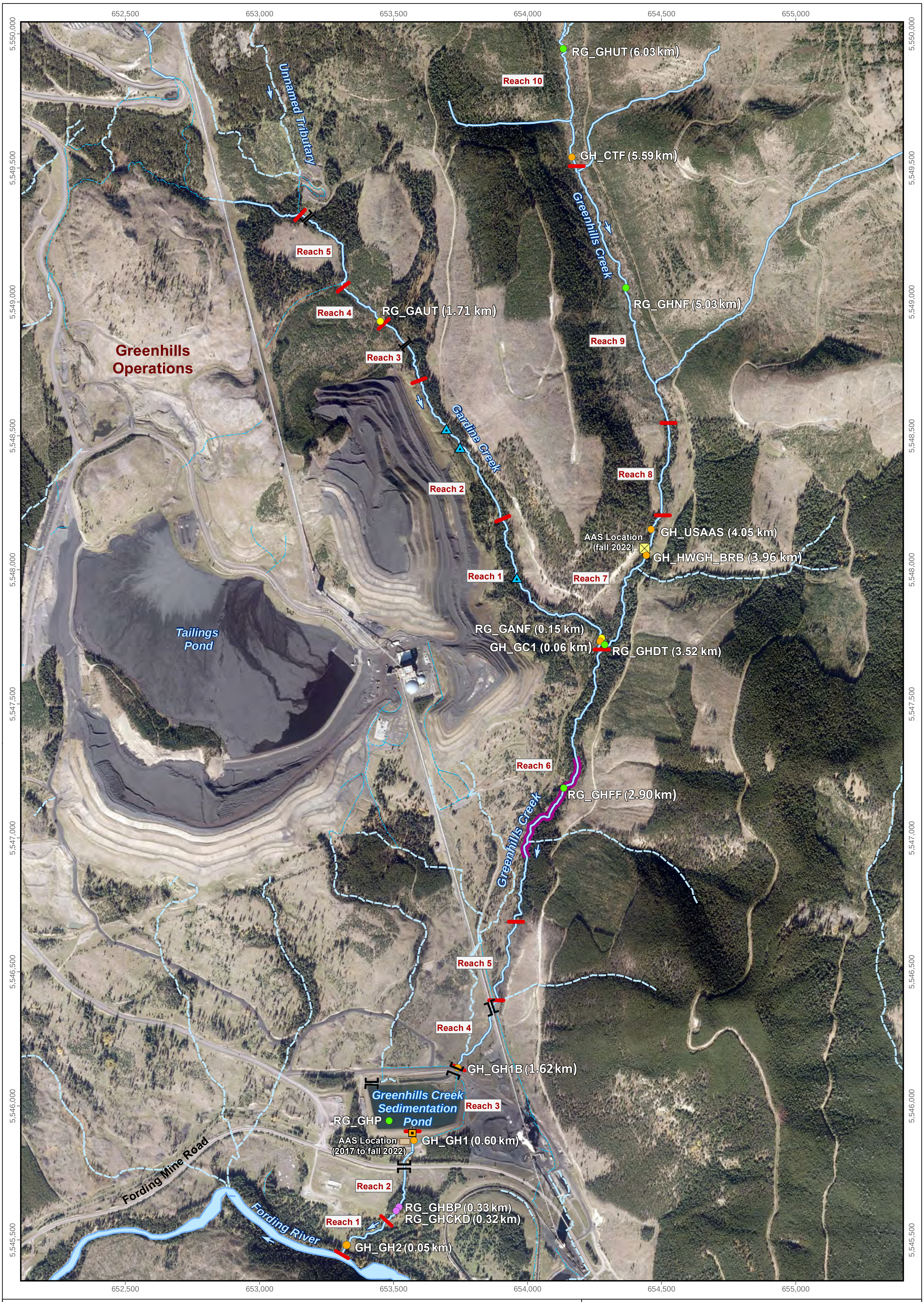
As required under the Permit, Teck collects monthly water samples and *in situ* measurements at four stations on Upper Greenhills Creek, two stations on Lower Greenhills Creek, and one station on Gardine Creek (Figure 2.1; Table 2.1).[10,11] Stations GH_CTF and GH_USAAS are on Upper Greenhills Creek, upstream from the current AAS location (Figure 2.1; Table 2.1). Stations GH_HWGH_BRB and GH_GH1B are also on Upper Greenhills Creek, downstream from the AAS but upstream from the Greenhills Creek Sedimentation Pond (Figure 2.1; Table 2.1). Station GH_GH1 is located on Lower Greenhills Creek, upstream from the historical (October 2017 to August 2022) AAS location (Figure 2.1). Station GH_GH2 is also on Lower Greenhills Creek, downstream from the historical AAS location and upstream from the UFR. Finally, the monitoring station on Gardine Creek (GH_GC1) is immediately upstream from the confluence with Upper Greenhills Creek (Figure 2.1; Table 2.1). Data for each of these stations were used, as appropriate, to support interpretation of the GC LAEMP data.

Water quality monitoring was also completed in February and September 2022, concurrent with benthic invertebrate tissue chemistry and benthic invertebrate community sampling, respectively (see Appendix A for detailed methods). In February 2022, water chemistry and selenium speciation samples were collected from RG_GHBP on Lower Greenhills Creek (Figure 2.1; Table 2.1). In September 2022, water chemistry and selenium speciation samples were collected from RG_GHUT, RG_GHNF, RG_GHDT, and RG_GHFF on Upper Greenhills Creek; RG_GHBP

[9] However, some components of the data analyses associated with the evaluation of biological triggers (Sections 2.4.3 and 2.5.3 and Appendix A) and comparisons to benchmarks for selenium in amphibian diets (see Appendix A) deviated from the study design.

[10] River kilometres (see Table 2.1) for the monthly water quality monitoring stations and biological monitoring areas are shown on Figure 2.1 but are excluded from subsequent figures for sake of space and readability.

[11] From March 15 to July 31, GH_GH1 is also sampled weekly for total suspended solids [TSS] and turbidity (see Appendix A).



LEGEND

- Teck Routine Water Quality Monitoring Location
- Upper Greenhills Creek Water and Selenium Speciation Sampling Location
- Lower Greenhills Creek Water and Selenium Speciation Sampling Location
- Gardine Creek Water and Selenium Speciation Sampling Location
- AAS Location (fall 2022)
- AAS Location (2017 to fall 2022)
- Proposed Remediation Area (2024)
- Seep
- Reach Break
- Culvert
- Fish Barrier (outflow weir)
- Ditch or Flow Inferred
- Intermittent Stream
- Watercourse

Note: Antiscalant Addition System (AAS)

Water Quality Monitoring and Selenium Speciation Sampling Locations

0 0.25 0.5 1
Kilometers

N E S W

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Figure 2.1

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 227202.0016 - 2022 GGCAMP\D - GIS\2022 Report\22-16 Figure 2.1 WQ Monitoring and Selenium Speciation Sampling.mxd on Lower Greenhills Creek; RG_GAUT and RG_GANF on Gardine Creek; and the Greenhills Creek Sedimentation Pond (RG_GHP; Figure 2.1; Table 2.1).

Additional selenium speciation data were collected in 2022 as part of Teck's Selenium Speciation Monitoring Program, which was first implemented in 2021 (ADEPT 2022; ADEPT et al. 2023). Relevant information from the 2022 Selenium Speciation Monitoring Program annual report (ADEPT et al. 2023) was included in the interpretation of the GC LAEMP data, as appropriate.

Quality assurance/quality control (QA/QC) measures included the collection of field duplicates, field blanks, and trip blanks for water chemistry and field duplicates for selenium speciation. Quality control (QC) samples comprised at least 10% of the total samples collected during each sampling event (see Appendix B).

2.2.2 Laboratory Analysis

Water chemistry and selenium speciation samples were shipped to accredited, third-party laboratories for analysis (see Appendix A for details). Specifically, water chemistry samples were shipped to ALS Environmental (ALS) in Calgary, Alberta, which is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA). Selenium speciation samples were submitted to Brooks Applied Labs in Seattle, Washington. Brooks Applied Labs are accredited by the National Environmental Laboratory Accreditation Program (NELAP).

A Data Quality Review (DQR) was completed following receipt of the water chemistry and selenium speciation data from February and September 2022 (Appendix B). Data quality information associated with Teck's monthly water sampling are provided in annual reports for Permits 107517 and 6248.

2.2.3 Data Analysis

Water quality data were compared to EVWQP Benchmarks, updated Effect Concentrations (EC), the proposed benchmark for nickel, screening values, Canadian Council of Ministers of the Environment (CCME) guidelines (total mercury), or British Columbia Water Quality Guidelines (BC WQG) for the protection of freshwater aquatic life (BCMOECCS 2021a,b; BCMWLRS 2023; CCME 2003), as appropriate.[12] Additionally, water quality data from Teck's monthly monitoring stations were evaluated to address the following general questions:

- Q1: Do the concentrations of mine-related constituents differ among areas?

[12] A discussion of the science-based benchmarks developed for the EVWQP (Teck 2014) and subsequent activities undertaken to validate/update those benchmarks (e.g., the use of updated chronic toxicity information to derive updated EC for sulphate) is provided in Appendix A.

- Q2: Have concentrations of mine-related constituents at the monitoring areas changed over time and are these changes unexpected based on the activities and projects occurring in the watershed (including relocation of the AAS)?
- Q3: Have concentrations of mine-related constituents in Lower Greenhills Creek changed over time relative to upstream following the application of antiscalant (i.e., can observed differences between Upper and Lower Greenhills Creek be attributed to antiscalant addition in Lower Greenhills Creek)?

Question 1 was addressed by comparing water chemistry data among Teck's monthly monitoring stations on Greenhills and Gardine creeks. To evaluate potential mine-related influences on water quality, constituents with Early Warning Triggers (EWTs) were included in the comparisons (see Appendix A). Interpretation focused on identifying upstream-to-downstream differences in concentrations or dilution effects like those observed for some constituents in Greenhills Creek downstream from Gardine Creek (Minnow 2021a, 2022a). Additionally, the data were interpreted in light of the AAS moving from Lower Greenhills Creek to Upper Greenhills Creek in fall 2022.

Question 2 was addressed by evaluating differences in concentrations of constituents with EWTs among years for each of Teck's monthly monitoring stations (see Appendix A). Data collected from 2016 to 2022 were used; however, the analysis was restricted to years with at least six months of data and stations with at least two years of data.

Consistent with the approach for 2021, Question 3 was addressed based on comparisons of May to September means for water quality constituents measured in samples collected from 2017 to 2022 (Minnow 2022a,b).[13] Differences in aqueous concentrations of constituents observed downstream from the AAS on Lower Greenhills Creek relative to upstream both before and after the introduction of antiscalant treatment were compared using a Before-After-Control-Impact [BACI] design (see Appendix A). A similar analysis was not completed for Upper Greenhills Creek, given the AAS did not begin operating there until November 2022.

Water quality and aqueous selenium speciation data were used to interpret the results of substrate, benthic invertebrate community, and tissue chemistry evaluations, as appropriate (see Sections 3.2 to 3.4, below). This includes selenium speciation data collected as part of the Selenium Speciation Monitoring Program (see Section 2.2.1).

[13] The AAS was not operating in May 2018, September 2019, or May 2020; consequently, data for these months were excluded from the "after" data set, consistent with previous years (Minnow 2020a, 2021a, 2022a). Additionally, since the AAS ceased to operate on Lower Greenhills Creek in August 2022, the September 2022 data were also excluded from the "after" data set.

2.3 Substrate Quality

2.3.1 Calcite

2.3.1.1 Field Sampling

Calcite monitoring in Greenhills and Gardine creeks in 2022 was completed as part of Teck's Regional Calcite Monitoring Program and concurrent with benthic invertebrate community sampling for the GC LAEMP (Figure 2.2; see also Section 2.4). Six stations on Upper Greenhills Creek, three stations on Lower Greenhills Creek, and three stations on Gardine Creek were monitored as part of the Regional Calcite Monitoring Program (Smit and Robinson 2023; Appendix A). During the September 2022 program for the GC LAEMP, Minnow Environmental Inc. (Minnow) collected calcite data from RG_GHUT, RG_GHNF, RG_GHDT, and RG_GHFF on Upper Greenhills Creek, RG_GHBP on Lower Greenhills Creek, and RG_GAUT, and RG_GANF on Gardine Creek to allow for direct correlation of benthic invertebrate community endpoints with CI and CI' values (Figure 2.2; Table 2.1; Appendix A).

Calcite index measurements were made using methods detailed by Zathey et al. (2021) and summarized in Lotic (2021) (see also Appendix A).

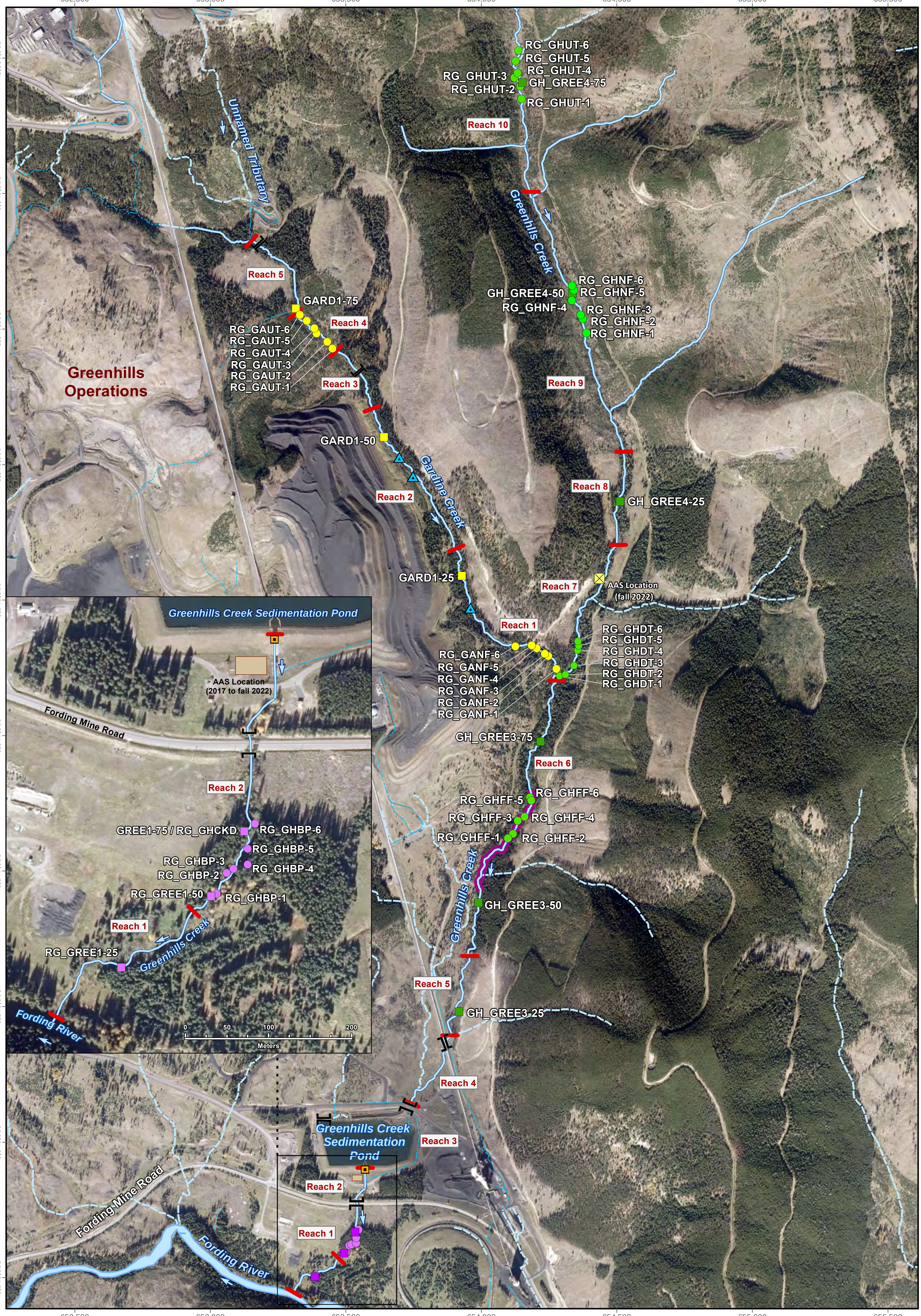
2.3.1.2 Data Analysis

Calcite indices were calculated in two ways (Appendix A). The first method relied on the binary (0 [absent] or 1 [present]) calcite presence (C_p) scores used historically (e.g., Minnow 2020a, 2021a, 2022a; see also Teck 2016). The second method, which was first implemented as part of the GC LAEMP in 2021 (Minnow 2022a), was based on the updated methods described by Zathey et al. (2021).

Calcite indices (CI and CI') were calculated for each biological monitoring area and data were used to address the following general questions:

- Q1: Do calcite scores differ among areas?
- Q2: Have calcite scores changed at the monitoring areas over time and are these changes unexpected based on the activities and projects occurring in the watershed?
- Q3: Have calcite scores in Lower Greenhills Creek changed relative to upstream following the application of antiscalant?

Questions 1 through 3 are unchanged relative to 2021 because calcite measurements were completed in September 2022 and the AAS on Lower Greenhills Creek operated until August 21, 2022. The AAS did not begin operating on Upper Greenhills Creek



LEGEND

- Upper Greenhills Creek Calcite Monitoring (Biological Area)
- Upper Greenhills Creek Calcite Monitoring (Regional)
- Gardine Creek Calcite Monitoring (Biological Area)
- Gardine Creek Calcite Monitoring (Regional)
- Lower Greenhills Creek Calcite Monitoring (Biological Area)
- Lower Greenhills Creek Calcite Monitoring (Regional)
- AAS Location (fall 2022)
- AAS Location (2017 to fall 2022)
- Seep
- Proposed Remediation Area (2024)
- Reach Break
- Fish Barrier (outflow weir)
- Culvert
- Ditch or Flow Inferred
- Intermittent Stream
- Watercourse

Note: Antiscalant Addition System (AAS)

Calcite Monitoring Locations, September 2022

0 0.25 0.5 1
Kilometers

N E S W

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Figure 2.2

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 227202.0016 - 2022 GGCAMP\D - GIS\2022 Report\22-16 Figure 2.2 Calcite Monitoring Locations, Sept 2022.mxd until November 7, 2022. Therefore, monitoring completed in September 2022 represented the last year of pre-treatment monitoring on Upper Greenhills Creek.

Questions 1 through 3 were addressed by comparing calcite presence and concretion scores among biological monitoring areas and years (Appendix A). Calcite presence (C_p and C_p') and concretion scores (C_c) were also plotted to support qualitative comparisons among areas and over time within areas. Additionally, CI and CI' were used to support interpretation of benthic invertebrate community data (see Section 2.4). Results from the 2022 Regional Calcite Monitoring Program were integrated into the interpretation of calcite data for the GC LAEMP, as appropriate.

2.3.2 Sediment

2.3.2.1 Field Sampling

Sediment chemistry samples were collected from Lower Greenhills Creek (RG_GHBP), Gardine Creek (RG_GAUT and RG_GANF), and Greenhills Creek Sedimentation Pond (RG_GHP) in September 2022 (Figures 2.3 and 2.4; Table 2.1; Appendix A).

2.3.2.2 Laboratory Analysis

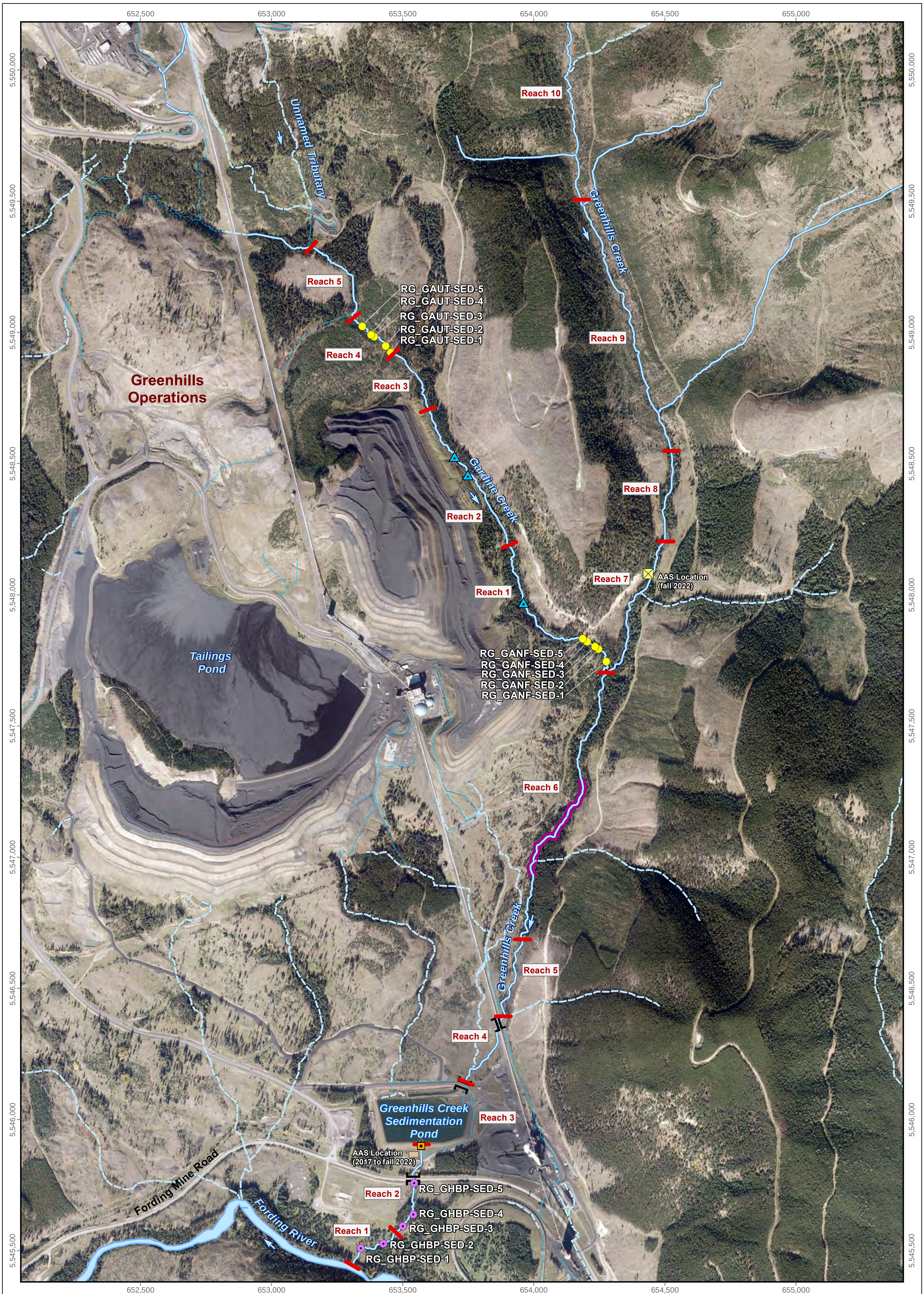
Sediment chemistry samples were sent to ALS, a CALA-certified laboratory, in Calgary, Alberta for analysis of moisture content, particle size, total organic carbon (TOC), bulk metals, and polycyclic aromatic hydrocarbons (PAHs) (Appendix A). Additional sub-samples were also subjected to sequential extraction analysis (SEA) for metals (Tessier et al. 1979; Appendix A). The SEA analyses completed in 2022 were intended to address recommendations from the EMC and reduce any residual uncertainties around effects from treatment with antiscalant to sediment chemistry.

A DQR was completed following receipt of the sediment chemistry data for samples collected in September 2022 (Appendix B).

2.3.2.3 Data Analysis

Metal and PAH concentrations in sediment samples were tabulated and plotted to support comparisons to applicable BC Working Sediment Quality Guidelines[14] (BC WSQG; BCMOECCS 2021b). Concentrations in bulk sediment and the sums of concentrations in sediment fractions 1 to 4 (i.e., the “potentially mobile” and therefore potentially bioavailable fractions) were included in the comparisons (Appendix A).

[14] Including the alert concentration for selenium (see BCMOE 2014 and BCMOECCS 2021a).



LEGEND

- Gardine Creek Sediment Sampling Location
- Lower Greenhills Creek Sediment Sampling Location
- AAS Location (fall 2022)
- AAS Location (2017 to fall 2022)
- Proposed Remediation Area (2024)
- Seep
- Reach Break
- Fish Barrier (outflow weir)
- Culvert
- Ditch or Flow Inferred
- Intermittent Stream
- Watercourse

Note: Antiscalant Addition System (AAS)

Creek Sediment Sampling Locations, September 2022

0 0.25 0.5 1
Kilometers

N E S W

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Figure 2.3

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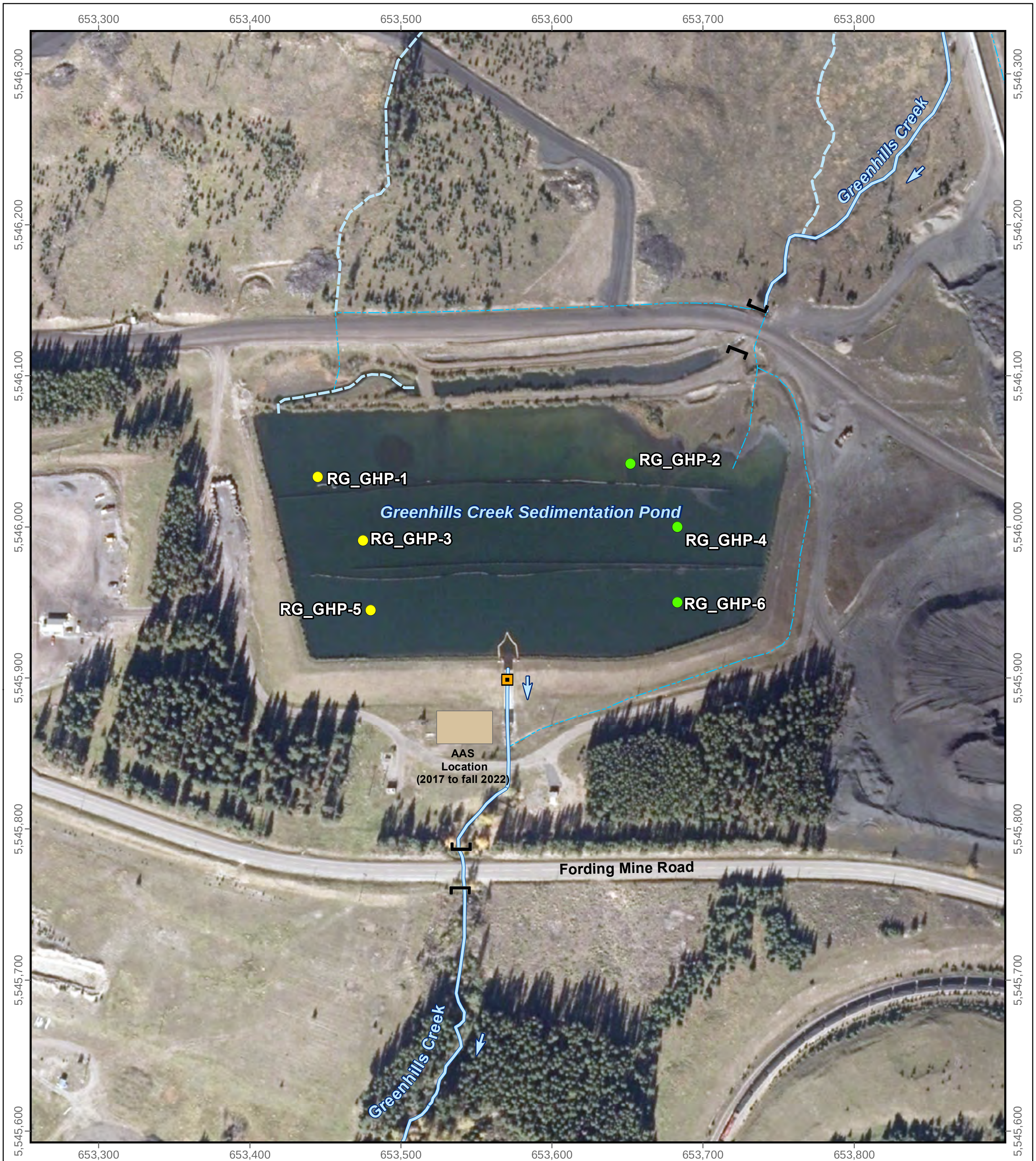

LEGEND

- Sediment and Benthic Invertebrate Community Sampling Location
- Sediment, Benthic Invertebrate Community, and Tissue
- Fish Barrier (outflow weir)
- Culvert
- AAS Location (2017 to fall 2022)
- Ditch or Flow Inferred
- Intermittent Stream
- Watercourse

Note: Antiscalant Addition System (AAS)

Sediment and Benthic Invertebrate Sampling Locations in Greenhills Creek Sedimentation Pond, September 2022

0 62.5 125 250 Meters

N W E S

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Figure 2.4

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Sediment chemistry (bulk and SEA) data were used to address the following general questions:

- Q1: Does sediment chemistry differ among areas?
- Q2: Have sediment particle sizes, TOC content, and/or the concentrations of mine-related constituents at the monitoring areas changed over time and are these changes unexpected based on the activities and projects occurring in the watershed?
- Q3: Has sediment chemistry downstream from the AAS changed relative to upstream after the introduction of water treatment?

Sediment sampling (mid-September 2022) was completed shortly after cessation of water treatment on Lower Greenhills Creek (August 21, 2022) and prior to the initiation of antiscalant addition on Upper Greenhills Creek (November 7, 2022). Therefore, sediment chemistry samples collected in September 2022 represent the last year of pre-treatment monitoring for Greenhills Creek Sedimentation Pond (RG_GHP).

Question 1 was addressed by comparing sediment chemistry (bulk and SEA) among biological monitoring areas to evaluate potential mine-related influences on sediment. Censored regression two-way Analysis of Variance (ANOVA) methods were used (Appendix A).

To address Question 2, temporal differences in metal and calcium[15] concentrations in bulk sediments and sediment fractions 1 to 5 were examined for each sediment sampling location. Censored regression two-way ANOVAs were used and were restricted to the years 2019 to 2022 to standardize the sizes of the chemistry data sets among areas and years (Appendix A).

Question 3 was addressed by comparing differences in concentrations of constituents in bulk sediment before (2017) and after (2018 to 2022) initiation of antiscalant addition on Lower Greenhills Creek. A censored regression ANOVA with a nested design was used (Appendix A).

To support conclusions regarding overall sediment quality (i.e., all metals and PAHs considered together), Sediment Quality Indices (SQI) were calculated by year within each area. The SQI integrated the scope, frequency, and amplitude of guideline exceedances and were calculated based on the lower BC WSQG and alert concentration for selenium (BCMOECCS 2021a,b; Appendix A). The SQI were reviewed to identify differences among sampling areas and changes in bulk sediment chemistry over time.

[15] Calcium is a correlate for calcite (see Minnow 2021a).

2.4 Benthic Invertebrate Community

2.4.1 Field Sampling

2.4.1.1 Greenhills and Gardine Creeks

Benthic invertebrate community monitoring completed in 2022 provided a sixth year of pre-treatment data for Upper Greenhills Creek, a fifth year of data following initiation of antiscalant addition on Lower Greenhills Creek, and a fourth year of data collection on Gardine Creek.

Samples representative of lotic habitats were collected from the following biological monitoring areas in September 2022 (Figure 2.5; Table 2.1):

- RG_GHUT, RG_GHNF, RG_GHDT, and RG_GHFF on Upper Greenhills Creek;
- RG_GHBP on Lower Greenhills Creek; and
- RG_GAUT and RG_GANF on Gardine Creek.

Consistent with previous years, area-based kick sampling (1/3 square metre [m^2]) was completed at six stations per biological monitoring area (Appendix A). Additionally, timed kick sampling was completed at RG_GHNF and RG_GHDT (three stations each) on Upper Greenhills Creek to support comparisons to reference area normal ranges and/or biological triggers for %EPT (see Section 2.4.3).[16]

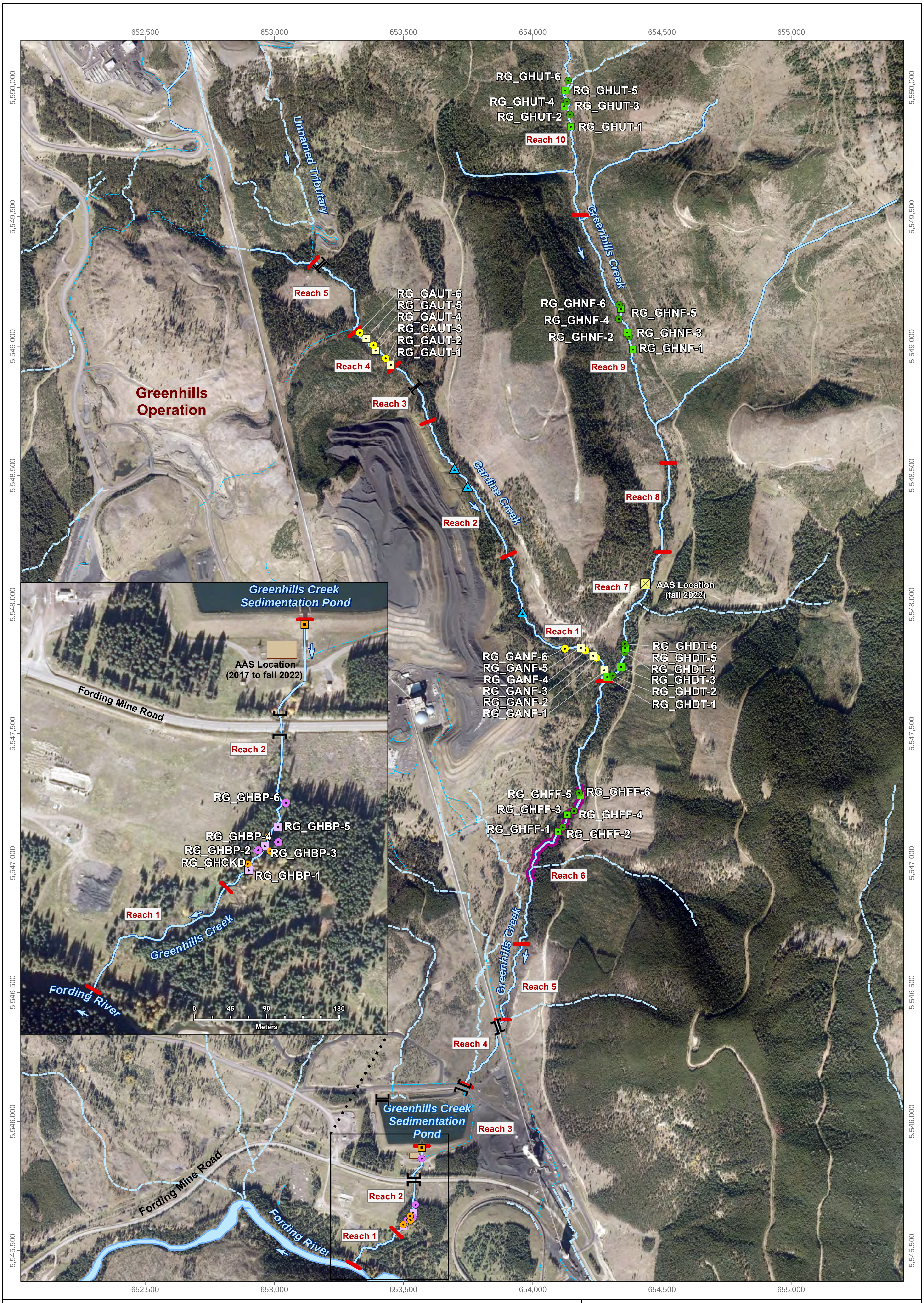
2.4.1.2 Greenhills Creek Sedimentation Pond

The year 2022 represented the fifth year of benthic invertebrate community data collection in Greenhills Creek Sedimentation Pond. A Petite Ponar grab sampler was used to collect benthic invertebrate community samples from six locations in September 2022 (Figure 2.4; Table 2.1; Appendix A).

2.4.2 Laboratory Analysis

Benthic invertebrate community samples collected using area-based kicks and Petite Ponar grabs were sent to ZEAS Inc. (ZEAS) in Nobleton, Ontario for analysis. Organisms were sorted and identified to the lowest practical level (LPL) of taxonomy before being grouped at the family level for determination of family-level biomass (Appendix A).

[16] Results for benthic invertebrate community sampling at RG_GHCKD on Lower Greenhills Creek will be reported on in the next RAEMP report; however, relevant findings were integrated into this report.



LEGEND

- Gardine Creek Benthic Invertebrate Community Sampling Location
- Gardine Creek Benthic Invertebrate Community and Composite Tissue Sampling Location
- Upper Greenhills Creek Benthic Invertebrate Community Sampling Location
- Upper Greenhills Creek Benthic Invertebrtae Community and Composite Tissue Sampling Location
- RAEMP Benthic Invertebrate Community and Composite Tissue Sampling Location
- Lower Greenhills Creek Benthic Invertebrate Community Sampling Location
- Lower Greenhills Creek Benthic Invertebrate Community and Composite Tissue Sampling Location
- AAS Location (fall 2022)
- AAS Location (2017 to fall 2022)
- Proposed Remediation Area (2024)
- Fish Barrier (outflow weir)
- Seep
- Culvert
- Reach Break
- Ditch or Flow Inferred
- Intermittent Stream
- Watercourse

Note: Antiscalant Addition System (AAS)

Creek Benthic Invertebrate Sampling Locations, 2022

0 0.25 0.5 1
Kilometers

N W E S

Projection: North American Datum 1983 UTM Zone 11U

Date: June 2023
Project 227202.0016

minnow environmental inc.

Figure 2.5

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 227202.0016 - 2022 GGCAMP\D - GIS\2022 Report\22-16 Figure 2.5 Creek BI Sampling Locations. Sept 2022.mxd

Benthic invertebrate community samples collected using the timed kick method were sent to Cordillera Consulting (Cordillera) in Summerland, BC for sorting and taxonomic identification. Organisms were identified to the LPL of taxonomy (Appendix A).

A DQR was completed following receipt of the benthic invertebrate community data from September 2022 (Appendix B).

2.4.3 Data Analysis

Data for area-based and timed kick samples were summarized by calculating endpoints that are indicators of changes in benthic invertebrate community structure (Appendix A). Plots and tables of the benthic invertebrate community endpoints were used to address the following general questions:

- Q1: Do community endpoints differ among areas?
- Q2: Have community endpoints changed at the monitoring areas over time and are these changes unexpected based on the activities and projects occurring in the watershed?
- Q3: Have community endpoints in Lower Greenhills Creek changed relative to upstream following the application of antiscalant (i.e., can observed differences between Upper and Lower Greenhills Creek be attributed to antiscalant addition)?

Because antiscalant addition on Lower Greenhills Creek did not cease until August 21, 2022, data collected from RG_GHBP on Lower Greenhills Creek in mid-September 2022 are considered representative of a fifth year of monitoring post-antiscalant addition. Because antiscalant addition on Upper Greenhills Creek did not commence until November 7, 2022, benthic invertebrate community data collected from Upper Greenhills and Gardine creeks and the Greenhills Creek Sedimentation Pond in 2022 were included with the “untreated” data collected from 2016 to 2021.

Questions 1 and 2 were addressed together. Differences among areas and years for benthic community endpoints were compared using an ANOVA with factors *Area* and *Year* and *Area x Year* (Appendix A).

Question 3 was addressed by comparing differences in benthic invertebrate community endpoints in relation to the addition of antiscalant based on a BACI design (Green 1979). An ANOVA model was used to fit the data for each area from pre- and post-application of antiscalant (Appendix A). *Post hoc* contrasts were conducted, as appropriate.

Potential relationships between benthic invertebrate community endpoints and calcite measurements (CI, CI’, and C_c) and water chemistry data were examined by correlation analysis

(Appendix A).[17] Benthic invertebrate community endpoints for area-based kick samples were included in the analyses.

Data for the timed kick samples were used to support comparisons to regional reference area normal ranges from the RAEMP (RG_GHNF, RG_GHDT, and RG_GHCKD) (Minnow 2020b) and comparisons to the biological trigger for %EPT (RG_GHNF and RG_GHCKD (Teck 2018, 2021) (Appendix A).

2.5 Benthic Invertebrate Tissue Chemistry

2.5.1 Field Sampling

2.5.1.1 Greenhills and Gardine Creeks

Composite-taxa benthic invertebrate tissue chemistry samples were collected from Lower Greenhills Creek (RG_GHBP) in February 2022 and from Upper Greenhills Creek (RG_GHUT, RG_GHNF, RG_GHDT, and RG_GHFF), Lower Greenhills Creek (RG_GHBP), and Gardine Creek (RG_GANF and RG_GAUT) in September 2022 (Figure 2.5; Table 2.1; Appendix A). The year 2022 represents the final year of winter benthic invertebrate tissue chemistry sampling under the GC LAEMP (Minnow 2022a,b).

The kick sampling method described in Section 2.4.1 and Appendix A (Section A3.1.1.1) was used to collect benthic invertebrate tissue chemistry samples from three stations per biological area. However, rather than being restrained by time or area, kicks were completed until the desired mass of benthic invertebrate tissue was obtained.

2.5.1.2 Greenhills Creek Sedimentation Pond

Three composite-taxa benthic invertebrate tissue chemistry samples were collected from depositional areas within Greenhills Creek Sedimentation Pond (RG_GHP) in September 2022 (Figure 2.4; Table 2.1). Each of the three samples corresponded with one of six benthic invertebrate community sampling locations and were collected using the same methods described in Section 2.4.1.2 and Appendix A (Section A3.1.1.2).

2.5.2 Laboratory Analysis

Benthic invertebrate tissue samples were sent to TrichAnalytics Inc. (Trich), which is a CALA-accredited laboratory, in Saanichton, BC. Frozen samples were analyzed for metal concentrations and results were reported on a dry weight basis (Appendix A).

[17] Predictive models for benthic invertebrate communities are being developed for use in adaptive management and biological monitoring. Once these models are available for implementation, they may be used in place of the correlation analyses described herein.

A DQR was completed following receipt of the benthic invertebrate tissue data from February and September 2022 (Appendix B).

2.5.3 Data Analysis

Benthic invertebrate tissue selenium concentrations for samples collected in 2022 were summarized for each of the sampling areas in Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond and were used to address the following general questions:

- Q1: Do tissue selenium concentrations differ among areas?
- Q2: Have selenium concentrations in benthic invertebrate tissues at the monitoring areas changed over time and are these changes attributable to activities and projects occurring in the watershed, including the addition of antiscalant to Lower Greenhills Creek?
- Q3: Are selenium concentrations in benthic invertebrate tissues as expected, based on water quality?

Questions 1 and 2 were addressed together. Differences among areas and years for benthic invertebrate tissue selenium concentrations reported for September samples were compared using an ANOVA, as described in Section 2.4.3 and Appendix A. A separate ANOVA was used to compare selenium concentrations measured in composite-taxa samples from February and September of each year (i.e., 2019 to 2022; no winter sampling was completed in 2018; Appendix A).

Question 3 was addressed, in part, by comparing selenium concentrations in benthic invertebrate tissue chemistry samples from lotic habitats to prediction intervals generated from the regional lotic bioaccumulation model (Golder 2020; Appendix A). If observed concentrations were higher than the upper prediction limits, tissue concentrations were considered higher than expected.

Concentrations of selenium in benthic invertebrate tissues from Greenhills Creek Sedimentation Pond were not evaluated using the lotic or lentic bioaccumulation models developed for the Elk River watershed (Golder 2020). The Greenhills Creek Sedimentation Pond possesses some characteristics of a lentic environment (e.g., longer residence time, finer substrates, and abundant vegetation). However, the lentic bioaccumulation model was developed based on data for natural and naturalized lentic areas (i.e., data for sedimentation ponds were not included). Therefore, there is too much uncertainty regarding the applicability of the lentic model to the Greenhills Creek Sedimentation Pond to warrant comparisons to model predictions at this time.

Question 3 was also addressed through the evaluation of biological triggers developed for selenium concentrations in benthic invertebrate tissues (Teck 2018, 2021). Similar to the biological trigger for %EPT (Section 2.4.3 and Appendix A, Section A3.1.3), biological triggers for selenium concentrations were applied to biological monitoring areas RG_GHNF and RG_GHBP/RG_GHCKD on Upper and Lower Greenhills Creek, respectively.

Selenium concentrations in benthic invertebrate tissue samples were also interpreted using the selenium speciation bioaccumulation tool (B-tool; de Bruyn and Luoma 2021), regional reference area normal ranges, EVWQP Benchmarks, and relevant EC (Appendix A).

2.6 Westslope Cutthroat Trout

2.6.1 Field Sampling

In 2022, WCT population monitoring in Greenhills and Gardine creeks was completed within the framework of the UFR Fish Population Monitoring Program (Thorley et al. 2022a; see also WSP and Poisson 2023 [Appendix C] for detailed methods). Spawning (redd) surveys (early June to early August) and backpack electrofishing (late August and early September) were completed within Upper Greenhills, Lower Greenhills, and Gardine creeks. Night-time dip-net surveys (October) were also completed within Lower Greenhills Creek to support size estimates for age-0 fish. Observations of WCT in the plunge pool at the outlet of the duckbill culvert on Lower Greenhills Creek were recorded as part of snorkel surveys (August). Other observations of WCT (e.g., during effectiveness monitoring at the Stilling Basin and decant channel downstream from the Greenhills Creek Sedimentation Pond) were also documented.

Handling of WCT was completed in accordance with Teck's Field Methods and Data Collection Standards (Thorley et al. 2022b) and the study design for the UFR Fish Population Monitoring Program (Thorley et al. 2022a).

2.6.2 Data Analysis

Data collected during WCT monitoring activities completed in 2022 were compiled along with historical data for Greenhills and Gardine creeks and the rest of the 2022 data for the UFR Fish Population Monitoring Program (Thorley et al. 2023a,b; see also Appendix C). Westslope cutthroat trout within Upper Greenhills and Gardine creeks were treated as a single, separate sub-population from the WCT in Lower Greenhills Creek (Appendix C). Here, the data included in the stand-alone WCT monitoring report for Upper and Lower Greenhills and Gardine creeks were evaluated through the lens of the study questions for the 2022 GC LAEMP (Section 1.4). Specifically, the data were evaluated to address the following general questions:

- Q1: Do estimates of WCT abundance, densities, or health endpoints differ among areas?[18]
- Q2: Have endpoints changed at the monitoring areas over time and are these changes expected based on the activities and projects occurring in the watershed, including the addition of antiscalant to Lower Greenhills Creek?

Questions 1 and 2 from the GC LAEMP were addressed by comparing abundances, densities, and condition of age-1 and age-2+ WCT qualitatively among areas and years (Appendix C). Abundance, densities, and fish condition were calculated according to Thorley et al. (2022a) and as described in Appendix C (WSP and Poisson 2023). Results for condition were standardized to a fish with a fork length of 100 millimetres (mm) and expressed as the percent change in predicted body weight relative to a typical sub-population in a typical year (Appendix C).

Questions 1 and 2 from the GC LAEMP were also addressed by comparing incidences of external anomalies observed during fish processing (e.g., parasites, deformities, erosion, lesions, tumours) among areas and between 2021 and 2022. External anomaly data will be reported on separately from the stand-alone Greenhills Creek 2022 Fish Population Monitoring report provided in Appendix C (WSP and Poisson 2023). Temporal comparisons were restricted to 2021 and 2022 because, prior to 2021, external assessments were completed based on the classification system described by Sanders et al. (1999), whereas the approach for 2021 and 2022 was based on the updated approach from the RAEMP (Minnow 2021a,c).

No fish tissue chemistry monitoring was completed in the Greenhills Creek watershed in 2022, in an effort to minimize fish handling and risks to WCT, and there were no incidental mortalities that could have been sampled for tissue chemistry. Consequently, biological triggers developed for selenium concentrations in WCT muscle as part of Teck's AMP (Teck 2018, 2021) were not evaluated in 2022. However, water quality (Sections 2.2 and 3.1) and benthic invertebrate tissue chemistry (Sections 2.5 and 3.4) are sampled and evaluated on a routine basis (i.e., monthly, semi-annually) and are used to evaluate risks to WCT.

[18] Fish biomass is also referenced in Section 4.3 of Appendix C (WSP and Poisson 2023); however, WCT biomass was not among the endpoints evaluated for Greenhills and Gardine creeks in 2022, which is consistent with the GC LAEMP study design (Minnow 2022b).

3 RESULTS

3.1 Water Quality

3.1.1 Gardine Creek

At upper Gardine Creek (RG_GAUT), concentrations of mine-related constituents in 2022 were below the relevant BC WQG, CCME guideline for total mercury, EVWQP Benchmarks, proposed benchmarks, updated EC, and screening values (Appendix Figures E.1 to E.17; Appendix Table E.1). In lower Gardine Creek (RG_GANF and GH_GC1), concentrations of total dissolved solids (TDS) and sulphate were often above screening values or updated EC, respectively (Appendix Figures E.1 to E.17; Appendix Table E.1 and E2). Concentrations of organoselenium species at RG_GAUT and RG_GANF were among the lowest reported within the Greenhills Creek watershed in 2022 (Appendix Table E.3). Overall, the water quality results for Gardine Creek are consistent with previous years of monitoring.

The upstream-to-downstream differences in water quality within Gardine Creek are likely attributed to the seeps from the GHO Coarse Coal Rejects, which enter the creek between RG_GAUT and GH_GC1/RG_GANF (Figure 2.1). Regardless, Gardine Creek continues to act as an overall source of dilution for some mine-related constituents in Upper Greenhills Creek (e.g., total antimony, total and dissolved nickel) (see Section 3.1.2 and Appendix Figure E.18; Minnow 2022a).

Concentrations of mine-related constituents that were measured in water samples from lower Gardine Creek (GH_GC1) were comparable to or decreased significantly relative to the base year of monitoring (i.e., 2017) (Appendix Figures E.1 to E.17; Appendix Table E.4). Specifically, concentrations of TDS; total antimony, boron, manganese, nickel, and uranium; and dissolved cadmium were between 25 and 55% lower in 2022 relative to 2017 (Appendix Table E.4).

3.1.2 Upper and Lower Greenhills Creek

Concentrations of TDS and sulphate in the monthly water samples from Upper and Lower Greenhills Creek often exceeded screening values or updated EC, respectively, in 2022 (Figure 2.1; Appendix Figures E.1 to E.18; Appendix Table E.2). Total uranium concentrations in the monthly samples were also often above the BC WQG (Appendix Table E.2). Work is underway within the RAEMP framework to investigate potential relevant pathways of effects to benthic invertebrates from elevated aqueous uranium concentrations.

Concentrations of dissolved cadmium were higher at GH_CTF (furthest upstream station on Upper Greenhills Creek) relative to stations downstream from the Gardine Creek mouth (i.e., at

GH_GH1B, GH_GH1, and GH_GH2; Appendix Figure E.18). Seventeen percent of monthly samples from GH_CTF had dissolved cadmium concentrations above the long-term BC WQG; however, concentrations throughout Greenhills Creek were below the most conservative EVWQP benchmark (Appendix Figure E.16; Appendix Table E.1).

Concentrations of dissolved nickel[19] were above Level 3 proposed benchmarks at the furthest upstream stations on Upper Greenhills Creek (i.e., GH_CTF and GH_HWGH_BRB; Appendix Figure E.12; Appendix Table E.2). Dissolved nickel concentrations downstream from the Gardine Creek mouth (i.e., at GH_GH1B, GH_GH1, and GH_GH2) were significantly lower relative to upstream (Appendix Figure E.18). However, concentrations were still occasionally above Level 2 (25% of samples from GH_GH1B) or Level 1 (33% of samples from GH_GH1 and GH_GH2) proposed benchmarks (Appendix Table E.2).

Water chemistry sampling associated with the February and September 2022 field programs for the GC LAEMP (Figure 2.1; Table 2.1; see also Appendix A) showed results that were generally similar to the monthly water quality monitoring stations (Appendix Tables E.1 and E.2). Within Greenhills Creek, TDS concentrations were consistently above the Level 1 screening value and sulphate concentrations were above Level 2 or Level 3 updated EC throughout the creek. Concentrations of nitrate and total selenium and uranium appeared to decrease with distance downstream, despite concentrations of total uranium being above the relevant long-term BC WQG throughout Greenhills Creek in September 2022. Concentrations of dissolved nickel were above the Level 3 proposed benchmark at the furthest upstream biological monitoring areas (i.e., RG_GHUT and RG_GHNF) and decreased with distance downstream (i.e., were above Level 2 updated EC at RG_GHDT and RG_GHFF and then below Level 2 updated EC downstream at RG_GHP and RG_GHBP) (Appendix Figure E.12; Appendix Table E.1).

The results of the aqueous selenium speciation analyses completed as part of the GC LAEMP and Selenium Speciation Monitoring Program in 2022 indicated selenium was predominately in the form of selenate and concentrations of organoselenium species tended to differ among areas (Appendix Table E.3; see also ADEPT et al. 2023). Concentrations of organoselenium species dimethylselenoxide and methylseleninic acid, which have been linked to higher bioaccumulative potential (e.g., ADEPT 2022) tended to be higher downstream from the Greenhills Creek Sedimentation Pond relative to upstream in 2022, based on qualitative comparisons (Appendix Table E.3). These results are consistent with those for 2021 and are attributed to enhanced formation of organoselenium species resulting from processes within the pond and carry-over effects to lotic habitats downstream (Golder 2021; Minnow 2022a).

[19] Dissolved nickel does not have an EWT, but has proposed benchmarks (Golder 2022a).

Concentrations of most mine-related constituents have remained relatively stable or decreased over time at Teck's monthly (routine) water quality monitoring stations on Upper and Lower Greenhills Creek (Appendix Figures E.1 to E.17; Appendix Table E.4). Specifically, concentrations of nitrate, total antimony, total molybdenum, and total nickel decreased significantly over time at all monthly monitoring stations and concentrations of total barium and manganese decreased at all stations except GH_GH1B (Appendix Table E.4). Total zinc concentrations at GH_CTF (furthest upstream station) were also lower in 2022 relative to 2017 and 2018 (Appendix Table E.4). The results of the statistical comparisons for the monthly water quality samples from Greenhills Creek are supported by visual comparisons of the water chemistry data collected over time at biological monitoring areas sampled as part of the GC LAEMP (Appendix Figures E.1 to E.17).

Total selenium and lithium were the only mine-related constituents with concentrations that increased over time at one or more monthly water quality monitoring station on Greenhills Creek (Appendix Table E.4). Total selenium concentrations at GH_GH1 on Lower Greenhills Creek were higher in 2022 relative to 2016 but comparable to 2017 to 2021 (Appendix Table E.4). These results are not attributed to antiscalant addition, given GH_GH1 was located upstream from the AAS and concentrations at areas downstream of the historical AAS (e.g., RG_GHBP and GH_GH2) did not increase over time (Appendix Figure E.13). Although concentrations of total lithium at monthly and GC LAEMP monitoring areas on Upper Greenhills Creek and GH_GH1 were generally higher in 2022 relative to 2016 or 2017, they were comparable to concentrations reported in 2020 and 2021 (Figure 2.1; Appendix Figure E.8; Appendix Table E.4).

Preventative treatment for calcite in Lower Greenhills Creek occurred from October 23, 2017 to August 22, 2022 and water samples collected between those dates are considered representative of conditions associated with calcite management. In 2022, no significant differences in the ratios between upstream (GH_GH1) and downstream (GH_GH2) concentrations of mine-related constituents, other than total and dissolved molybdenum, were observed relative to pre-treatment (i.e., 2017; Figure 3.1; Appendix Table E.5). Total and dissolved molybdenum concentrations were 87% and 88% higher, respectively, downstream of the AAS relative to upstream in 2022 versus 2017; however, total concentrations were consistently below BC WQG (Appendix Table E.2). These results are similar to those reported for 2019 and 2021 and the results for molybdenum are not unexpected, given it is a component of the antiscalant compound (Figure 3.1). Overall, it can be concluded that concentrations of mine-related constituents in Lower Greenhills Creek have not undergone unexpected changes relative to upstream following the application of antiscalant.

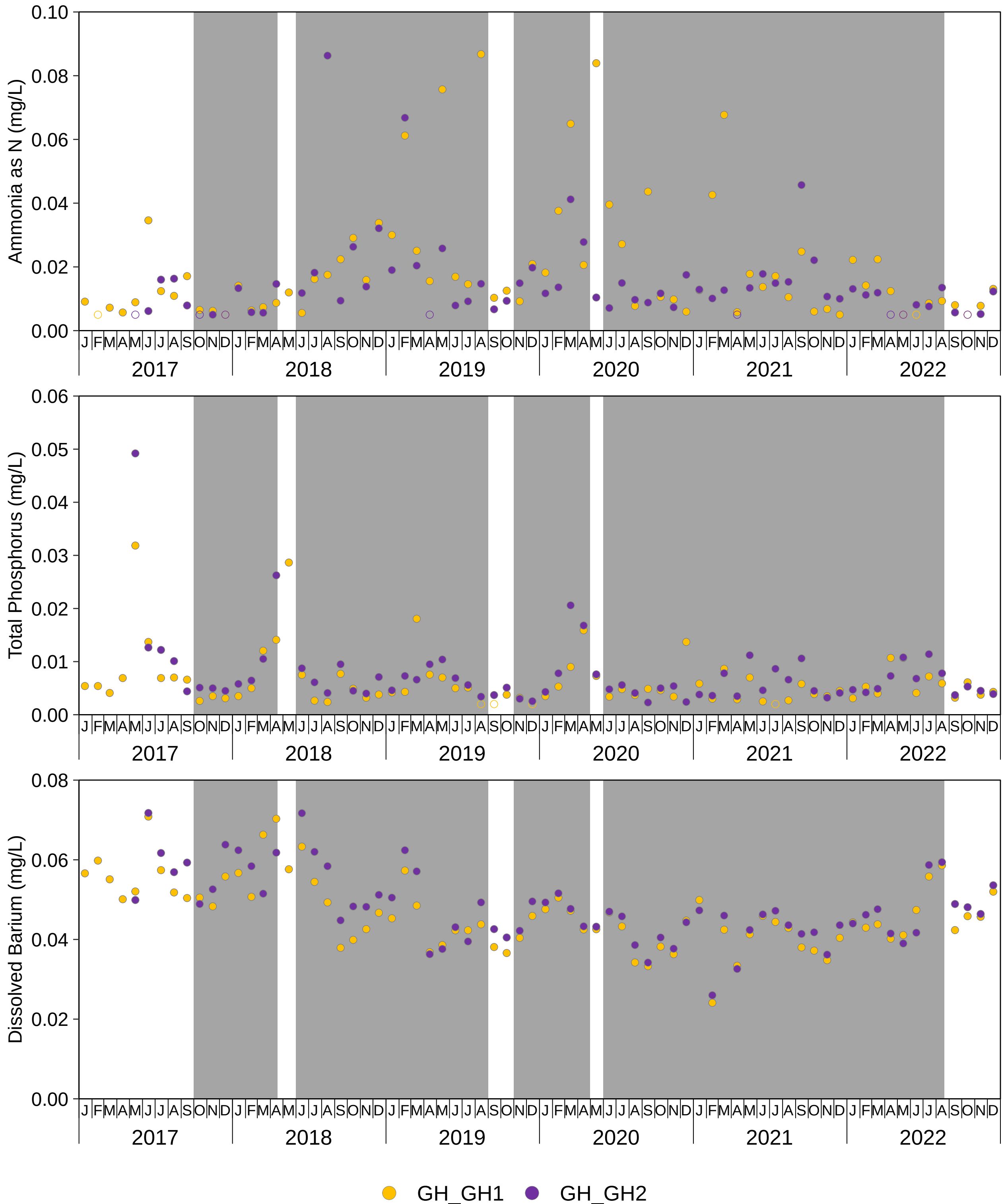


Figure 3.1: Monthly Mean Concentrations of Constituents Showing Significant Differences Before and After Calcite Treatment for Stations Upstream (GH_GH1) and Downstream (GH_GH2) from the Water Treatment Facility, 2017 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Grey shading represents prevention−mode calcite treatment.

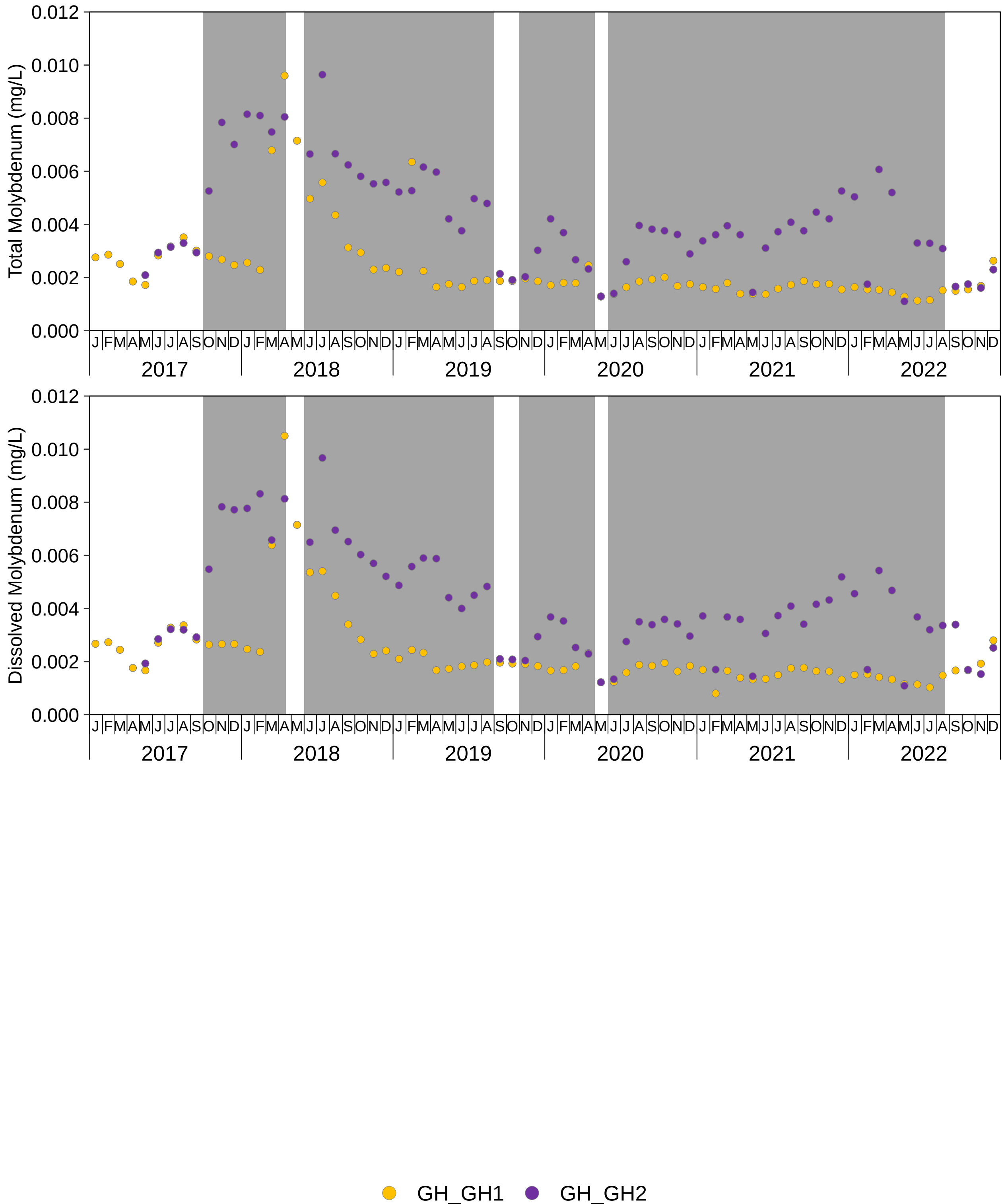


Figure 3.1: Monthly Mean Concentrations of Constituents Showing Significant Differences Before and After Calcite Treatment for Stations Upstream (GH_GH1) and Downstream (GH_GH2) from the Water Treatment Facility, 2017 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Grey shading represents prevention−mode calcite treatment.

3.1.3 Greenhills Creek Sedimentation Pond

No stratification was observed within the Greenhills Creek Sedimentation during September 2022 and the list of constituents with concentrations above BC WQG, the CCME guideline for total mercury, EVWQP Benchmarks, proposed benchmarks, updated EC, or screening values was similar to Upper and Lower Greenhills Creek (Section 3.1.2; Appendix Tables E.1 and E.6). Specifically, TDS concentrations were above the Level 1 screening value; sulphate concentrations were above the Level 2 updated EC; and dissolved nickel concentrations were above the Level 1 proposed benchmark (Appendix Table E.1).

The pond water samples from September 2022 had a combined dimethylselenoxide and methylseleninic acid concentration (i.e., 0.197 micrograms per litre [μg/L]) that was higher relative to all other GC LAEMP and Selenium Speciation Monitoring Program sampling locations in the Greenhills Creek watershed in 2022 (Appendix Table E.4; ADEPT et al. 2023). The draft screening value (0.025 μg/L) for detectable increases in selenium bioaccumulation was exceeded in the September 2022 sample.

3.2 Substrate Quality

3.2.1 Calcite

3.2.1.1 Gardine Creek

Calcite presence and concretion were lower in Gardine Creek upstream from the seeps (RG_GAUT, GARD1-50, and GARD1-75) in 2022, relative to downstream (RG_GANF and RG_GARD1-25) (Figures 2.2 and 3.2; Tables 3.1 and 3.2; Appendix Tables F.1 and F.2; Smit and Robinson 2023). These results are consistent with previous years of monitoring (i.e., 2019 to 2021) (Figure 3.2; Tables 3.1 and 3.2). Calcite presence (C_p) values for RG_GANF in 2022 were also comparable to previous years of monitoring. In 2022, C_p', C_c, CI, and CI' values at RG_GANF were higher relative to 2021, but C_c scores were, on average, the lowest recorded at RG_GANF since 2019 (Figure 3.2; Tables 3.1 and 3.2).

In 2022, RG_GAUT-1 and RG_GAUT-2 had higher C_p, C_p', CI, and CI' values relative to the upstream stations (RG_GAUT-3 to RG_GAUT-6 and GARD1-75), relative to GARD1-50, and relative to values reported at RG_GAUT-1 and RG_GAUT-2 in previous years (Figures 2.2 and 3.2; Table 3.1). Because the data for RG_GAUT-1 and RG_GAUT-2 were clearly misaligned with the rest of the calcite monitoring data collected upstream from the seeps in 2022, a more thorough review of the field data sheets, Regional Calcite Monitoring Program results, and Teck's activities within the area in 2022 was completed. The C_p, C_p,' CI, and CI' scores were evaluated from upstream-to-downstream along the creek, based on data from the GC LAEMP and Regional Calcite Monitoring Program. It was considered unrealistic that the

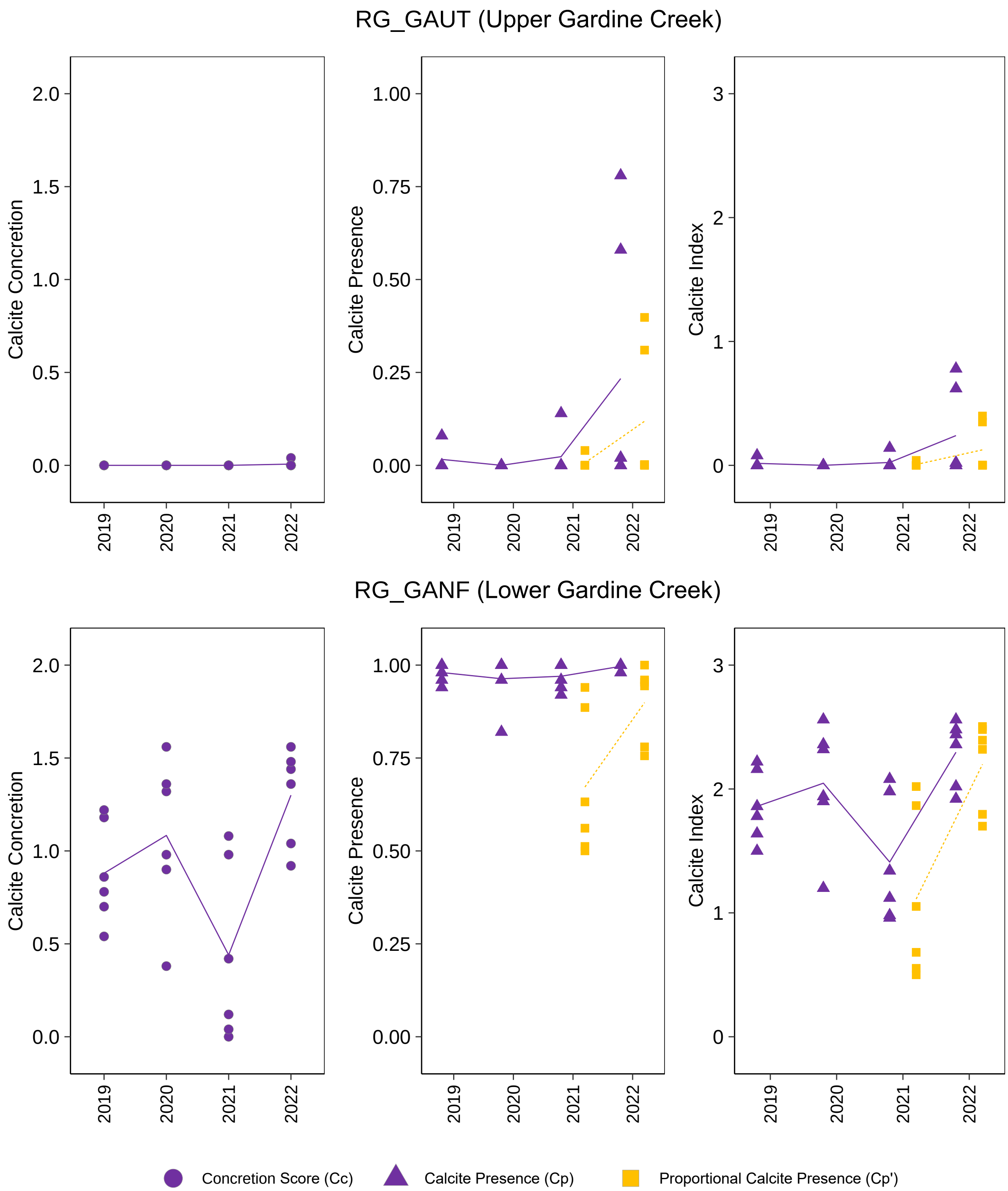


Figure 3.2: Calcite Presence and Concretion Scores for Monitoring Areas on Gardine Creek, 2019 to 2022

Note: In 2021 and 2022, calcite presence was measured using both presence/absence and proportional scoring methods.

Table 3.1: Calcite Indices (CI and CI') for Monitoring Locations on Greenhills and Gardine Creeks, 2015 to 2022

Watercourse	Station ID	UTM Coordinates (NAD83, 11U)		Calcite Index (CI)								Calcite Index Prime (CI')	
		Easting	Northing	2015	2016	2017	2018	2019	2020	2021	2022	2021	2022
	RG_GAUT-6	653321	5549045	-	-	-	-	0	0	0	0	0	0
	RG_GAUT-5	653346	5549023	-	-	-	-	0	0	0	0.02	0	0
	RG_GAUT-4	653379	5548991	-	-	-	-	0	0	0	0	0	0
	RG_GAUT-3	653392	5548984	-	-	-	-	0	0	0	0.02	0	0
	RG_GAUT-2	653431	5548953	-	-	-	-	0.08	0	0	0.78	0	0.40
	RG_GAUT-1	653451	5548928	-	-	-	-	0.04	0	0.14	0.62	0.04	0.35
	GARD1[a] GARD1-75	653316	5549076							0	0	0	0
Gardine Creek	GARD1[a] GARD1-50	653641	5548601	0.32	0.14	0.60	0.64	0.50	0.60	0	0	0	0
	GARD1[a] GARD1-25	653316	5549076							2.2	1.7	2.1	1.6
	RG_GANF-6	654125	5547829	-	-	-	-	1.8	1.9	2.0	2.4	1.9	2.3
	RG_GANF-5	654186	5547833	-	-	-	-	1.5	2.4	2.1	2.5	2.0	2.4
	RG_GANF-4	654204	5547822	-	-	-	-	2.2	2.3	1.3	1.9	1.1	1.7
	RG_GANF-3	654234	5547802	-	-	-	-	1.9	1.9	0.98	2.6	0.55	2.5
	RG_GANF-2	654247	5547794	-	-	-	-	2.2	2.6	0.96	2.4	0.50	2.4
	RG_GANF-1	654277	5547746	-	-	-	-	1.6	1.2	1.1	2.0	0.67	1.8
	RG_GHUT-6	654138	5550027	-	-	2.2	2.8	2.9	2.2	1.9	2.8	1.8	2.8
	RG_GHUT-5	654127	5549988	-	-	1.7	2.5	2.6	2.5	1.7	2.2	1.7	2.2
	RG_GHUT-4	654134	5549945	-	-	1.1	2.3	2.9	2.6	2.3	2.7	2.2	2.7
	RG_GHUT-3	654123	5549927	-	-	2.7	2.8	3.0	2.5	1.6	3.0	1.5	3.0
	GREE4-75	654152	5549910	2.8	2.5	2.3	2.6	2.3	2.7	2.7	2.6	2.7	2.6
	RG_GHUT-2	654145	5549895	-	-	2.8	2.5	2.9	2.6	1.6	2.3	1.6	2.3
	RG_GHUT-1	654149	5549848	-	-	2.3	2.8	2.5	2.4	2.7	2.4	2.7	2.4
Upper Greenhills Creek	RG_GH-CTF	654165	5549540	-	2.6	-	-	-	-	-	-	-	-
	GREE4-62.5	654195	5549512	2.7	-	-	-	-	-	-	-	-	-
	RG_GHNF-6	654336	5549159	-	-	2.8	2.6	3.0	2.9	2.2	2.5	2.2	2.5
	GREE4-50	654336	5549133	2.9	2.6	2.9	2.9	2.9	2.9	2.8	2.8	2.8	2.8
	RG_GHNF-5	654342	5549130	-	-	3.0	2.5	3.0	2.6	1.9	2.6	1.9	2.6
	RG_GHNF-4	654335	5549104	-	-	2.3	2.4	2.9	2.9	2.5	2.4	2.5	2.4
	RG_GHNF-3	654367	5549052	-	-	3.0	2.7	2.9	2.7	2.2	2.4	2.2	2.4
	RG_GHNF-2	654375	5549036	-	-	2.9	2.7	3.0	2.5	1.9	2.5	1.9	2.5
	RG_GHNF-1	654384	5549004	-	-	3.0	2.8	3.0	2.8	2.4	2.5	2.4	2.5
	GREE4-37.5	654447	5548758	2.8	-	-	-	-	-	-	-	-	-

Calcite Index 0.01 to 0.50.
Calcite Index 0.51 to 1.00.
Calcite Index 1.01 to 1.50.
Calcite Index 1.51 to 2.00.
Calcite Index 2.01 to 2.50.
Calcite Index ≥ 2.51.

Notes: ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; - = no data; ≥ = greater than or equal to.
[a] From 2015 to 2020, data for Reach 1 of Gardine Creek were reported as an average of three stations. In 2021 and 2022, the data were reported for individual stations.

Table 3.1: Calcite Indices (CI and CI') for Monitoring Locations on Greenhills and Gardine Creeks, 2015 to 2022

Watercourse	Station ID	UTM Coordinates (NAD83, 11U)		Calcite Index (CI)								Calcite Index Prime (CI')	
		Easting	Northing	2015	2016	2017	2018	2019	2020	2021	2022	2021	2022
Upper Greenhills Creek	RG_GHDT-6	654288	5547720	-	-	-	-	-	-	-	2.7	-	2.7
	RG_GHDT-5	654288	5547720	-	-	-	-	-	-	-	2.9	-	2.9
	RG_GHDT-4	654288	5547720	-	-	-	-	-	-	-	2.7	-	2.7
	RG_GHDT-3	654288	5547720	-	-	-	-	-	-	-	2.6	-	2.6
	RG_GHDT-2	654288	5547720	-	-	-	-	-	-	-	3.0	-	3.0
	RG_GHDT-1	654288	5547720	-	-	-	-	-	-	-	2.6	-	2.6
	GREE4-25	654512	5548365	2.8	2.7	2.8	2.8	1.8	2.9	2.6	2.8	2.6	2.8
	GRE-CA06	654451	5548079	-	2.6	-	-	-	-	-	-	-	-
	GREE4-12.5	654393	5547996	2.9	-	-	-	-	-	-	-	-	-
	RG_GHFF-6	654181	5547271	-	-	2.0	2.7	2.6	2.0	2.5	2.9	2.4	2.9
	RG_GHFF-5	654187	5547244	-	-	2.4	2.7	2.6	2.5	2.7	2.6	2.5	2.5
	GREE3-75	654172	5547243	2.5	2.4	2.7	2.5	1.6	2.6	2.7	2.9	2.7	2.9
	RG_GHFF-4	654161	5547200	-	-	2.2	2.5	2.8	2.5	2.6	2.6	2.6	2.6
	RG_GHFF-3	654135	5547185	-	-	1.8	2.6	2.8	2.5	2.3	2.2	2.2	2.2
	RG_GHFF-2	654118	5547137	-	-	2.0	2.5	2.2	2.2	2.7	2.3	2.6	2.3
	RG_GHFF-1	654099	5547120	-	-	2.6	2.6	2.2	2.3	2.2	2.8	2.0	2.8
	GREE3-62.5	654048	5547076	2.7	-	-	-	-	-	-	-	-	-
	GREE3-50	653990	5546883	2.5	2.4	2.5	2.5	2.3	2.6	2.9	2.7	2.9	2.7
	GREE3-37.5	653954	5546673	2.2	-	-	-	-	-	-	-	-	-
	GREE3-25	653918	5546481	2.6	1.7	2.4	2.4	1.8	2.5	2.4	2.3	2.4	2.3
Lower Greenhills Creek	GH_DSAF	653543	5545805	-	-	-	1.5	-	-	-	-	-	-
	RG_GHBP-6	653547	5545677	-	2.4	2.4	2.1	2.0	1.9	1.2	1.8	1.0	1.7
	GH_GREE1-75	653534	5545668	1.4	2.1	2.1	1.4	1.2	1.3	1.2	1.3	1.2	1.2
	RG_GHBP-5	653538	5545647	-	1.9	1.9	1.4	1.4	1.1	0.92	1.5	0.44	1.3
	RG_GHBP-4	653538	5545628	-	0.72	0.72	1.6	0.76	0.50	0.90	1.0	0.42	0.83
	RG_GHBP-3	653521	5545623	-	0.68	0.68	0.24	0.62	0.42	0.90	0.90	0.45	0.27
	RG_GHBP-2	653513	5545618	-	0.52	0.52	0.40	0.54	0.64	0.90	0.08	0.47	0.04
	RG_GHBP-1	653501	5545593	-	0.30	0.30	0.32	0.72	0.30	0.86	0.18	0.36	0.06
	GH_GREE1-50	653494	5545590	0.88	0.90	0.90	0.26	0.54	0.11	1.0	1.0	0.26	0.22
	GH_GREE1-25	653386	5545504	0.30	0.23	0.23	0.23	0.21	0.47	1.1	1.0	0.86	0.30

Calcite Index 0.01 to 0.50.
Calcite Index 0.51 to 1.00.
Calcite Index 1.01 to 1.50.
Calcite Index 1.51 to 2.00.
Calcite Index 2.01 to 2.50.
Calcite Index ≥ 2.51.

Notes: ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; - = no data; ≥ = greater than or equal to.

[a] From 2015 to 2020, data for Reach 1 of Gardine Creek were reported as an average of three stations. In 2021 and 2022, the data were reported for individual stations.

Table 3.2: Calcite Concretion Scores for Stations on Greenhills and Gardine Creeks, 2015 to 2022

Watercourse	Station ID	UTM Coordinates (NAD83, 11U)		2015	2016	2017	2018	2019	2020	2021	2022
		Easting	Northing								
Gardine Creek	RG_GAUT-6	653321	5549045	-	-	-	-	0	0	0	0
	RG_GAUT-5	653346	5549023	-	-	-	-	0	0	0	0
	RG_GAUT-4	653379	5548991	-	-	-	-	0	0	0	0
	RG_GAUT-3	653392	5548984	-	-	-	-	0	0	0	0
	RG_GAUT-2	653431	5548953	-	-	-	-	0	0	0	0
	RG_GAUT-1	653451	5548928	-	-	-	-	0	0	0	0.04
	GARD1[a] GARD1-75	653316	5549076							0	0
	GARD1[a] GARD1-50	653641	5548601	0.06	0.02	0.28	0.29	0.01	0.22	0	0
	GARD1[a] GARD1-25	653316	5549076							1.2	0.74
	RG_GANF-6	654125	5547829	-	-	-	-	0.78	0.90	0.98	1.4
	RG_GANF-5	654186	5547833	-	-	-	-	0.54	1.4	1.1	1.5
	RG_GANF-4	654204	5547822	-	-	-	-	1.2	1.3	0.42	0.92
	RG_GANF-3	654234	5547802	-	-	-	-	0.86	0.98	0.04	1.6
	RG_GANF-2	654247	5547794	-	-	-	-	1.2	1.6	0	1.4
	RG_GANF-1	654277	5547746	-	-	-	-	0.70	0.38	0.12	1.0
Upper Greenhills Creek	RG_GHUT-6	654138	5550027	-	-	1.2	1.5	1.9	1.3	0.88	1.8
	RG_GHUT-5	654127	5549988	-	-	0.70	1.5	1.6	1.5	0.70	1.2
	RG_GHUT-4	654134	5549945	-	-	0.08	1.3	1.9	1.6	1.3	1.7
	RG_GHUT-3	654123	5549927	-	-	1.7	1.8	2.0	1.5	0.60	2.0
	GREE4-75	654152	5549910	1.8	1.5	1.4	1.6	1.3	1.8	1.7	1.6
	RG_GHUT-2	654145	5549895	-	-	1.8	1.5	1.9	1.6	0.64	1.4
	RG_GHUT-1	654149	5549848	-	-	1.3	1.8	1.5	1.4	1.7	1.4
	GREE4-62.5	654195	5549512	1.8	-	-	-	-	-	-	-
	RG_GHNF-6	654336	5549159	-	-	1.8	1.6	2.0	1.9	1.2	1.5
	GREE4-50	654336	5549133	1.9	1.7	1.9	1.9	1.9	1.9	1.8	1.8
	RG_GHNF-5	654342	5549130	-	-	2.0	1.5	2.0	1.6	0.88	1.6
	RG_GHNF-4	654335	5549104	-	-	1.3	1.4	1.9	1.9	1.5	1.4
	RG_GHNF-3	654367	5549052	-	-	2.0	1.7	1.9	1.7	1.2	1.4
	RG_GHNF-2	654375	5549036	-	-	1.9	1.7	2.0	1.5	0.86	1.5
	RG_GHNF-1	654384	5549004	-	-	2.0	1.8	2.0	1.8	1.4	1.5
	GREE4-37.5	654447	5548758	1.8	-	-	-	-	-	-	-

Concretion Score 0.01 to 0.50.
Concretion Score 0.51 to 1.00.
Concretion Score 1.01 to 1.50.
Concretion Score 1.51 to 2.00.

Notes: ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; - = no data.
[a] From 2015 to 2020, data for Reach 1 of Gardine Creek were reported as an average of three stations. In 2021 and 2022, the data were reported for individual stations.

Table 3.2: Calcite Concretion Scores for Stations on Greenhills and Gardine Creeks, 2015 to 2022

Watercourse	Station ID	UTM Coordinates (NAD83, 11U)		2015	2016	2017	2018	2019	2020	2021	2022
		Easting	Northing								
Upper Greenhills Creek	GREE4-25	654512	5548365	1.8	1.7	1.8	1.8	0.81	1.9	1.6	1.8
	GREE4-12.5	654393	5547996	1.9	-	-	-	-	-	-	-
	RG_GHDT-6	654288	5547720	-	-	-	-	-	-	-	1.7
	RG_GHDT-5	654288	5547720	-	-	-	-	-	-	-	1.9
	RG_GHDT-4	654288	5547720	-	-	-	-	-	-	-	1.7
	RG_GHDT-3	654288	5547720	-	-	-	-	-	-	-	1.6
	RG_GHDT-2	654288	5547720	-	-	-	-	-	-	-	2.0
	RG_GHDT-1	654288	5547720	-	-	-	-	-	-	-	1.6
	RG_GHFF-6	654181	5547271	-	-	0.96	1.7	1.6	0.98	1.5	1.9
	RG_GHFF-5	654187	5547244	-	-	1.4	1.7	1.6	1.5	1.7	1.6
	GREE3-75	654172	5547243	1.6	1.5	1.7	1.6	0.64	1.6	1.7	1.9
	RG_GHFF-4	654161	5547200	-	-	1.2	1.5	1.8	1.5	1.6	1.6
	RG_GHFF-3	654135	5547185	-	-	0.80	1.6	1.8	1.5	1.3	1.2
	RG_GHFF-2	654118	5547137	-	-	1.0	1.5	1.2	1.2	1.7	1.3
	RG_GHFF-1	654099	5547120	-	-	1.6	1.6	1.4	1.3	1.3	1.8
	GREE3-62.5	654048	5547076	1.7	-	-	-	-	1.5	-	-
	GREE3-50	653990	5546883	1.6	1.4	1.5	1.5	1.3	1.6	1.9	1.7
	GREE3-37.5	653954	5546673	1.3	-	-	-	-	1.6	-	-
	GREE3-25	653918	5546481	1.6	0.84	1.5	1.4	0.81	1.5	1.4	1.3
Lower Greenhills Creek	GH_DSAF	653543	5545805	-	-	-	0.70	-	-	-	-
	RG_GHBP-6	653547	5545677	-	-	1.4	1.1	1.0	1.1	0.24	0.88
	GH_GREE1-75	653534	5545668	0.10	0.61	1.1	0.57	0.28	0.39	0.18	0.28
	RG_GHBP-5	653538	5545647	-	-	0.90	0.44	0.50	0.30	0	0.48
	RG_GHBP-4	653538	5545628	-	-	0	0.64	0.08	0.02	0	0.06
	RG_GHBP-3	653521	5545623	-	-	0	0	0	0	0	0
	RG_GHBP-2	653513	5545618	-	-	0	0.02	0	0.04	0	0
	RG_GHBP-1	653501	5545593	-	-	0	0	0	0	0	0
	GH_GREE1-50	653494	5545590	0.02	0.20	0.14	0.03	0	0	0	0
	GH_GREE1-25	653386	5545504	0	0	0.02	0	0	0	0.05	0

Concretion Score 0.01 to 0.50.
Concretion Score 0.51 to 1.00.
Concretion Score 1.01 to 1.50.
Concretion Score 1.51 to 2.00.

Notes: ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; - = no data.

[a] From 2015 to 2020, data for Reach 1 of Gardine Creek were reported as an average of three stations. In 2021 and 2022, the data were reported for individual stations.

calcite scores for the two downstream-most stations at RG_GAUT (i.e., RG_GAUT-1 and RG_GAUT-2) would exhibit such large differences relative to the next upstream stations (e.g., RG_GAUT-3 and RG_GAUT-4) and relative to the Regional Calcite Monitoring Program stations (GARD1-50 and GARD1-75) (see Table 3.1). Additionally, there were no upstream activities in 2022 that could explain why more calcium carbonate would be present in this section of Gardine Creek in 2022. For these reasons, and in consideration of the absence of changes over time in the regional data set and expected timelines for calcite deposition and concretion, it is considered highly likely that the 2022 calcite data for RG_GAUT-1 and RG_GAUT-2 were not recorded correctly and are unreliable. Calcite monitoring planned for September 2023 is expected to confirm whether C_p, C_p', CI, and CI' values for RG_GAUT-1 and RG_GAUT-2 are, in reality, more like those recorded historically (i.e., from 2019 to 2021) or if values are in fact increasing (as recorded in 2022).

3.2.1.2 Upper and Lower Greenhills Creek

Calcite measurements completed in 2022 indicated that calcified substrates were present throughout Upper Greenhills Creek and, to a lesser extent, in Lower Greenhills Creek (Figure 3.3; Table 3.1; Appendix Tables F.3 to F.7). Calcite presence (C_p) and CI values were significantly lower downstream from the historical (i.e., October 2017 to August 2022) AAS location on Lower Greenhills Creek relative to upstream (Table 3.2; Appendix Table F.8).

Overall, C_p values for RG_GHUT, RG_GHNF, and RG_GHFF on Upper Greenhills Creek and RG_GHBP on Lower Greenhills Creek have remained fairly consistent since 2017, but C_c values have changed over time within individual monitoring areas (Figures 2.2 and 3.3; Appendix Table F.8). Most importantly, C_c values for RG_GHBP on Lower Greenhills Creek showed signs of improvement starting in 2019 and were consistently and significantly lower (i.e., by 39 to 90%) throughout 2020 to 2022 relative to 2017 (Appendix Table F.8). The improvement in C_c values for RG_GHBP is attributed to successful treatment with antiscalant between October 2017 and August 2022.

3.2.2 Sediment Chemistry

3.2.2.1 Gardine Creek

Concentrations of cadmium and nickel in bulk sediments from upper (RG_GAUT) and lower (RG_GANF) Gardine Creek were within reference area normal ranges but consistently above the lower BC WSQG in 2022 (Figure 3.4; Appendix Table F.9). Results of the SEA indicated guideline exceedances for cadmium and nickel were associated with the potentially mobile sediment fractions (i.e., sediment fractions 1 to 4; Figures 3.5 and 3.6; Appendix Tables F.10

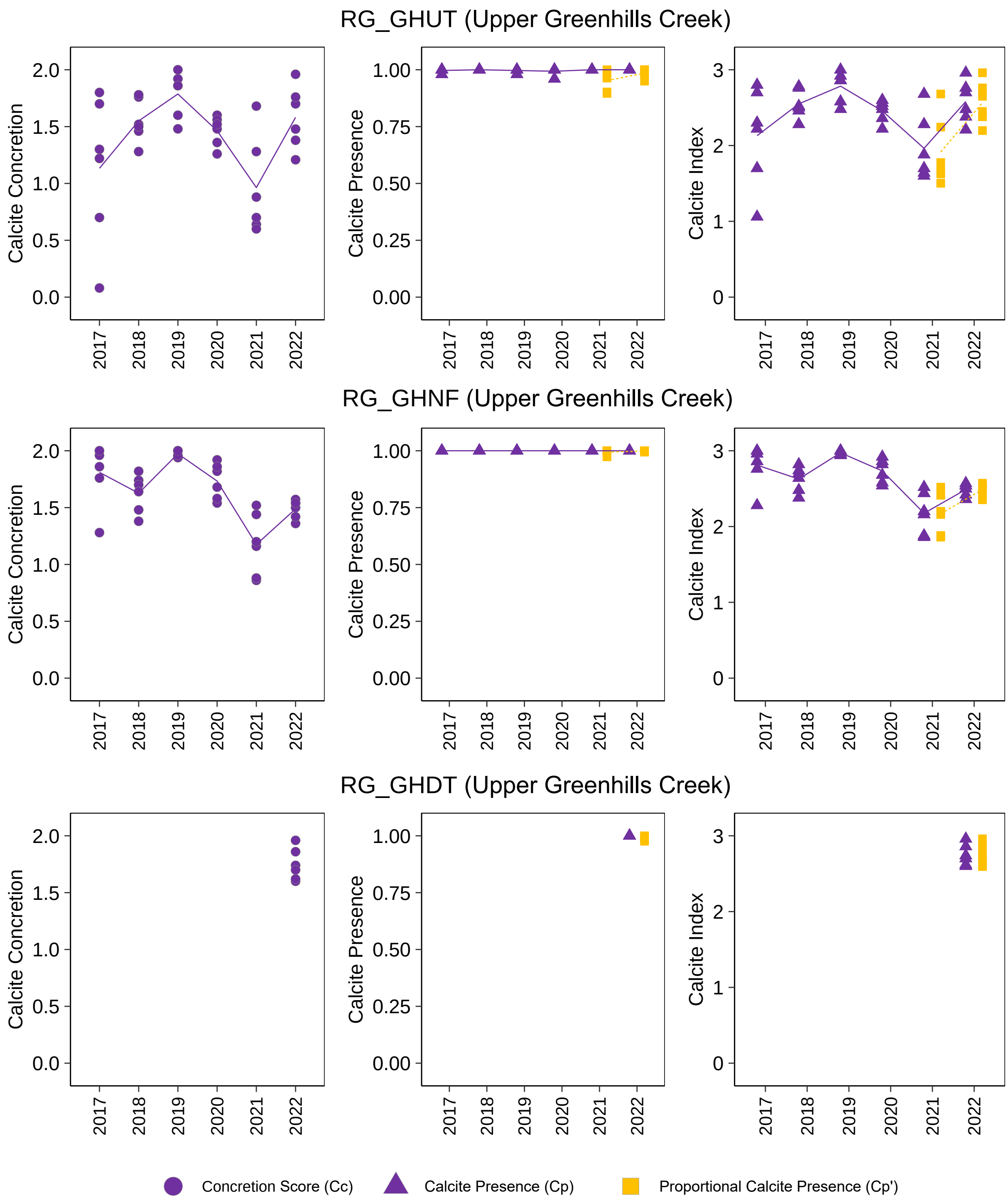


Figure 3.3: Calcite Presence and Concretion Scores for Monitoring Areas on Greenhills Creek, 2017 to 2022

Note: In 2021 and 2022, calcite presence was measured using both presence/absence and proportional scoring methods.

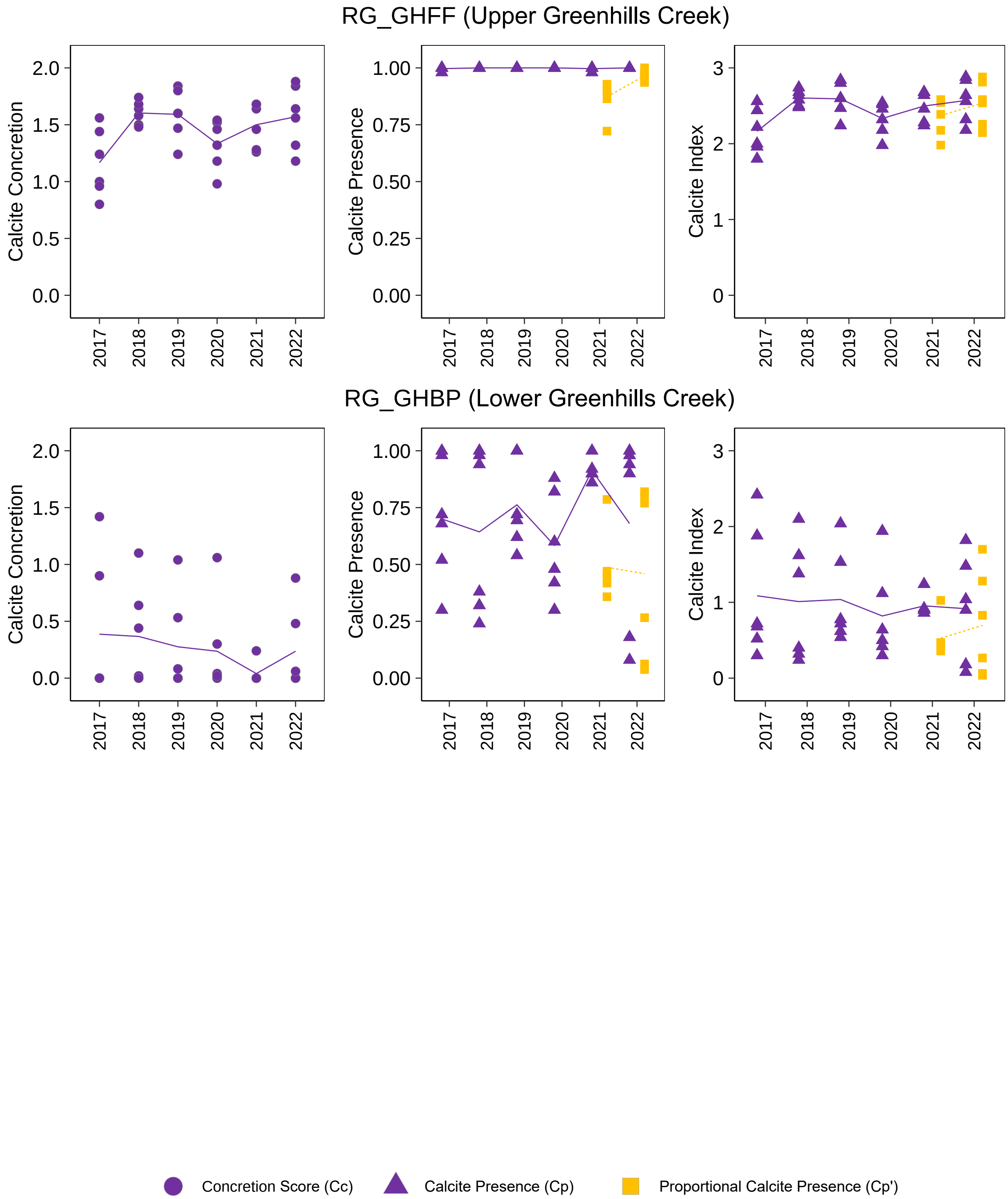


Figure 3.3: Calcite Presence and Concretion Scores for Monitoring Areas on Greenhills Creek, 2017 to 2022

Note: In 2021 and 2022, calcite presence was measured using both presence/absence and proportional scoring methods.

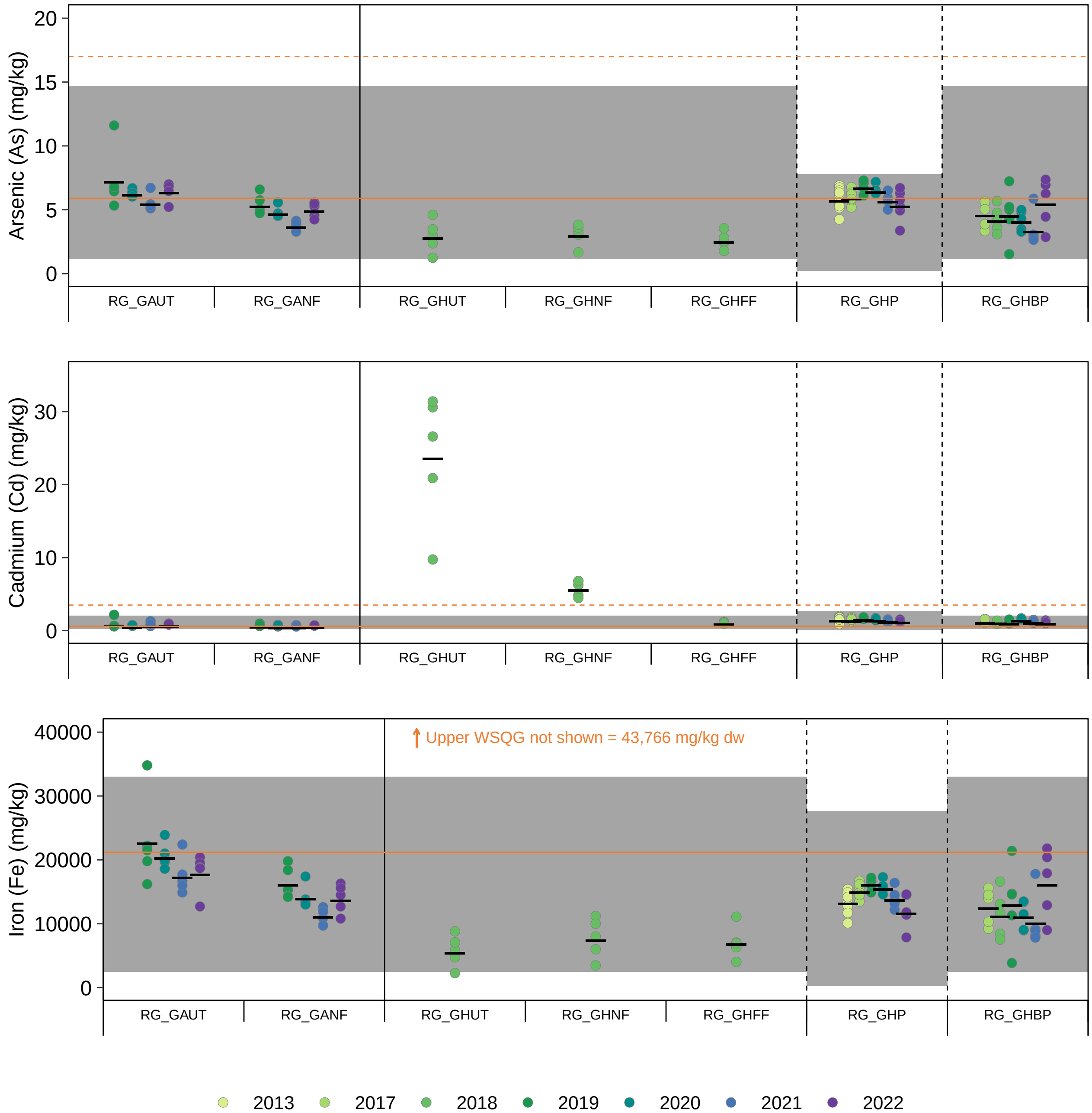


Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) were plotted as open symbols at the LRL. Solid orange line = lower BC WSQG; hashed orange line = upper BC WSQG (or alert concentration in the case of selenium). Solid black line separates Gardine Creek stations from Greenhills Creek stations. Hashed black lines separate Greenhills Creek Sedimentation Pond (RG_GHP) from Greenhills Creek. Solid, black horizontal bars represent annual averages. For the calculation of averages, values below the LRL were substituted with the LRL. Grey shading = the reference area normal range (i.e., the 2.5th and 97.5th percentiles of pooled reference area data after removal of outliers). Normal ranges were calculated separately for lotic areas and the Greenhills Creek Sedimentation Pond and were excluded when >75 % of the values were censored.

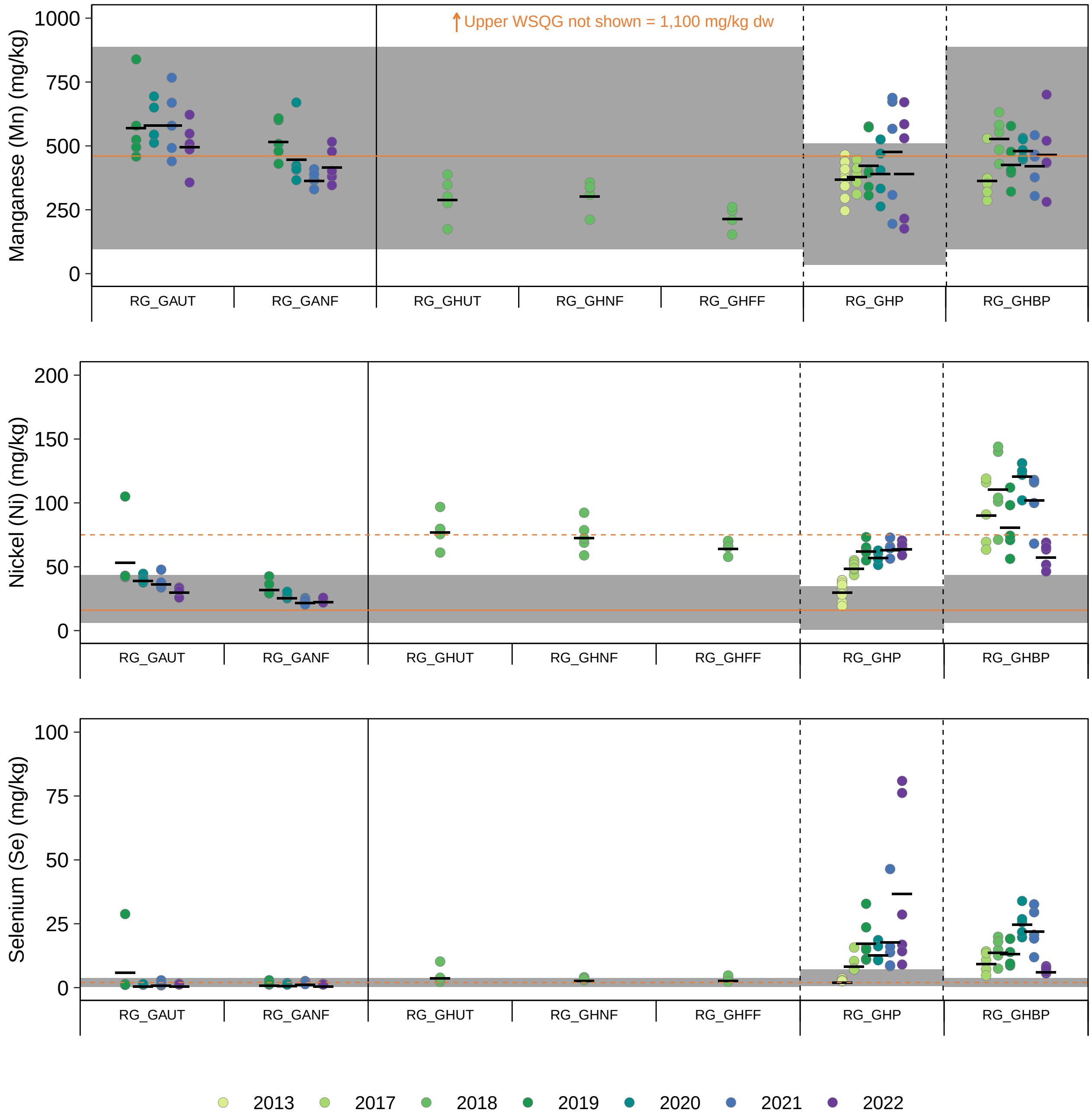


Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) were plotted as open symbols at the LRL. Solid orange line = lower BC WSQG; hashed orange line = upper BC WSQG (or alert concentration in the case of selenium). Solid black line separates Gardine Creek stations from Greenhills Creek stations. Hashed black lines separate Greenhills Creek Sedimentation Pond (RG_GHP) from Greenhills Creek. Solid, black horizontal bars represent annual averages. For the calculation of averages, values below the LRL were substituted with the LRL. Grey shading = the reference area normal range (i.e., the 2.5th and 97.5th percentiles of pooled reference area data after removal of outliers). Normal ranges were calculated separately for lotic areas and the Greenhills Creek Sedimentation Pond and were excluded when >75 % of the values were censored.

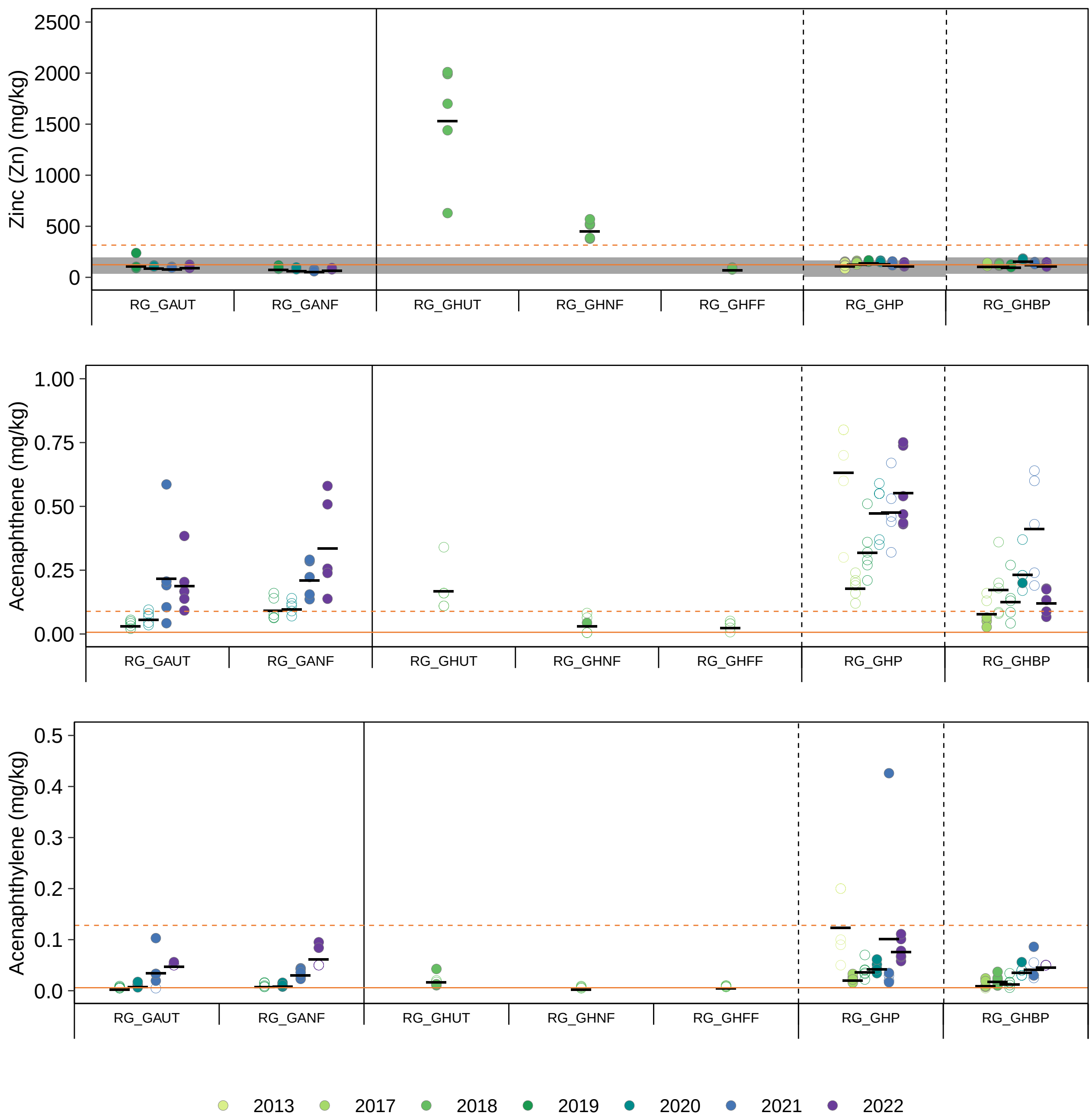


Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) were plotted as open symbols at the LRL. Solid orange line = lower BC WSQG; hashed orange line = upper BC WSQG (or alert concentration in the case of selenium). Solid black line separates Gardine Creek stations from Greenhills Creek stations. Hashed black lines separate Greenhills Creek Sedimentation Pond (RG_GHP) from Greenhills Creek. Solid, black horizontal bars represent annual averages. For the calculation of averages, values below the LRL were substituted with the LRL. Grey shading = the reference area normal range (i.e., the 2.5th and 97.5th percentiles of pooled reference area data after removal of outliers). Normal ranges were calculated separately for lotic areas and the Greenhills Creek Sedimentation Pond and were excluded when >75 % of the values were censored.

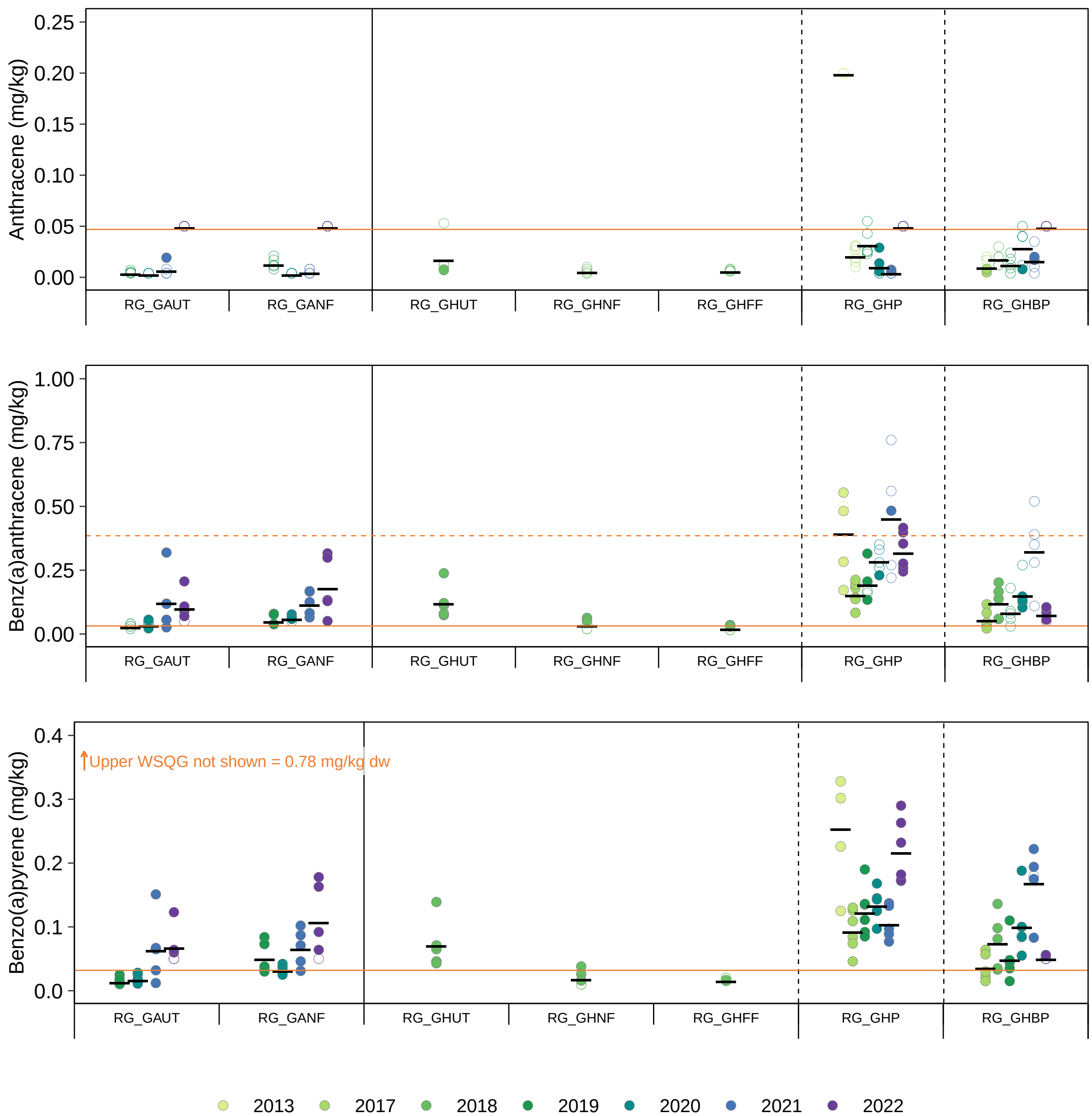


Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) were plotted as open symbols at the LRL. Solid orange line = lower BC WSQG; hashed orange line = upper BC WSQG (or alert concentration in the case of selenium). Solid black line separates Gardine Creek stations from Greenhills Creek stations. Hashed black lines separate Greenhills Creek Sedimentation Pond (RG_GHP) from Greenhills Creek. Solid, black horizontal bars represent annual averages. For the calculation of averages, values below the LRL were substituted with the LRL. Grey shading = the reference area normal range (i.e., the 2.5th and 97.5th percentiles of pooled reference area data after removal of outliers). Normal ranges were calculated separately for lotic areas and the Greenhills Creek Sedimentation Pond and were excluded when >75 % of the values were censored.

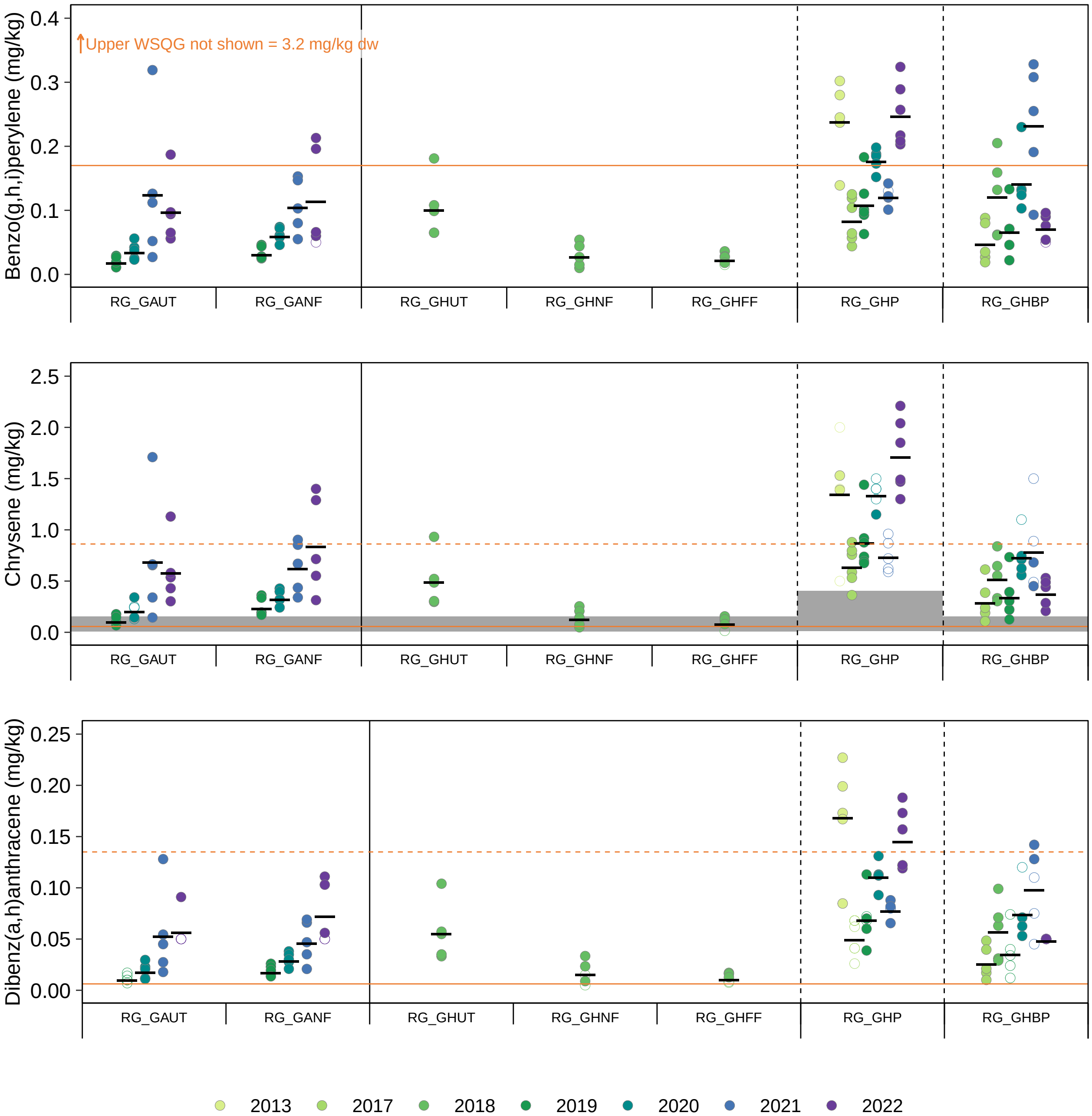


Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2022

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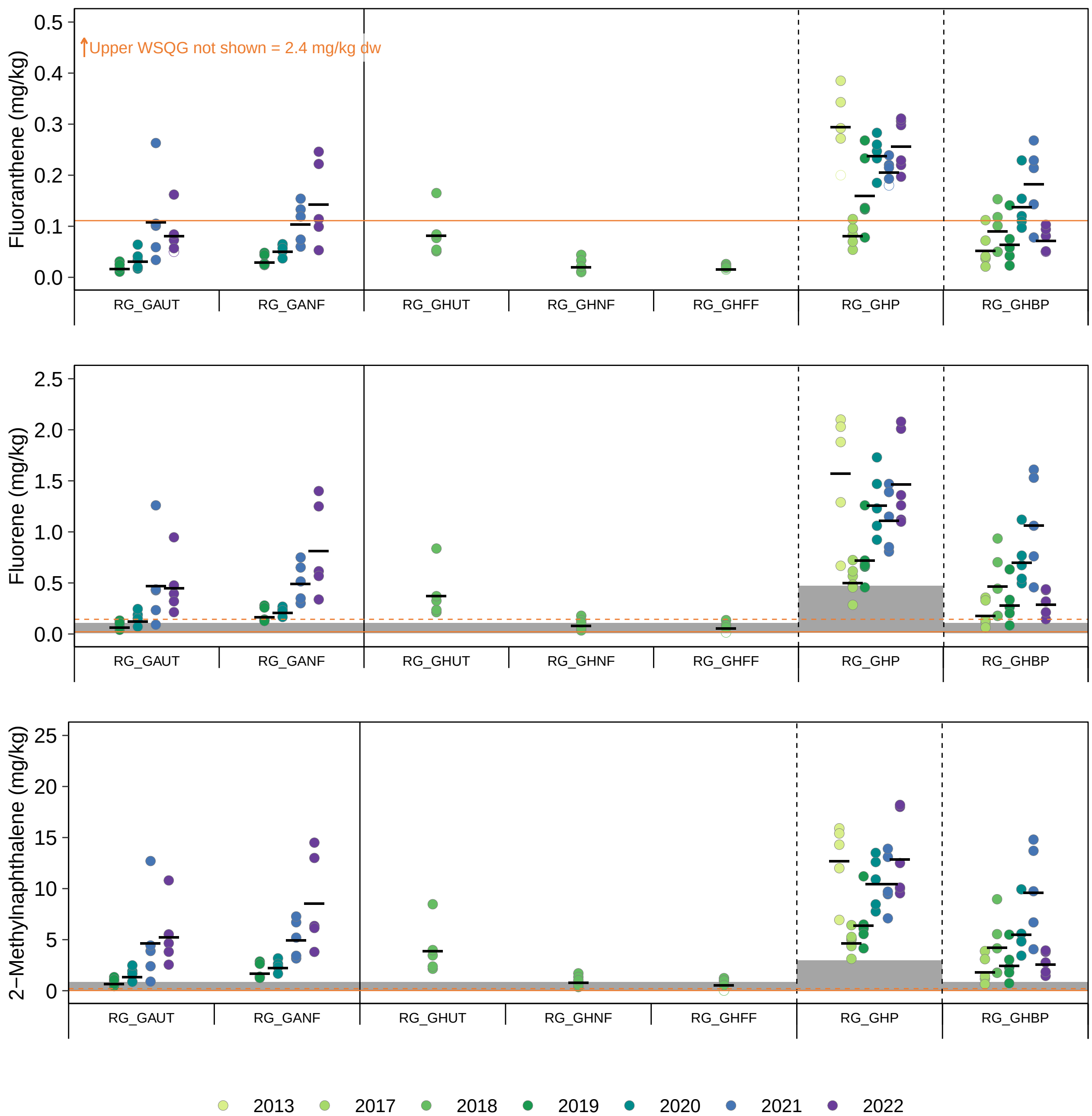

Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) were plotted as open symbols at the LRL. Solid orange line = lower BC WSQG; hashed orange line = upper BC WSQG (or alert concentration in the case of selenium). Solid black line separates Gardine Creek stations from Greenhills Creek stations. Hashed black lines separate Greenhills Creek Sedimentation Pond (RG_GHP) from Greenhills Creek. Solid, black horizontal bars represent annual averages. For the calculation of averages, values below the LRL were substituted with the LRL. Grey shading = the reference area normal range (i.e., the 2.5th and 97.5th percentiles of pooled reference area data after removal of outliers). Normal ranges were calculated separately for lotic areas and the Greenhills Creek Sedimentation Pond and were excluded when >75 % of the values were censored.

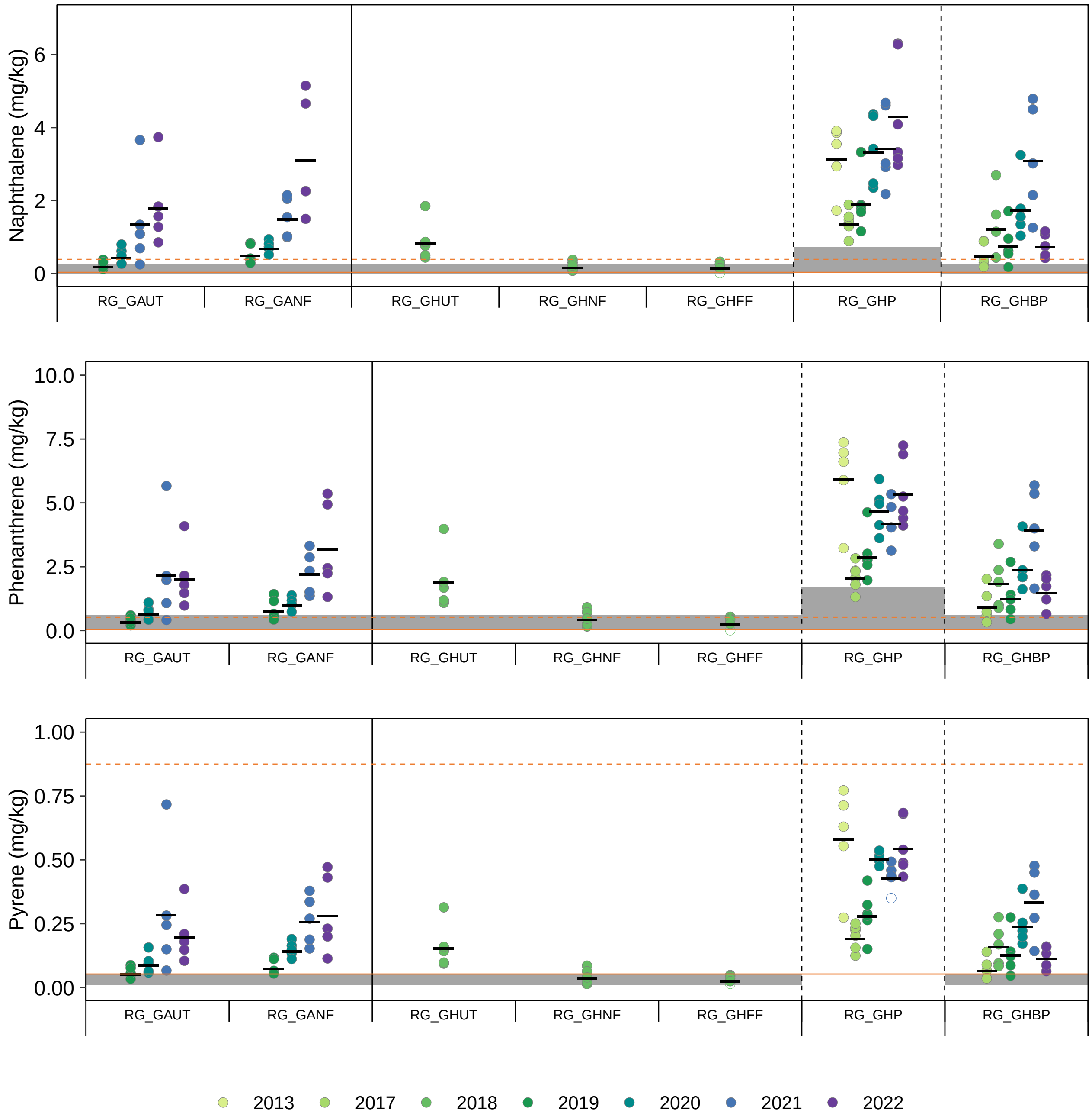

Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2022

Notes: Concentrations below the laboratory reporting limit (LRL) were plotted as open symbols at the LRL. Solid orange line = lower BC WSQG; hashed orange line = upper BC WSQG (or alert concentration in the case of selenium). Solid black line separates Gardine Creek stations from Greenhills Creek stations. Hashed black lines separate Greenhills Creek Sedimentation Pond (RG_GHP) from Greenhills Creek. Solid, black horizontal bars represent annual averages. For the calculation of averages, values below the LRL were substituted with the LRL. Grey shading = the reference area normal range (i.e., the 2.5th and 97.5th percentiles of pooled reference area data after removal of outliers). Normal ranges were calculated separately for lotic areas and the Greenhills Creek Sedimentation Pond and were excluded when >75 % of the values were censored.

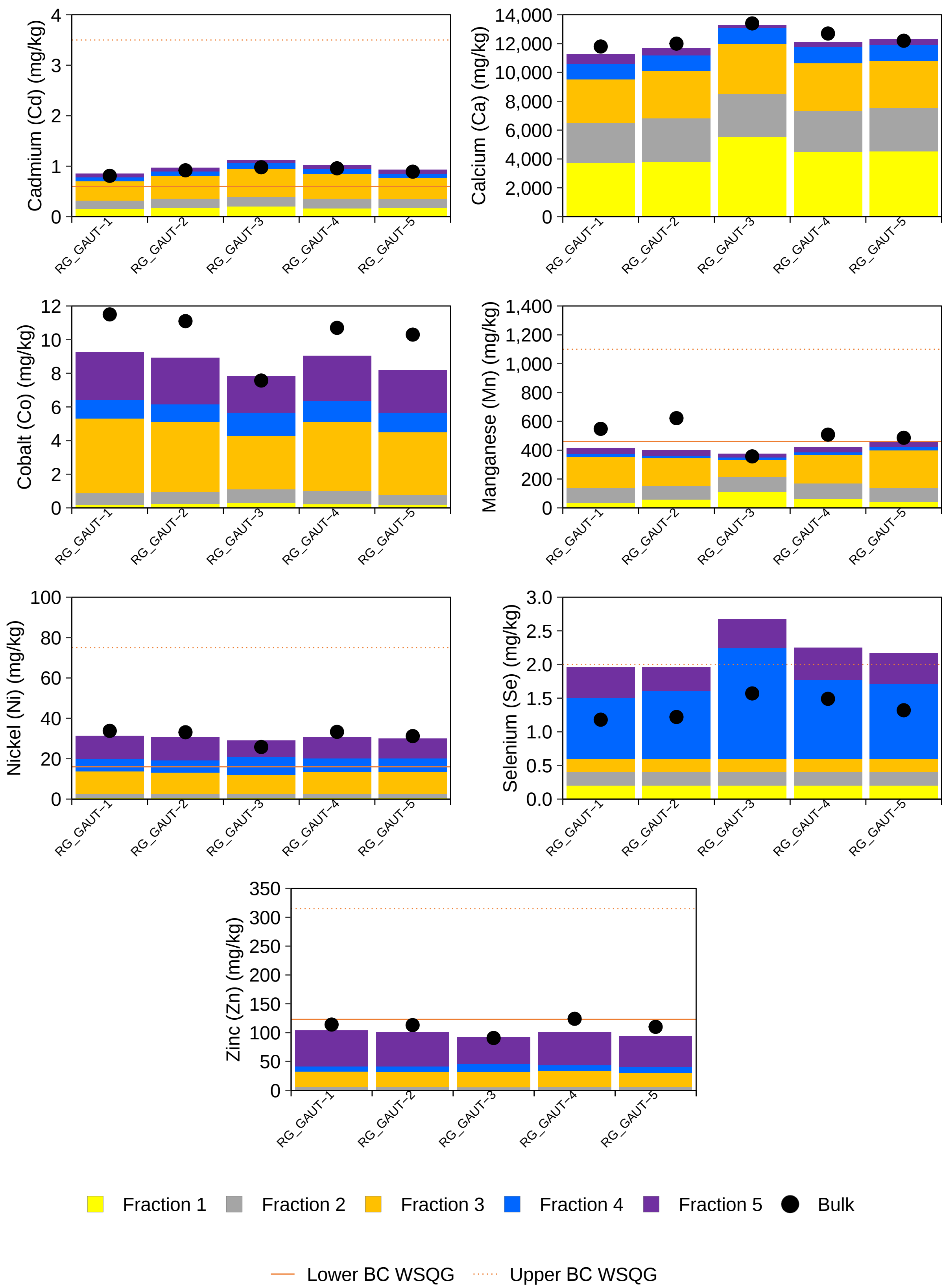

Figure 3.5: Comparisons of Metal Concentrations (Dry Weight Basis) in Sequentially Extracted Sediment Fractions to British Columbia Working Sediment Quality Guidelines, Upper Gardine Creek (RG_GAUT), 2022

Notes: mg/kg = milligrams per kilogram dry weight; BC WSQG = British Columbia Working Sediment Quality Guideline. Values at the Laboratory Reporting Limit (LRL) were plotted at the LRL. Concentrations were determined using Tessier Extraction (Tessier et al. 1979).

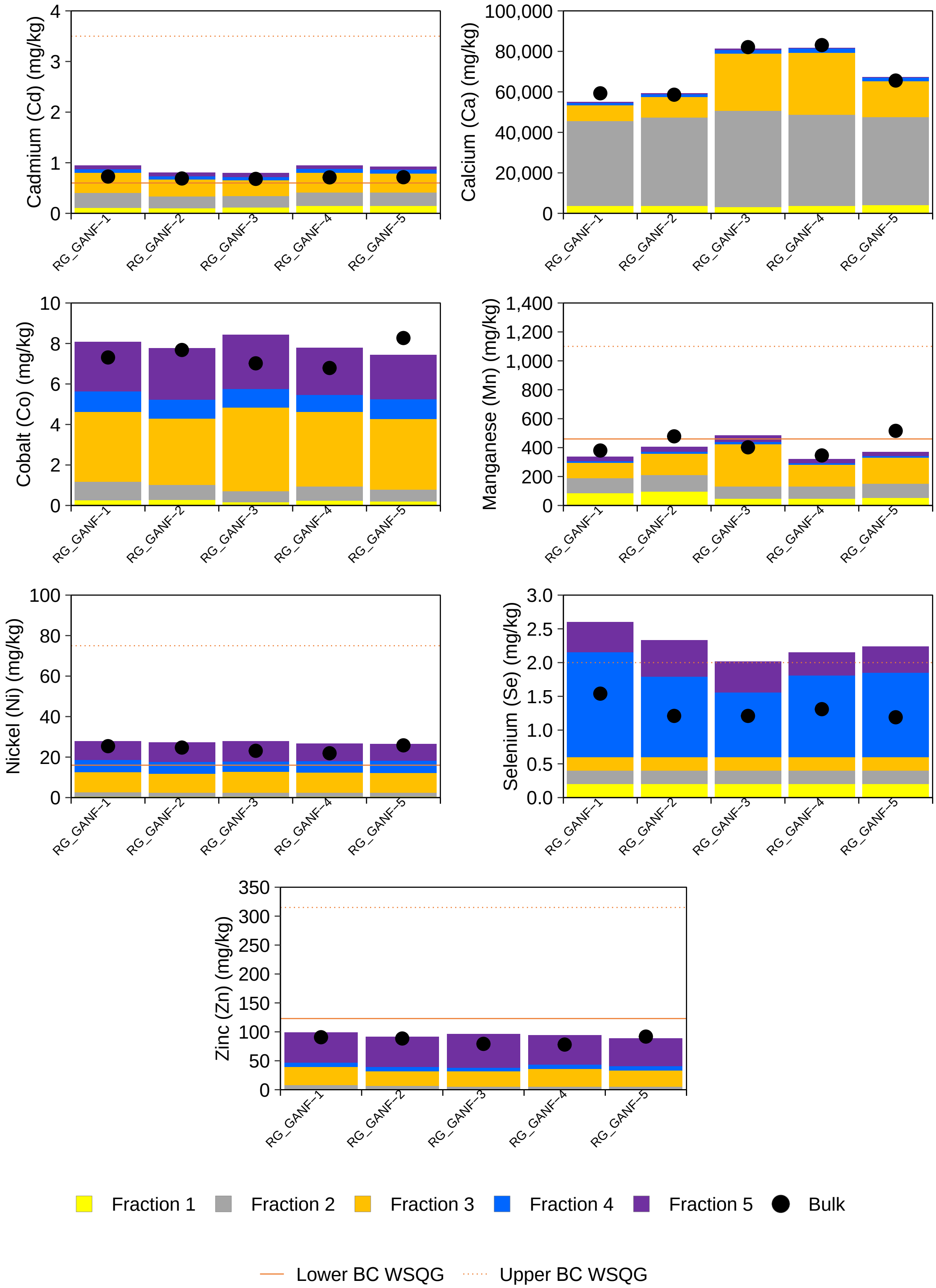

Figure 3.6: Comparisons of Metal Concentrations (Dry Weight Basis) in Sequentially Extracted Sediment Fractions to British Columbia Working Sediment Quality Guidelines, Lower Gardine Creek (RG_GANF), 2022

Notes: mg/kg = milligrams per kilogram dry weight; BC WSQG = British Columbia Working Sediment Quality Guideline. Values at the Laboratory Reporting Limit (LRL) were plotted at the LRL. Concentrations were determined using Tessier Extraction (Tessier et al. 1979).

to F.19).[20] Concentrations of arsenic (RG_GAUT), manganese (RG_GAUT and RG_GANF), and zinc (RG_GAUT) in bulk sediments were occasionally (i.e., in one to four of n = 5 samples per area) above the lower BC WSQG, despite concentrations being consistently within reference area normal ranges (Figure 3.4; Appendix Table F.9). However, concentrations of these metals in the potentially mobile sediment fractions were less than the lower BC WSQG (Figures 3.5 and 3.6; Appendix Tables F.10 to F.19). Based on the above comparisons, it appears that potentially bioavailable concentrations of arsenic, manganese, and zinc in sediments from Gardine Creek are low enough that adverse biological effects would not be expected under most circumstances (BCMOECCS 2021b). In contrast, bioavailable concentrations of cadmium and nickel in sediments are more likely to be associated with potential adverse effects.

Concentrations of PAHs in sediments from Gardine Creek were frequently above the lower BC WSQG and concentrations of acenaphthene, fluorene, 2-methylnaphthalene, naphthalene, and phenanthrene were consistently above the upper BC WSQG in 2022 (Figure 3.4; Appendix Table F.9). Additionally, concentrations of chrysene, fluorene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene were above their respective reference area normal ranges at RG_GAUT and RG_GANF in 2022, consistent with 2021 (Figure 3.4; Minnow 2022a).

Bulk sediment samples collected from RG_GANF (downstream) in 2022 had lower concentrations of most metals relative to RG_GAUT (upstream), despite having similar TOC content, higher clay content (magnitude of difference [MOD] = 110%), and less coarse sand and gravel relative to RG_GAUT (Figure 3.4; Appendix Table F.20) (e.g., Horowitz 1991; Zhang et al. 2014). The bulk sediment samples from RG_GANF did however have higher concentrations of calcium (MOD = 499%) relative to RG_GAUT, consistent with the higher incidence of calcite presence at RG_GANF (see Section 3.2.1). The spatial patterns in metal concentrations within bulk sediments were reflected in the comparisons of SEA results between RG_GAUT and RG_GANF (Appendix Table F.21). Other than concentrations of benzo(k)fluoranthene being higher (MOD = 162%) at RG_GANF relative to RG_GAUT, no statistically significant differences in concentrations of PAHs were identified between the two Gardine Creek stations in 2022 (Appendix Table E.20).

In 2022, concentrations of metals in bulk sediment samples from Gardine Creek were generally lower than or comparable to previous years, whereas concentrations of PAHs were substantially higher relative to 2019 and 2020 (Figure 3.4; Appendix Table F.22). The higher PAH concentrations in the sediments from RG_GAUT (upstream) may be partially attributed to the

[20] Comparison of the sum of sediment fractions 1 to 4 to the BC WSQG is considered to be a conservative screening of the potentially mobile, and therefore potentially bioavailable, sediment constituents. It would take highly unusual/aggressive reducing and oxidizing conditions, respectively, to mobilize fractions 3 and 4 and these conditions are not likely to occur in the Greenhills Creek watershed.

higher TOC (MODs = 78 and 115%) and fine silt (MODs = 76 and 187%) content in 2022 relative to 2019 and 2020 (Figure 3.4; Appendix Table F.22) (e.g., Christensen 1998; Shi et al. 2007). Similarly, the higher PAH concentrations observed at RG_GANF (downstream) in 2022 versus 2019 and 2020 may be attributed to the higher TOC (MODs = 78 and 82%) and clay (MODs = 144 and 165%) content in 2022 (Appendix Table F.22). However, this interpretation is complicated by the absence of statistically significant differences in PAH concentrations at RG_GAUT in 2021 and 2022, despite the sediment samples from 2022 having higher TOC (MOD = 79%) and fine silt (MOD = 84%) relative to 2021 (Appendix Table F.22). A similar phenomenon was also observed for RG_GANF when evaluating PAH concentrations relative to TOC and sediment particle sizes (Appendix Table F.22).

The SEA results for Gardine Creek indicate that metal concentrations in individual sediment fractions may differ from year to year (i.e., in conjunction with changes in bulk concentrations), but the distribution of metals among the fractions is generally consistent over time (Figures 3.5 and 3.6; Appendix Table F.23). Relatively few exceptions were identified for constituents that had guideline exceedances based on concentrations in the potentially mobile sediment fractions (i.e., cadmium and nickel). Specifically, at RG_GAUT, there was more cadmium distributed within sediment fractions 3 (easily reducible/bound to iron and manganese oxides) and 4 (organic-bound) versus fraction 5 (residual) in 2022 relative to 2019 and 2020. Additionally, for the samples collected from RG_GANF in 2022, there was more nickel distributed within fraction 3 versus fraction 2 (carbonate) relative to 2021 (Figures 3.5 and 3.6; Appendix Table F.23).

Overall, the distribution of constituent concentrations among the sediment fractions has been comparable among years. Therefore, as discussed in the May 2022 and 2023 meetings with the EMC, adding to the existing multi-year data set for SEA analyses is not expected to provide additional information. Bulk sediment chemistry results are considered sufficient to address study questions and evaluate changes over time and among areas. Therefore, upcoming cycles of the GC LAEMP will continue to include bulk sediment chemistry analyses and SEA will be discontinued starting in 2023.

The SQI calculated for RG_GAUT (upstream) and RG_GANF (downstream) on Gardine Creek in 2022 were low (on a scale of 0 to 100) and therefore indicative of poor sediment quality, consistent with previous years of monitoring (Appendix Table F.24). The SQI were also lower than SQI for most lotic sampling areas included in the 2017 to 2019 RAEMP report (Minnow 2020b). Similar to the 2021 results for the GC LAEMP, the scope and frequency of BC WSQG exceedances were higher at RG_GAUT than RG_GANF, but the amplitude of exceedances was similar between the two areas (Minnow 2022a).

3.2.2.2 Lower Greenhills Creek

Bulk sediment samples collected from Lower Greenhills Creek in 2022 had cadmium and nickel concentrations that were consistently above the lower BC WSQG, selenium concentrations that were consistently above the alert concentration, and multiple PAHs with concentrations above reference area normal ranges and the lower or upper BC WSQG (Figure 3.4; Appendix Table F.9). At least one of the bulk sediment samples collected from Lower Greenhills Creek in 2022 also had concentrations of arsenic, iron, manganese, or zinc that exceeded the lower BC WSQG, despite being within reference area normal ranges (Figure 3.4; Appendix Table F.9). Results of the SEA for metals, however, indicated that guideline/alert concentration exceedances within the potentially mobile sediment fractions (i.e., fractions 1 to 4) were restricted to cadmium, nickel, and selenium (Figure 3.7; Appendix Tables F.25 to F.29). Therefore, metal concentrations reported in bulk sediments provide a conservative (i.e., overestimation) of the bioavailable fractions of some metals and potential risks to aquatic organisms (e.g., benthic invertebrates, fish).

Comparisons among areas highlighted some patterns in metal and PAH concentrations that may be attributable to RG_GHBP being downstream from the Greenhills Creek Sedimentation Pond and differences in sediment composition (Figure 2.3). For example, selenium concentrations in sediments from RG_GHBP were less than in the pond (MOD = 75%) but higher relative to Gardine Creek (MODs = 80 and 81%) in 2022 (Figure 3.4; Appendix Table F.20). This pattern may be attributed to carry-over effects of selenium cycling within the pond, as well as the creek samples having less fine silt, clay, and TOC than the pond samples (Appendix Table F.20; e.g., Zhang et al. 2014). Concentrations of most PAHs in bulk sediments from Lower Greenhills Creek were lower relative to the pond (MODs = 73 to 83%, depending on the constituent) in 2022, and, again, this is likely attributed to the sediments from Lower Greenhills Creek having less fine silt and clay (Figure 3.4; Appendix Table F.20).

In 2022, concentrations of metals and PAHs in bulk sediment samples from Lower Greenhills Creek were generally lower than or comparable to previous years (Figure 3.4; Appendix Table F.23). The limited number of exceptions included:

- higher arsenic, molybdenum, tin, and titanium concentrations in 2022 relative to 2021;
- higher acenaphthylene concentrations in 2022 relative to 2020; and
- higher lithium concentrations in 2022 relative to 2019 and 2021.

The distribution of various metals among sediment fractions 1 to 5 exhibited more temporal variability within Lower Greenhills Creek relative to Gardine Creek (Appendix Table F.23). However, nickel and selenium were among the exceptions; concentrations in individual sediment

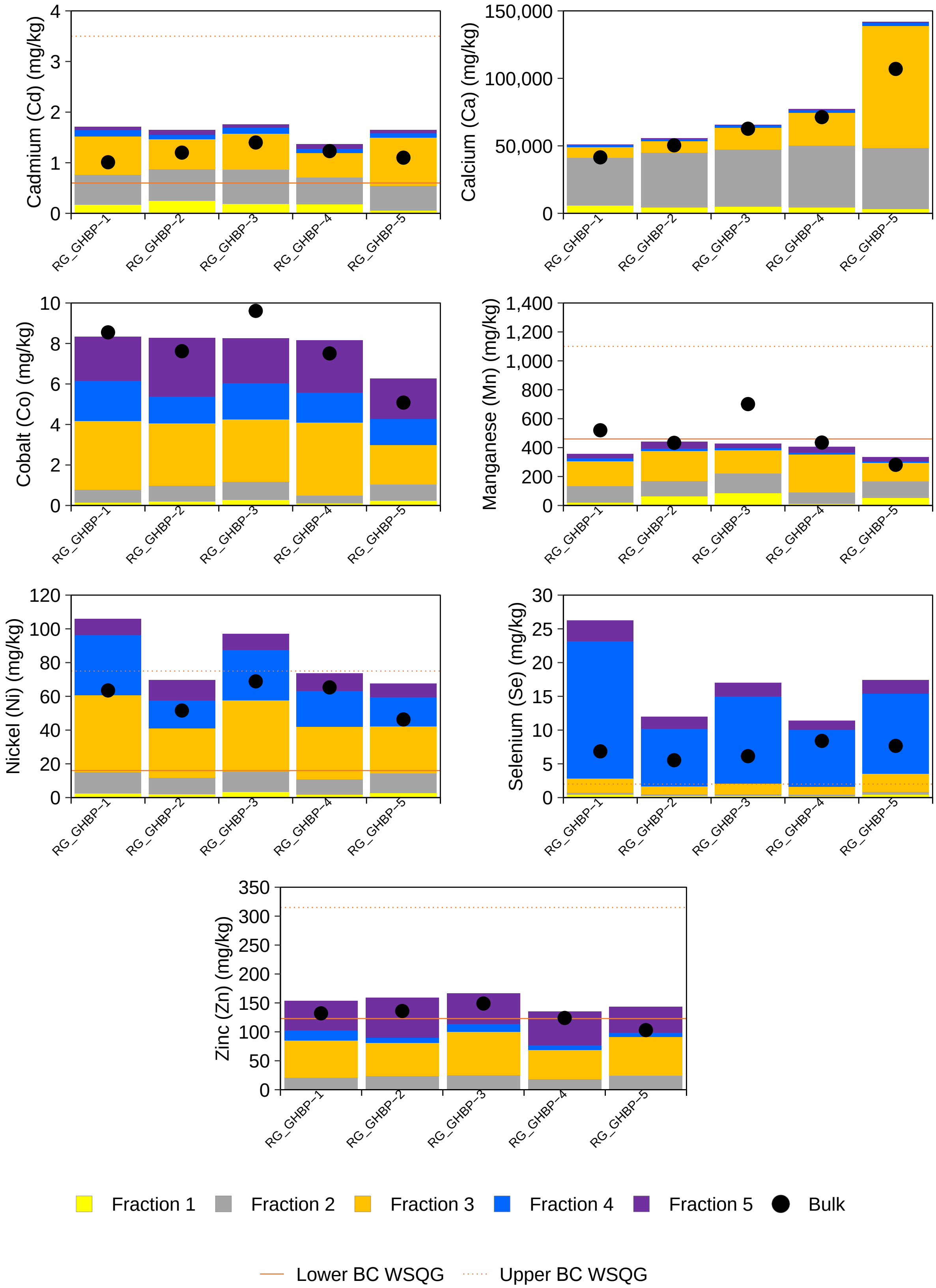

Figure 3.7: Comparisons of Metal Concentrations (Dry Weight Basis) in Sequentially Extracted Sediment Fractions to British Columbia Working Sediment Quality Guidelines, Lower Greenhills Creek (RG_GHBP), 2022

Notes: mg/kg = milligrams per kilogram dry weight; BC WSQG = British Columbia Working Sediment Quality Guideline. Values at the Laboratory Reporting Limit (LRL) were plotted at the LRL. Concentrations were determined using Tessier Extraction (Tessier et al. 1979).

fractions increased or decreased in conjunction with bulk concentrations without there being "trade-offs" among the sediment fractions (Appendix Table F.23).

Concentrations of manganese and most PAHs[21] in bulk sediments collected from Lower Greenhills Creek were higher throughout the period of antiscalant addition (i.e., from 2018 to 2022) relative to before treatment began (i.e., 2017) (Appendix Table F.30). Concentrations of boron, mercury, selenium, sodium, titanium, uranium, zinc, and dibenz(a,h)anthracene were also higher in one or two of the post-treatment years relative to 2017. Although some of the MODs for the "after" versus "before" treatment periods are relatively large (i.e., >100%), there is still some uncertainty as to whether observed increases are attributable to water treatment or some combination of factors that may or may not include water treatment. For example, the sediments in the Greenhills Creek Sedimentation Pond have accumulated higher concentrations of PAHs relative to lotic habitats (Appendix Table F.20). Activities or events that disturb and resuspend sediments within the pond (e.g., dredging to remove sediments, overfilling of the pond, and heavy precipitation events) can lead to flushing of PAH-laden sediments to lotic environments downstream (e.g., Crane et al. 2010).

Similar to Gardine Creek (Section 3.2.2.1), the SQI for Lower Greenhills Creek in 2022 was indicative of poor sediment quality and was lower relative to other lotic areas evaluated in the 2017 to 2019 RAEMP report (Appendix Table F.24; Minnow 2020b). However, qualitatively, the SQI for Lower Greenhills Creek in 2022 appears to represent an improvement over 2018 to 2021, potentially owing to the lower frequency and/or amplitude of BC WSQG exceedances in 2022 relative to years prior (Appendix Table F.24).

It is noteworthy that although elevated concentrations of some metals and PAHs were identified in Lower Greenhills Creek (and Gardine Creek; see Section 3.2.2.1), sediment in erosional, lotic systems is not generally considered to be a primary pathway for aquatic effects. Sediment and fines generally accumulate in small deposits near banks and pools in lotic systems. As such, changes in the bioavailability of constituents in the sediment in Lower Greenhills or Gardine creeks is not anticipated to have the same biological impact as would be expected from changes in water quality.

3.2.2.3 Greenhills Creek Sedimentation Pond

Within bulk sediments from the Greenhills Creek Sedimentation Pond, cadmium and nickel concentrations were consistently above the lower BC WSQG, selenium concentrations were consistently above the alert concentration, and multiple PAHs had concentrations above the lower

[21] I.e., benzo[a]pyrene, benzo[b&j]fluoranthene, benzo[e]pyrene, benzo[g,h,i]perylene, fluoranthene, fluorene, indeno[1,2,3-c,d]pyrene, 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, and pyrene.

(e.g., benz[a]anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, fluoranthene, and pyrene) or upper (e.g., acenaphthene, chrysene, 2-methylnaphthalene, naphthalene, and phenanthrene) BC WSQG (Figure 3.4; Appendix Table F.9). Concentrations of arsenic, manganese, and zinc in bulk sediment samples were also occasionally (i.e., in two to four of the n = 6 samples) above the lower BC WSQG (Figure 3.4; Appendix Table F.9). Results of the SEA analysis indicated that guideline/alert concentration exceedances for cadmium, manganese, nickel, and selenium were associated with the potentially mobile sediment fractions (Figure 3.8; Appendix Tables F.31 to F.36). Potentially bioavailable concentrations of arsenic and zinc were below concentrations at which adverse biological effects might be expected.

Cadmium, nickel, and selenium concentrations in bulk sediments from the pond were higher relative to Gardine Creek (MODs = 33 to 95%, depending on the constituent) and selenium concentrations were higher relative to Lower Greenhills Creek (Appendix Table E.20; see also Section 3.2.2.2). Nickel and selenium concentrations in sediment samples from the Greenhills Creek Sedimentation Pond in 2022 were also above their respective reference area normal ranges (Figure 3.4).[22] Additionally, consistent with 2019 and 2020, concentrations of PAHs in sediments collected from the Greenhills Creek Sedimentation Pond in 2022 were comparable to or higher than those reported for the creek sampling sites in 2022 (Appendix Table F.20). The samples from the pond had more fine silt and clay and less sand relative to the other sediment sampling locations, which is as expected given the depositional nature of the pond. The predominance of fine sediment particles is expected to contribute to the higher concentrations of cadmium, nickel, selenium, and PAHs observed within the pond sediments (Appendix Tables F.9 and F.20).

In 2022, concentrations of metals in bulk sediment samples from Greenhills Creek Sedimentation Pond were generally lower than or comparable to previous years, whereas concentrations of PAHs were comparable to or higher than in 2019 to 2021 (Figure 3.4; Appendix Table F.22). No inter-annual differences in cadmium, nickel, or selenium concentrations were identified (Appendix Table E.22). Additionally, there was no evidence to suggest cadmium and selenium were distributed differently among sediment fractions 1 to 5 depending on the year (Appendix Table E.23). Conversely, nickel was more closely associated with fractions 1 to 3, with lesser amounts in fraction 5, in 2021 and 2022 relative to 2019 (Appendix Table E.23). For PAHs, the greatest differences among years (i.e., the largest MODs and the largest number of

[22] Comparisons of sediment chemistry data to reference area normal ranges were made in consideration of the fact the reference area normal ranges were developed based on data for natural and naturalized lentic areas (i.e., sedimentation ponds were not included in the data set) (Minnow 2020c).

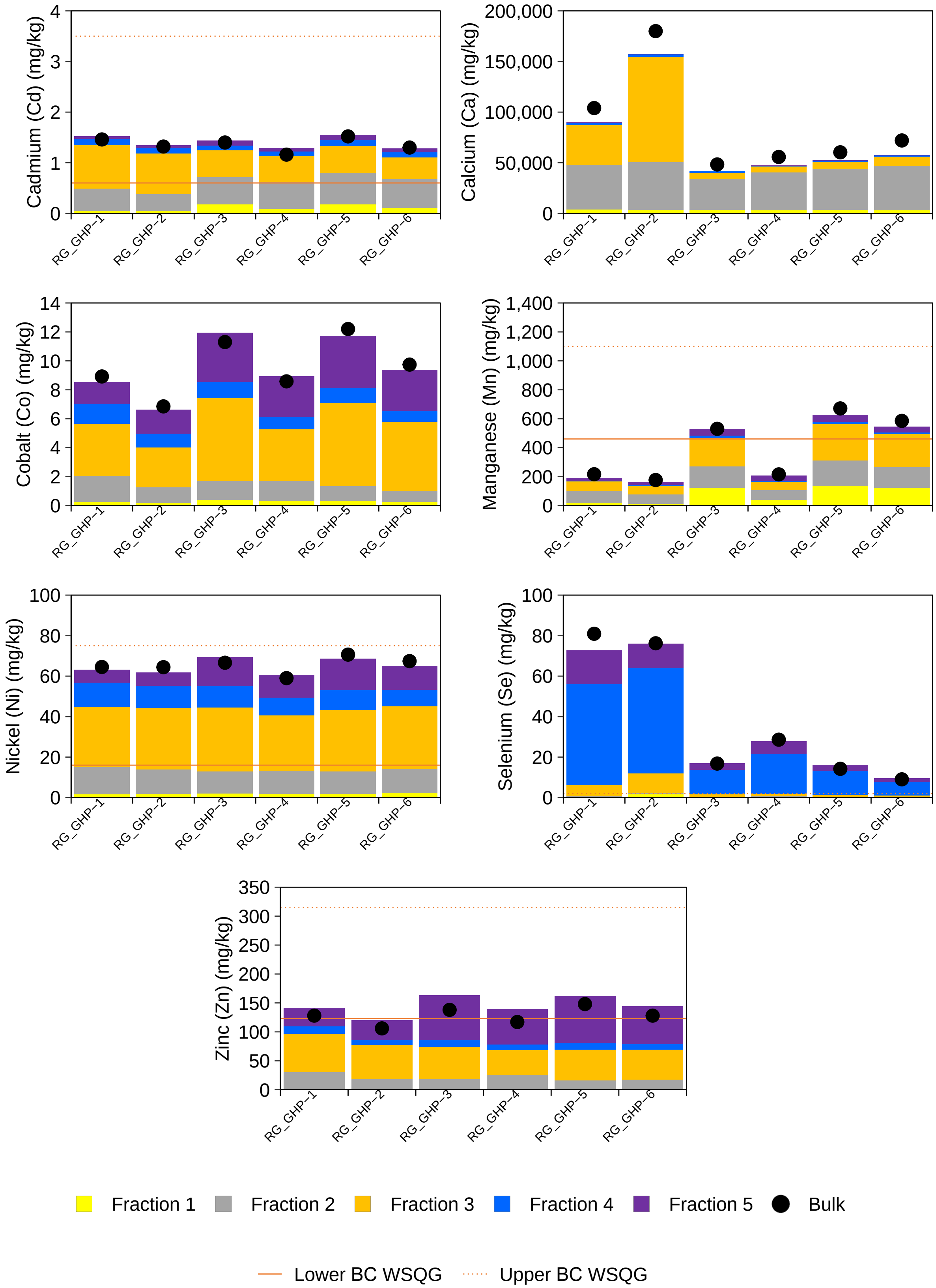

Figure 3.8: Comparisons of Metal Concentrations (Dry Weight Basis) in Sequentially Extracted Sediment Fractions to British Columbia Working Sediment Quality Guidelines, Greenhills Creek Sedimentation Pond (RG_GHP), 2022

Notes: mg/kg = milligrams per kilogram dry weight; BC WSQG = British Columbia Working Sediment Quality Guideline. Values at the Laboratory Reporting Limit (LRL) were plotted at the LRL. Concentrations were determined using Tessier Extraction (Tessier et al. 1979).

affected constituents) were associated with the comparison between 2022 and 2019 (Figure 3.4; Appendix Table E.22).

The SQI for the Greenhills Creek Sedimentation Pond was lower relative to those for the lotic habitats on Gardine and Lower Greenhills creeks (Sections 3.2.2.1 and 3.2.2.2, respectively) in 2022, and was among the lowest reported since 2013 (Appendix Table F.24). These results are attributed to the larger scope, frequency, and amplitude of BC WSQG exceedances within the pond relative to the other GC LAEMP sediment sampling areas, and the higher amplitude of BC WSQG exceedances relative to previous years (Appendix Table F.24).

3.3 Benthic Invertebrate Community

3.3.1 Gardine Creek

Area-based kick samples collected from upper Gardine Creek (RG_GAUT) in 2022 had higher percentages of EPT taxa (individually and combined) and lower %Diptera relative to lower Gardine Creek (RG_GANF) (Figure 3.9; Appendix Tables G.1 to G.6). These upstream-to-downstream differences in the percentages of the major taxonomic groups are not unexpected. Lower Gardine Creek is downstream from the seeps from the GHO Coarse Coal Rejects and had poorer water quality (including higher TDS and sulphate concentrations) and substrate (i.e., calcite) conditions relative to upstream in 2022 (see Sections 3.1.1 and 3.2.1.2). In 2022, %EPT was strongly and negatively correlated (r_s less than or equal to [≤] -0.6)[23] with concentrations of TDS, sulphate, nickel, and selenium as well as C_c, CI, and CI' values, whereas %Diptera was strongly and positively correlated (r_s greater than or equal to [≥] 0.6) with concentrations of the same constituents and calcite endpoints (Figures 3.10 and 3.11; Tables 3.3 and 3.4). The longer-term data sets for Greenhills and Gardine creeks (i.e., from 2017 to 2022) also supported the conclusion that %Diptera is strongly and positively correlated with sulphate and selenium concentrations, as well as C_c and CI values (Appendix Figures G.1 and G.2; Appendix Tables G.7 and G.8). Although spatial patterns in benthic invertebrate communities within the Greenhills Creek watershed are thought to be largely attributed to changes in calcite conditions, the potential influence of water quality constituents like TDS and sulphate cannot be ruled out.

No biologically meaningful temporal changes in the benthic invertebrate communities on Gardine Creek were identified, other than lower densities at RG_GAUT (upstream) and higher %Trichoptera at RG_GAUT and RG_GANF (downstream) in 2022 relative to the first year of

[23] Correlations (with water chemistry and calcite) were considered biologically meaningful when the correlation coefficients explained at least 60% of the variance in a given benthic invertebrate community endpoint (i.e., rs ≤ -0.6 or rs ≥ 0.6 were considered indicative of strong, significant relationships).

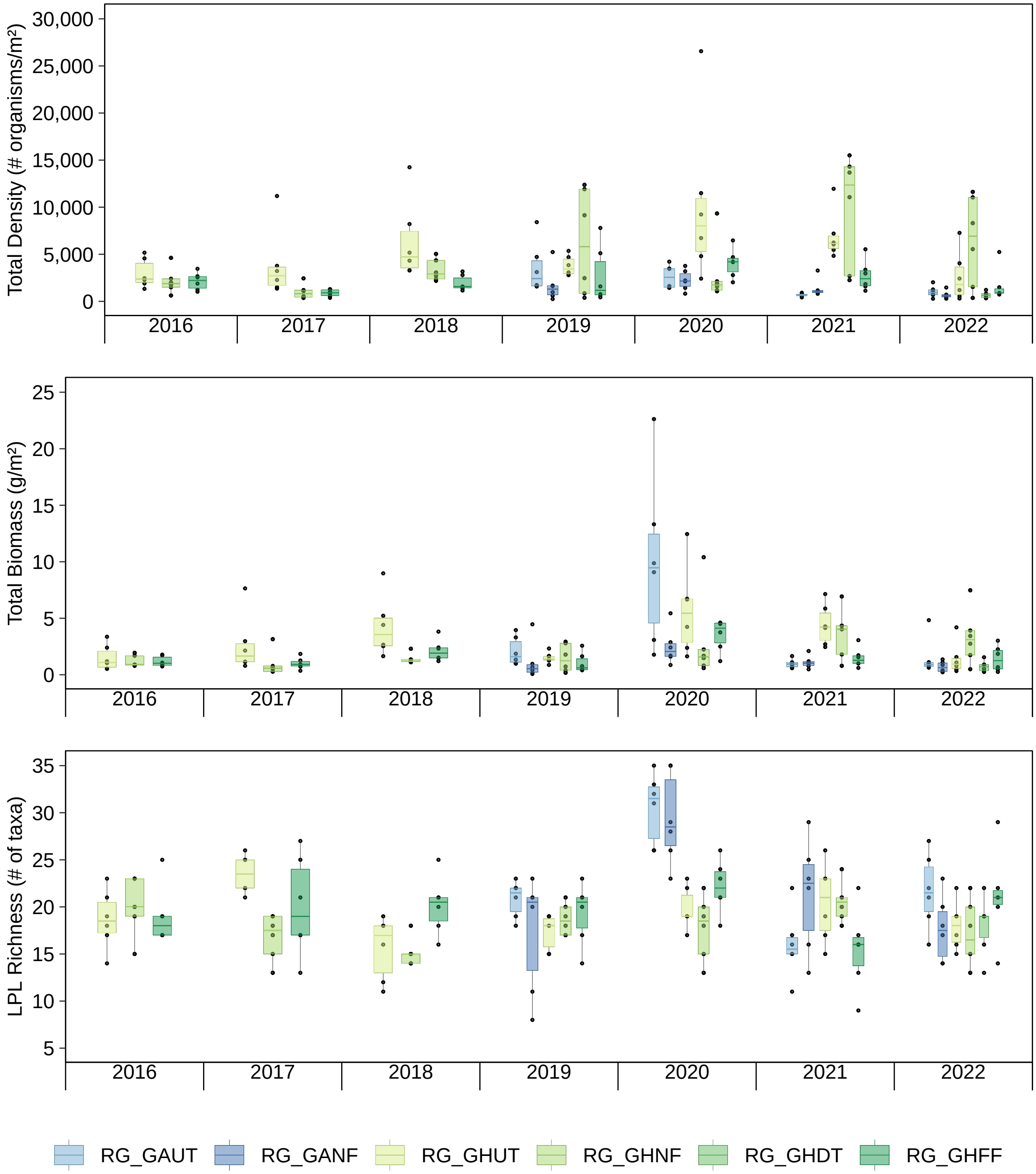

Figure 3.9: Benthic Invertebrate Community Endpoints for Area−based Kick Samples, Upper Greenhills and Gardine Creeks, September 2016 to 2022

Note: Samples were collected by kicking an area of 1/3 m².

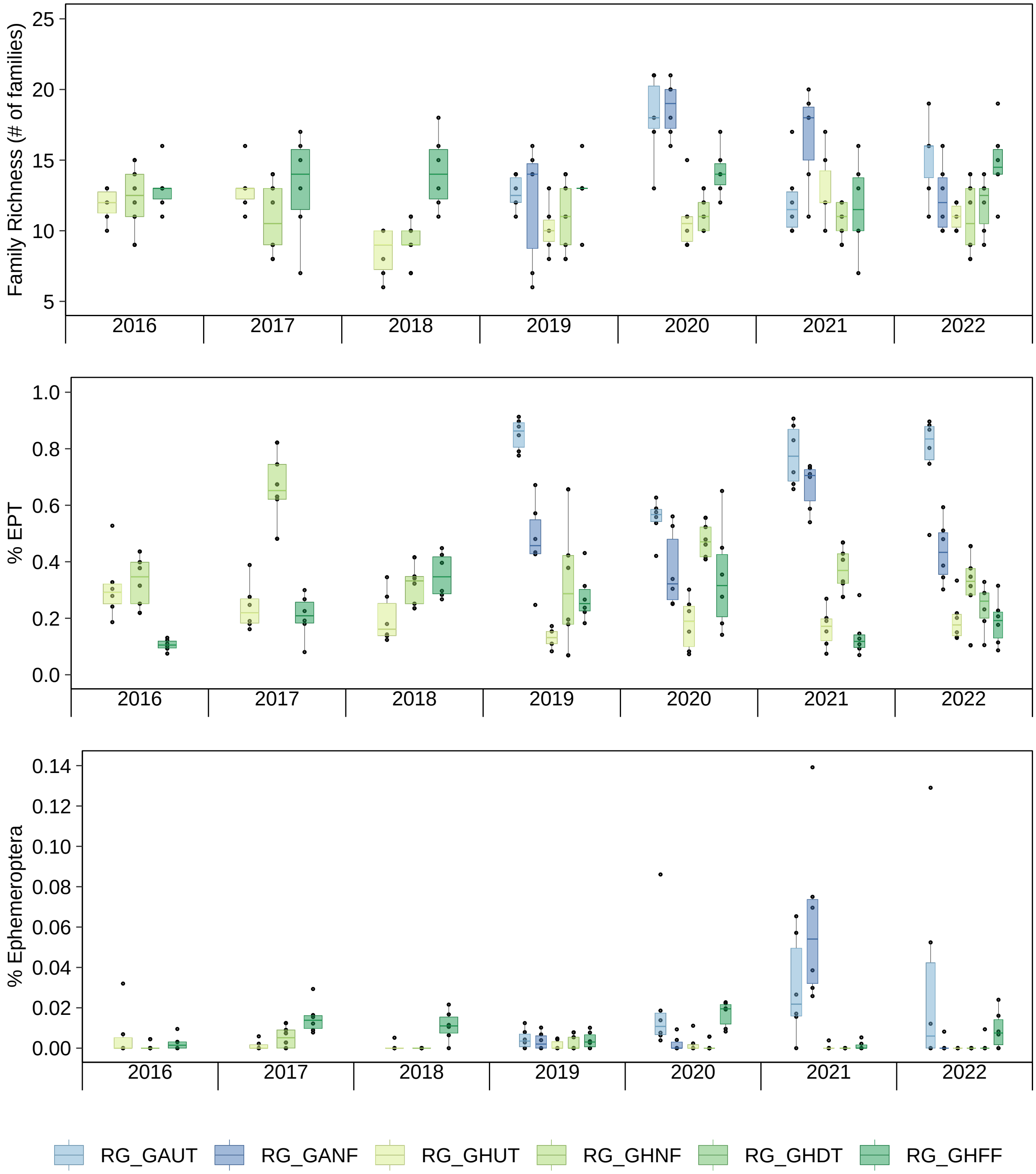

Figure 3.9: Benthic Invertebrate Community Endpoints for Area−based Kick Samples, Upper Greenhills and Gardine Creeks, September 2016 to 2022

Note: Samples were collected by kicking an area of 1/3 m^2.

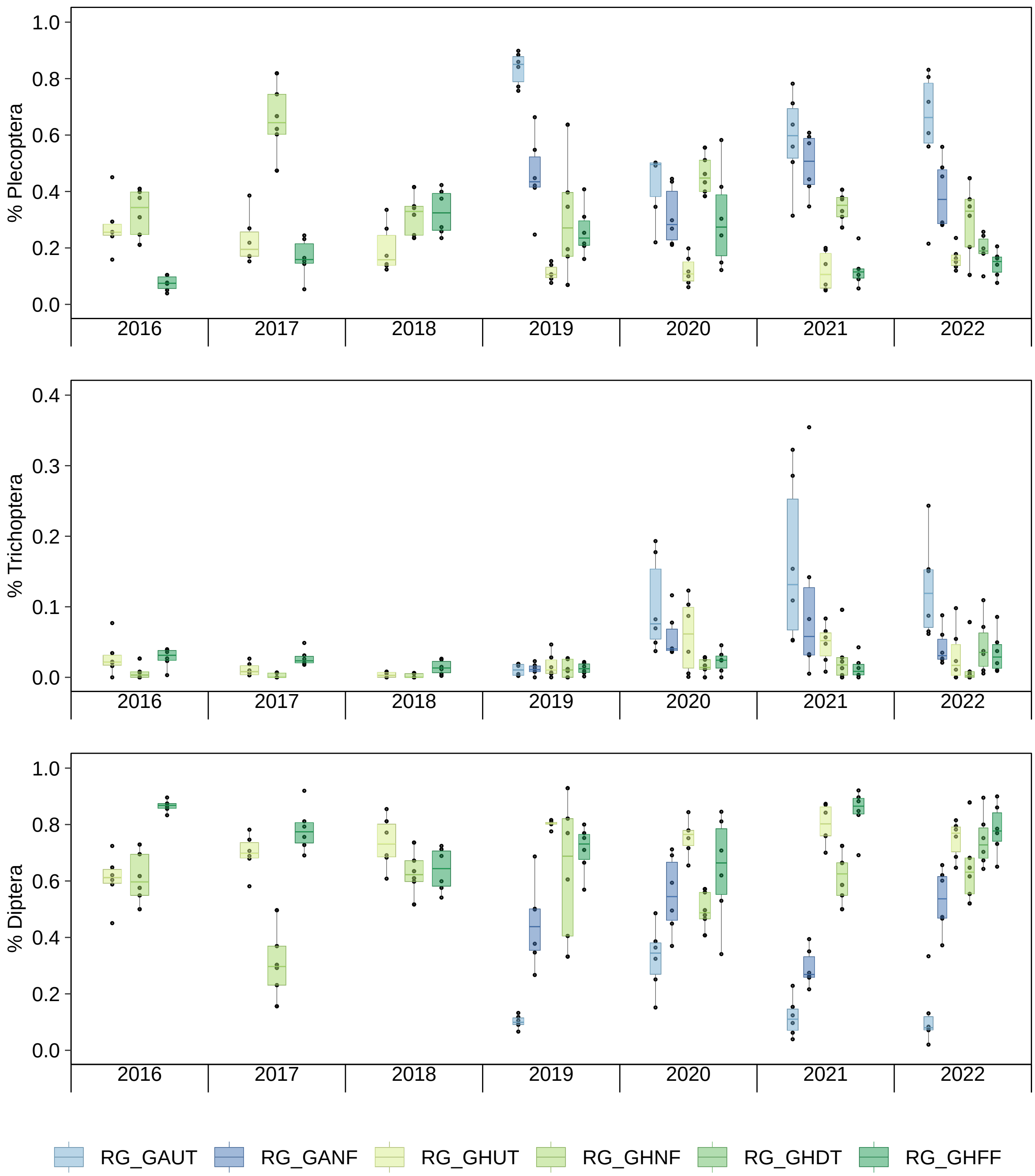

Figure 3.9: Benthic Invertebrate Community Endpoints for Area−based Kick Samples, Upper Greenhills and Gardine Creeks, September 2016 to 2022

Note: Samples were collected by kicking an area of 1/3 m^2.

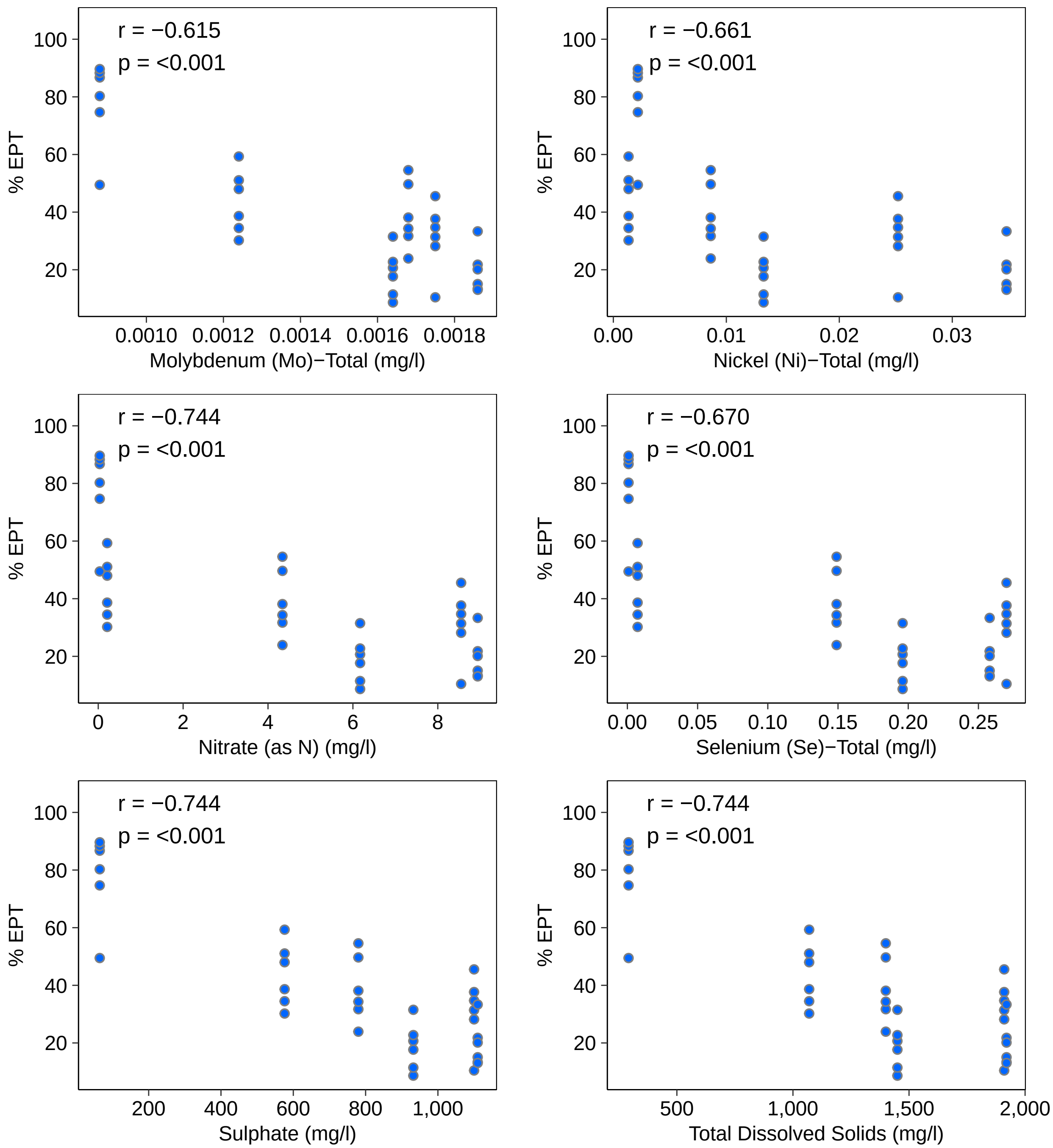

Figure 3.10: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Water Chemistry Constituents with Early Warning Triggers, Greenhills and Gardine Creeks, 2022

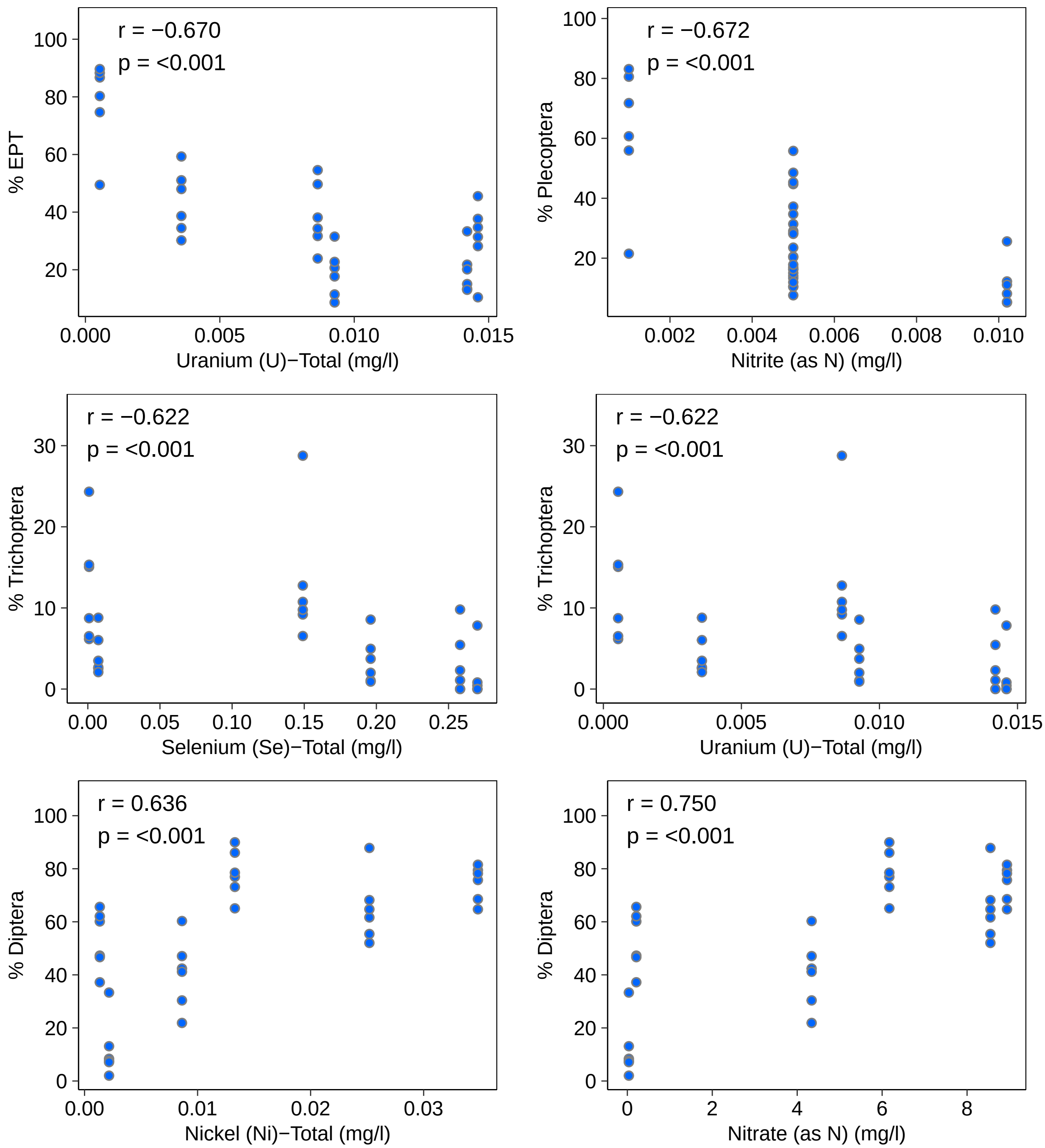

Figure 3.10: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Water Chemistry Constituents with Early Warning Triggers, Greenhills and Gardine Creeks, 2022

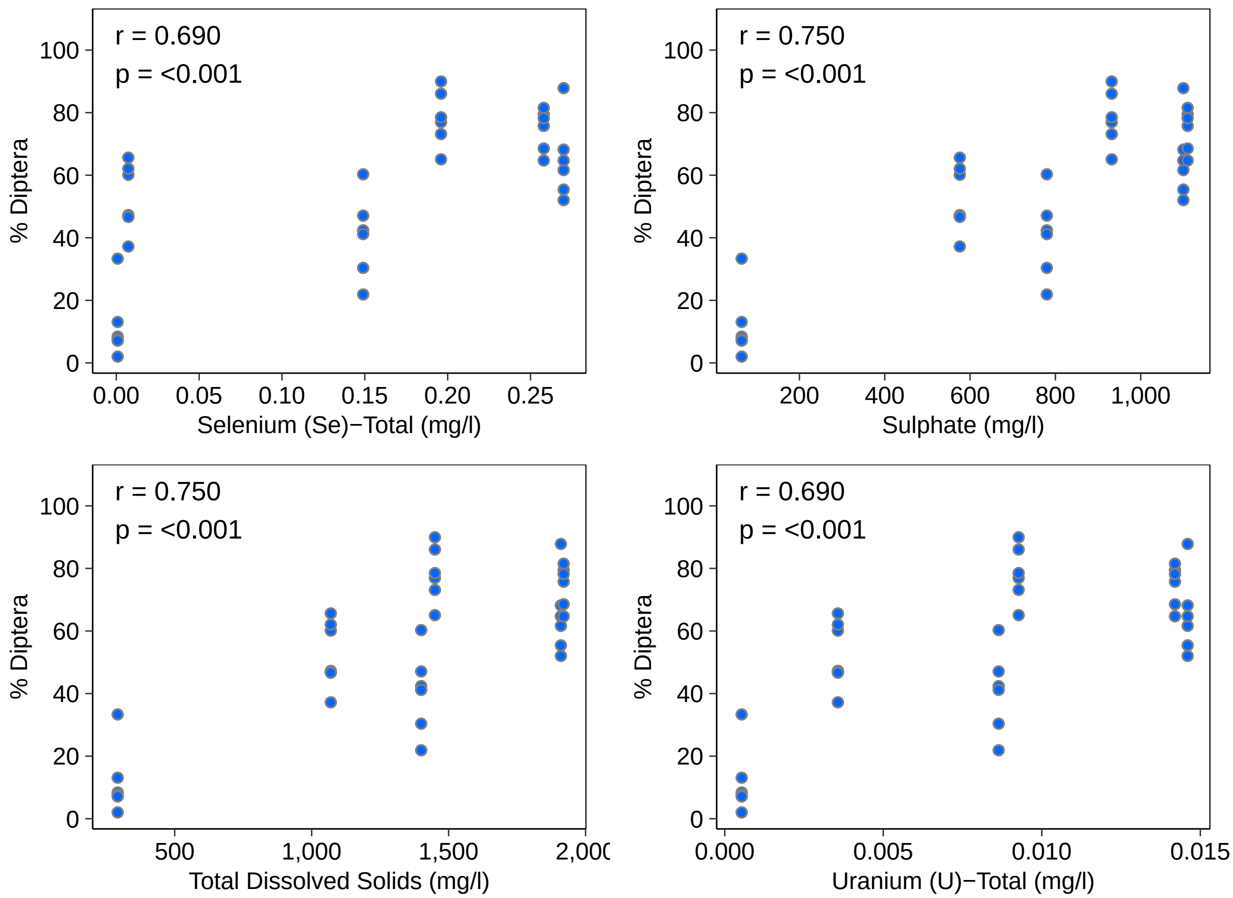

Figure 3.10: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Water Chemistry Constituents with Early Warning Triggers, Greenhills and Gardine Creeks, 2022

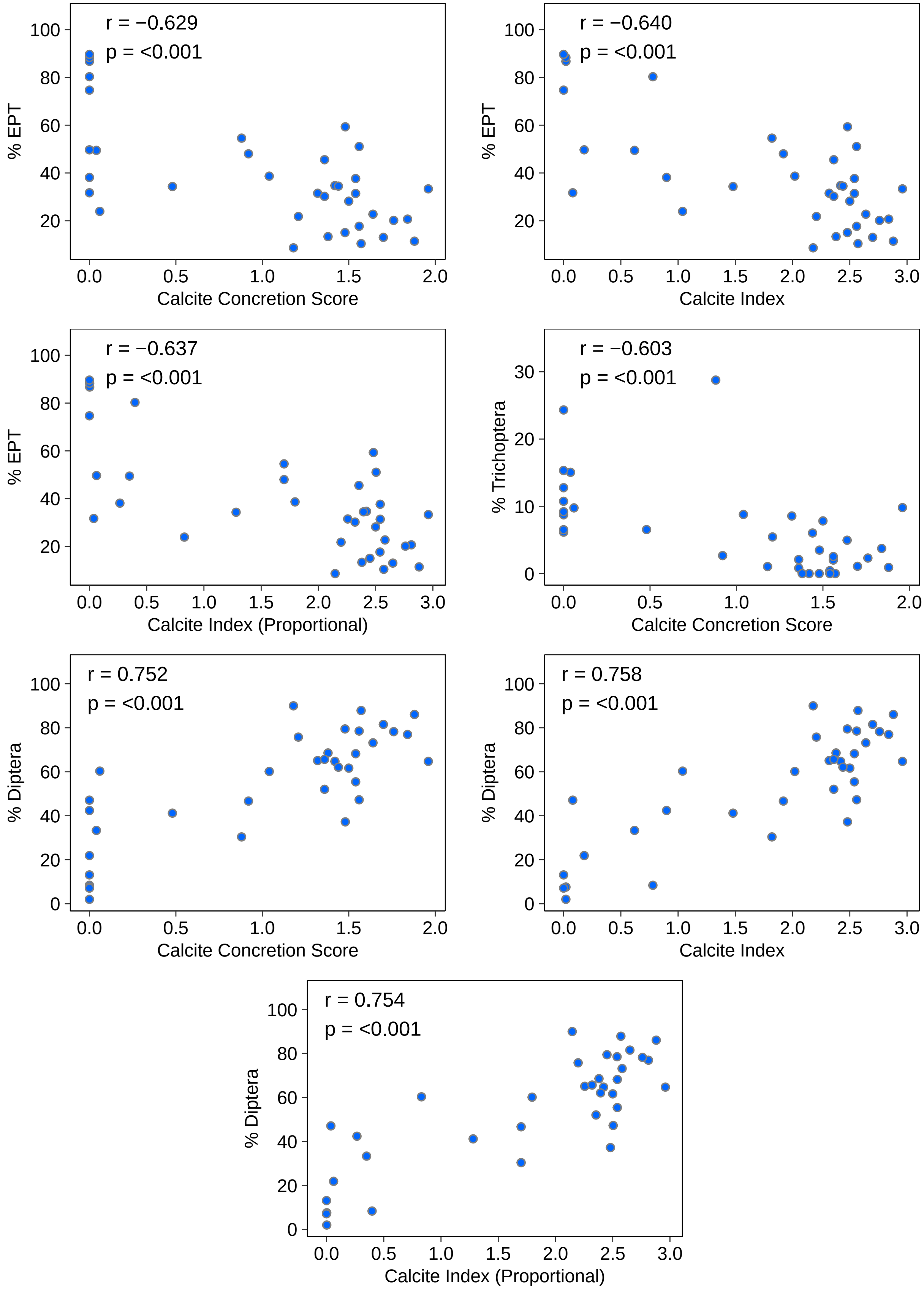

Figure 3.11: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Calcite Index and Concretion Scores, Greenhills and Gardine Creeks, 2022

Table 3.3: Spearman Rank Correlations Between Benthic Invertebrate Endpoints and Water Quality Constituents with Early Warning Triggers, 2022

Constituent	Density (No. org./m^2)		Total Biomass (g/m^2)		LPL Richness		Family Richness		%EPT		%Ephemeroptera		%Plecoptera		%Trichoptera		%Diptera	
	P-value	r_s	P-value	r_s	P-value	r_s	P-value	r_s	P-value	r_s	P-value	r_s	P-value	r_s	P-value	r_s	P-value	r_s
Antimony - Total (mg/L)	0.00300	0.481	0.0764	0.299	0.369	-0.154	0.0785	-0.297	<0.001	-0.532	0.446	-0.131	0.00385	-0.470	0.0535	-0.325	0.00523	0.456
Barium - Total (mg/L)	<0.001	-0.565	0.00658	-0.445	0.260	0.193	0.215	0.212	0.0108	0.420	0.865	-0.0294	0.00200	0.498	0.0560	0.321	0.0387	-0.346
Boron - Total (mg/L)	0.0590	-0.318	0.0638	-0.312	0.430	-0.136	0.222	-0.209	0.419	0.139	0.155	-0.242	0.253	0.195	0.465	0.126	0.483	-0.121
Cadmium - Dissolved (mg/L)	0.377	-0.152	0.277	-0.186	0.252	0.196	0.490	0.119	0.472	-0.124	0.808	0.0419	0.561	-0.100	0.215	0.212	0.696	0.0673
Cobalt - Total (mg/L)	0.780	0.0482	0.780	-0.0482	0.541	-0.105	0.0409	-0.342	0.939	-0.0133	0.0113	-0.417	0.159	0.240	0.427	-0.137	0.893	0.0233
Lithium - Total (mg/L)	0.657	-0.0767	0.241	-0.200	0.00693	-0.442	<0.001	-0.574	0.102	-0.277	<0.001	-0.576	0.598	0.0908	<0.001	-0.583	0.00797	0.435
Manganese - Total (mg/L)	0.0491	0.330	0.241	0.200	0.467	-0.125	0.0516	-0.327	0.264	-0.191	0.102	-0.277	0.772	-0.0501	0.226	-0.207	0.402	0.144
Molybdenum - Total (mg/L)	0.00773	0.437	0.162	0.238	0.131	-0.257	0.0182	-0.392	<0.001	-0.615	0.237	-0.202	0.00125	-0.517	0.00894	-0.430	<0.001	0.570
Nickel - Total (mg/L)	0.0141	0.406	0.289	0.182	0.377	-0.152	0.0360	-0.351	<0.001	-0.661	0.124	-0.261	0.00797	-0.435	0.00407	-0.467	<0.001	0.636
Nitrate as N (mg/L)	0.0302	0.362	0.484	0.121	0.135	-0.254	0.00652	-0.445	<0.001	-0.744	0.0477	-0.332	0.00290	-0.482	<0.001	-0.572	<0.001	0.750
Nitrite as N (mg/L)	0.0469	0.333	0.0574	0.320	0.787	-0.0465	0.473	0.124	0.0614	-0.315	0.0134	0.408	<0.001	-0.672	0.830	0.0371	0.256	0.195
Selenium - Total (mg/L)	0.00823	0.434	0.223	0.208	0.110	-0.271	0.00631	-0.447	<0.001	-0.670	0.0477	-0.332	0.0137	-0.407	<0.001	-0.622	<0.001	0.690
Sulfate (mg/L)	0.0302	0.362	0.484	0.121	0.135	-0.254	0.00652	-0.445	<0.001	-0.744	0.0477	-0.332	0.00290	-0.482	<0.001	-0.572	<0.001	0.750
Total Dissolved Solids (mg/L)	0.0302	0.362	0.484	0.121	0.135	-0.254	0.00652	-0.445	<0.001	-0.744	0.0477	-0.332	0.00290	-0.482	<0.001	-0.572	<0.001	0.750
Uranium - Total (mg/L)	0.00823	0.434	0.223	0.208	0.110	-0.271	0.00631	-0.447	<0.001	-0.670	0.0477	-0.332	0.0137	-0.407	<0.001	-0.622	<0.001	0.690
Zinc - Total (mg/L)	0.0136	0.408	0.0795	0.296	0.365	-0.156	0.221	-0.209	0.0349	-0.353	0.895	0.0227	0.00277	-0.484	0.575	-0.0966	0.172	0.233

P-value <0.05/n parameters = 0.05/16 = 0.00313.

$r_s \leq -0.6$ or $r_s \geq 0.6$.

Notes: No. org./m^2 = number of organisms per square metre; g/m^2 = grams per square metre; LPL = Lowest Practical Level; % = percent; EPT = Ephemeroptera, Plecoptera, and Trichoptera combined; rs = Spearman's correlation coefficient; mg/L = milligrams per litre; < = less than; ≤ = less than or equal to; ≥ = greater than or equal to.

Table 3.4: Spearman's Correlation Relationships between Benthic Invertebrate Community Metrics and Calcite, Greenhills and Gardine Creeks, 2022

Endpoint	Calcite Index (CI)		Proportional Calcite Index (CI')		Concretion Score	
	r_s	P-value	r_s	P-value	r_s	P-value
Density (No. organisms/m²)	0.0582	0.736	0.0763	0.658	0.0302	0.861
Total Biomass (g/m²)	-0.120	0.485	-0.108	0.530	-0.134	0.436
LPL Richness	-0.190	0.267	-0.183	0.285	-0.198	0.247
Family Richness	-0.399	0.0159	-0.407	0.0137	-0.406	0.0139
%EPT	-0.640	<0.001	-0.637	<0.001	-0.629	<0.001
%Ephemeroptera	-0.463	0.00448	-0.473	0.00360	-0.473	0.00360
%Plecoptera	-0.270	0.111	-0.260	0.126	-0.237	0.164
%Trichoptera	-0.587	<0.001	-0.597	<0.001	-0.603	<0.001
%Diptera	0.758	<0.001	0.754	<0.001	0.752	<0.001

P-value <0.017 (0.05/3 for Bonferroni correction).

$r_s \leq -0.6$ or $r_s \geq 0.6$.

Notes: rs = Spearman's correlation coefficient; No. organisms/m^2 = number of organisms per square metre; g/m^2 = grams per square metre; LPL = Lowest Practical Level; % = percent; EPT = Ephemeroptera, Plecoptera, and Trichoptera combined; < = less than; ≤ = less than or equal to; ≥ = greater than or equal to.

monitoring in 2019 (Appendix Figures G.3 and G.4; Appendix Table G.9). However, despite being lower relative to 2019, total invertebrate densities at RG_GAUT in 2022 were statistically similar to 2021 (Appendix Figure G.3).

3.3.2 Upper and Lower Greenhills Creek

3.3.2.1 Area-Based Kicks

Benthic invertebrate densities and LPL richness were similar among biological monitoring areas on Upper and Lower Greenhills Creek in 2022, whereas spatial patterns were identified for the remaining endpoints that were evaluated (Figures 3.8 and 3.12; Appendix Tables G.1, G.2, and G.10 to G.17). First, biomass and %EPT were higher at RG_GHBP on Lower Greenhills Creek relative to upstream areas RG_GHUT and RG_GHFF. Second, %Ephemeroptera and %Trichoptera were higher and %Diptera were lower in Lower versus Upper Greenhills Creek in 2022 (Figures 3.8 and 3.12; Appendix Table G.18). Finally, family richness was higher in Greenhills Creek downstream from the Gardine Creek mouth (RG_GHFF and RG_GHBP) than it was upstream (RG_GHUT and RG_GHNF; Appendix Table G.18). Overall, in light of fairly similar benthic invertebrate densities among areas, the higher benthic invertebrate biomass at RG_GHBP on Lower Greenhills Creek suggests that the availability of food for fish was potentially better in Lower Greenhills Creek relative to upstream in 2022. Additionally, benthic invertebrate communities in Upper Greenhills Creek appear to show more signs of mine-related influence, given the higher %Diptera and lower %EPT and %Ephemeroptera relative to Lower Greenhills Creek.

Few consistent temporal patterns in benthic invertebrate community endpoints were identified for the biological monitoring areas on Greenhills Creek (Figures 3.8 and 3.12; Appendix Table G.18). However, %Diptera at RG_GHUT, which is the furthest upstream station on Greenhills Creek, increased gradually over time since 2016 and then levelled off after 2019 (Figure 3.8; Appendix Table G.18). The apparent increase may be attributed to C_c scores at RG_GHUT generally being higher after 2018, especially considering that concentrations of some mine-related constituents (e.g., TDS and sulphate) have not increased over time within that area (Section 3.2.1.2; Appendix Tables E.4 and F.8). Invertebrate densities were lower at RG_GHBP on Lower Greenhills Creek in 2022 relative to the base year of monitoring (i.e., 2016) but were similar to 2017 to 2021 (Figure 3.12; Appendix Table G.18). Percentages of Ephemeroptera were also higher at RG_GHBP in 2022 relative to 2016, but were similar to 2017 to 2022 (Figure 3.12; Appendix Table G.18).

Comparisons of benthic invertebrate community endpoints between Upper (untreated) and Lower (treated) Greenhills Creek before (i.e., 2016 and 2017) and after (2018 to 2022) initiation of

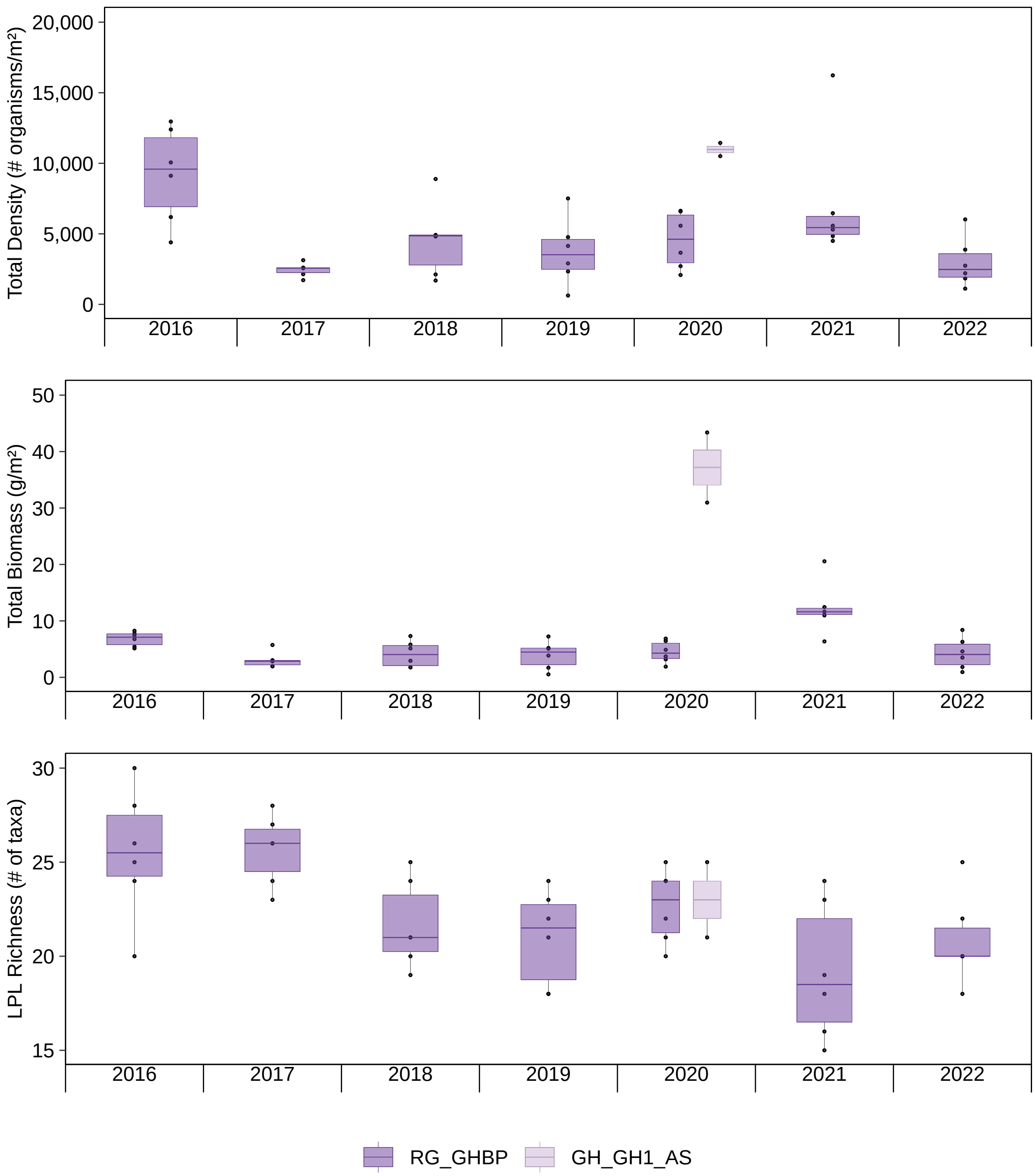

Figure 3.12: Benthic Invertebrate Community Endpoints for Area−based Kick Samples, Lower Greenhills Creek, September 2018 to 2022

Note: Samples were collected by kicking an area of 1/3 m^2.

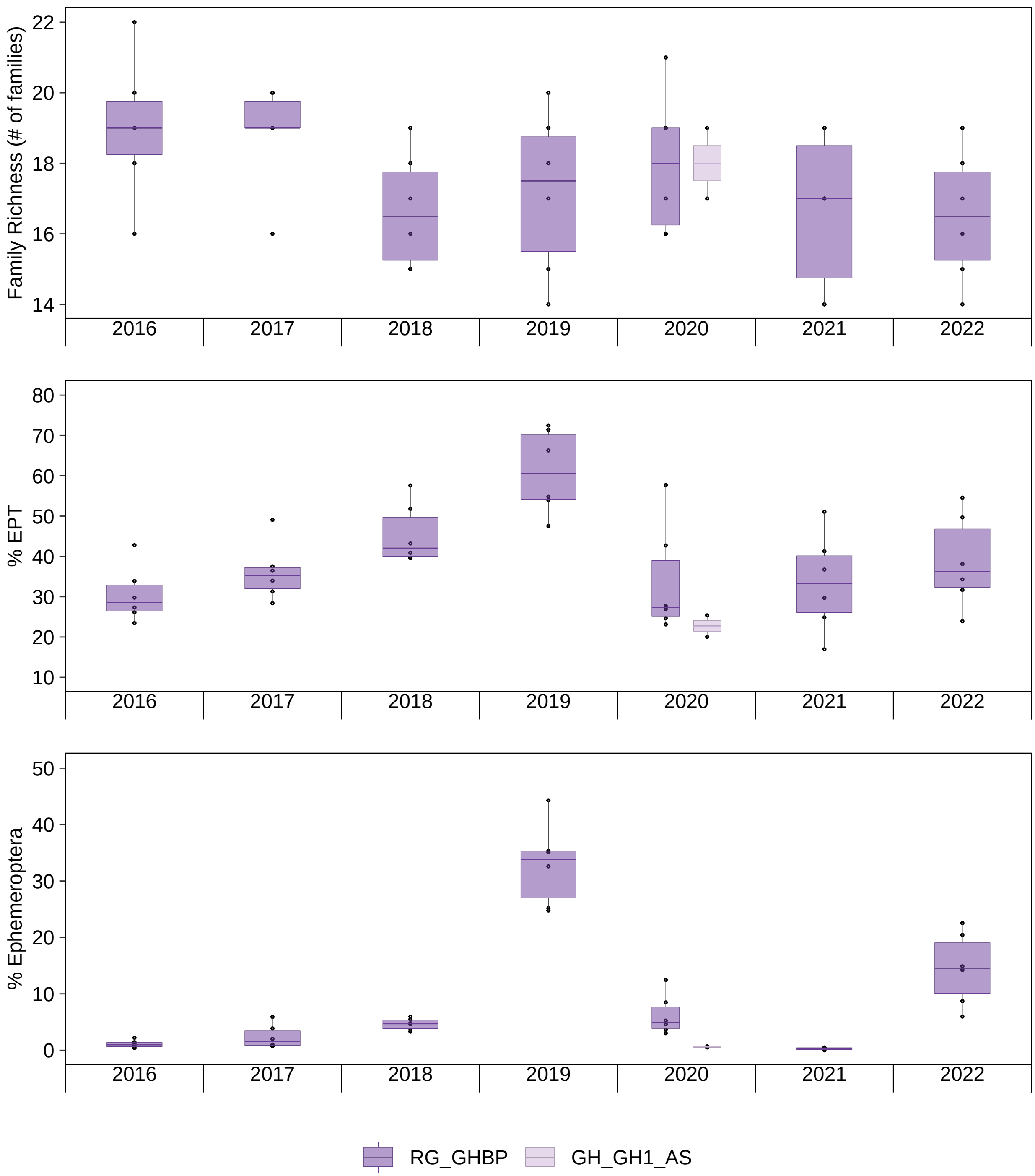

Figure 3.12: Benthic Invertebrate Community Endpoints for Area−based Kick Samples, Lower Greenhills Creek, September 2018 to 2022

Note: Samples were collected by kicking an area of 1/3 m^2.

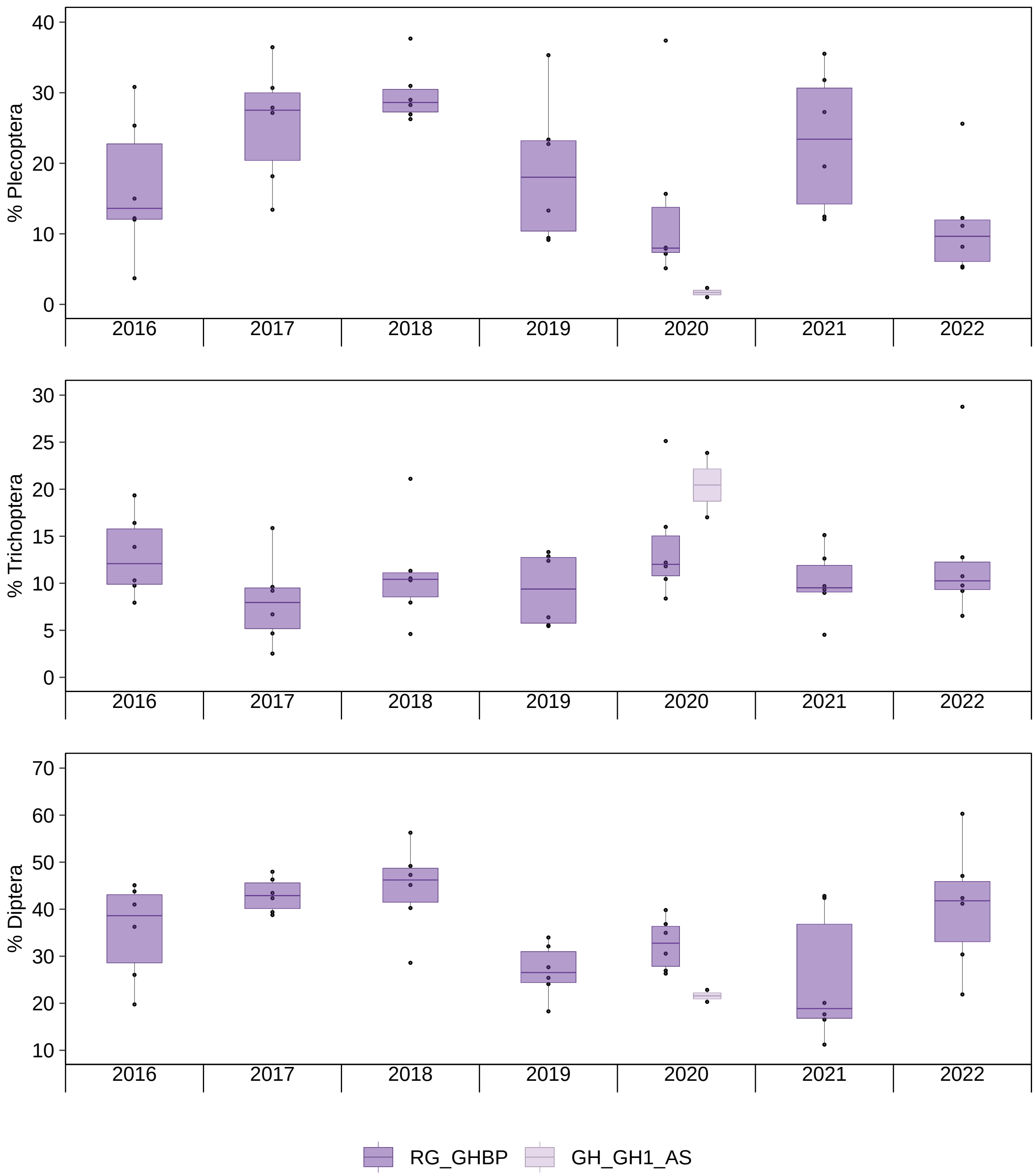

Figure 3.12: Benthic Invertebrate Community Endpoints for Area−based Kick Samples, Lower Greenhills Creek, September 2018 to 2022

Note: Samples were collected by kicking an area of 1/3 m^2.

antiscalant addition showed that, overall, density, biomass, LPL richness, family richness, %EPT, %Trichoptera, %Plecoptera, and %Diptera have not changed significantly in Lower Greenhills Creek, relative to Upper Greenhills Creek, since the initiation of treatment (Figure 3.13 Appendix Tables G.19 and G.20). However, there were a small number of differences among specific areas and years for endpoints other than %Trichoptera (Appendix Tables G.19 and G.20).

Large overall differences in %Ephemeroptera between RG_GHBP (treated) and all areas in Upper Greenhills Creek (untreated) were identified for 2018, 2019, 2020, and 2022 relative to 2016 and in 2019, 2020, and 2022 relative to 2017, due to higher %Ephemeroptera in Lower Greenhills Creek (Figure 3.13; Appendix Table G.21). Increases in %Ephemeroptera, which are less tolerant of degraded conditions, within Lower Greenhills Creek following initiation of antiscalant addition are considered indicative of improvements in calcite conditions downstream from the AAS (i.e., prevention of further calcite deposition and lower C_c scores in 2020 to 2022 relative to pre-treatment; see Section 3.2.1.2). These results are supported by the spatial and temporal comparisons described above, as well as consideration of correlations between benthic invertebrate community endpoints and concentrations of water quality constituents (e.g., TDS and sulphate, which did not exhibit upstream-to-downstream patterns in Greenhills Creek) and/or calcite endpoints (Figures 3.10 and 3.11; Tables 3.3 and 3.4; Appendix Table G.18). Therefore, observed differences or changes in benthic invertebrate communities are generally as expected.

3.3.2.2 Timed Kicks

For the timed kick samples, qualitative comparisons of benthic invertebrate community endpoints among areas and to reference area normal ranges highlighted similarities among RG_GHNF and RG_GHDT on Upper Greenhills Creek and RG_GHCKD on Lower Greenhills Creek (Appendix Figures G.5 and G.6; Appendix Tables G.22 to G.26). Total benthic invertebrate abundances at all three areas were generally at the lower boundary of or below the regional reference area normal range in 2022 (Appendix Figures G.5 and G.6). Except for one sample from RG_GHNF with a dipteran abundance of over 9,000 organisms per three-minute kick, abundances of the of major taxonomic groups (individually and combined) at RG_GHNF and RG_GHDT were marginally within or below reference area normal ranges (Appendix Figures G.5 and G.6; Appendix Table G.22). Finally, %EPT and %Ephemeroptera were below regional reference area normal ranges throughout Greenhills Creek in 2022 (Appendix Figures G.5 and G.6). Ephemeroptera made up larger percentages of the samples from RG_GHCKD relative to RG_GHNF and RG_GHDT, whereas %Diptera was lower for the RG_GHCKD samples (Appendix Table G.22). Family richness appeared to be higher at

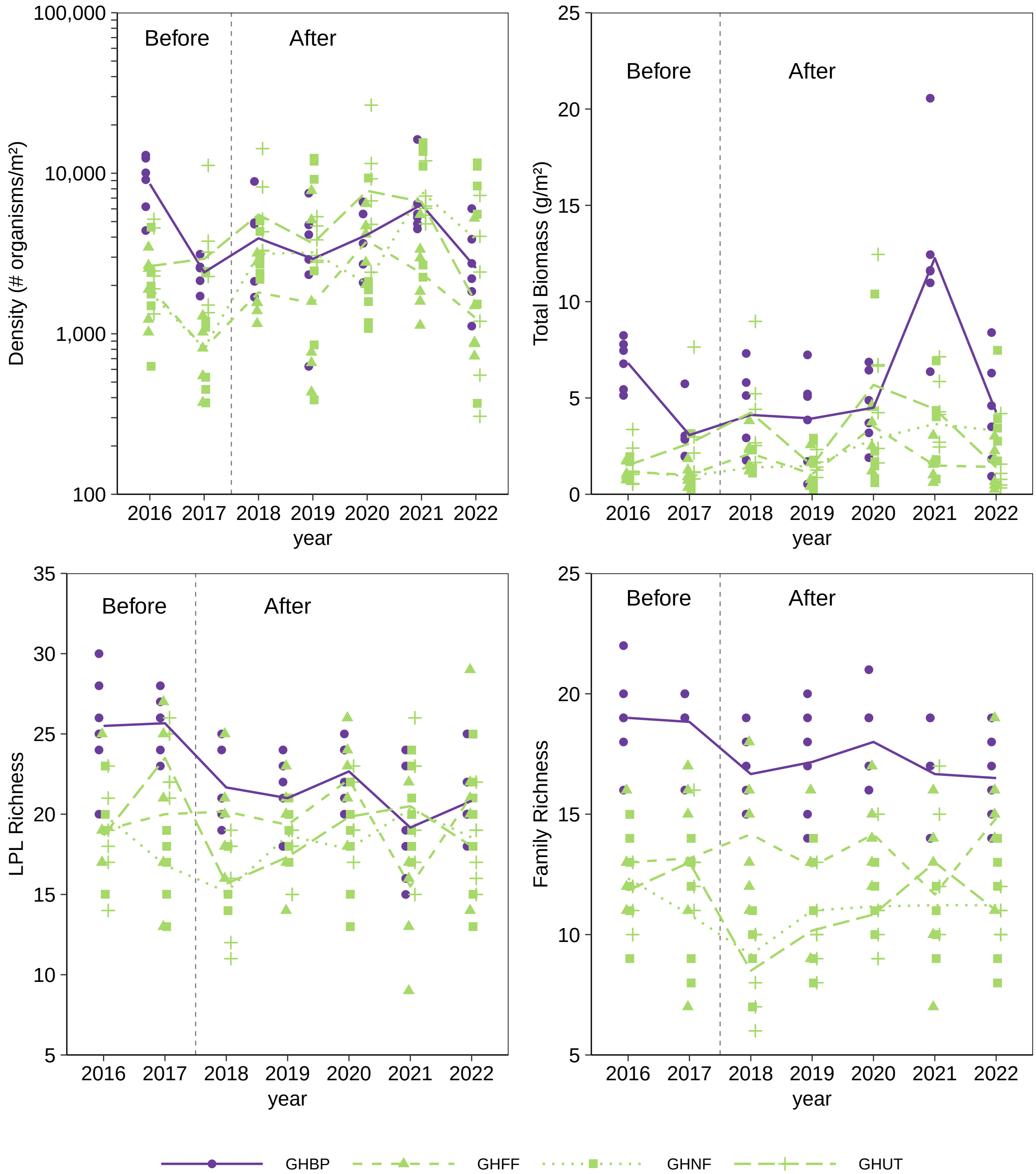

Figure 3.13: Benthic Invertebrate Endpoint Comparisons Before and After the Initiation of Antiscalant Treatment on Lower Greenhills Creek, 2016 to 2022

Notes: Purple represents the area on Lower Greenhills Creek that received treatment from 2017 to 2022. Green represents the areas on Upper Greenhills Creek that did not receive treatment from 2017 to 2022. Dashed or solid lines connect annual means for each area. When there was no Before−After−Control−Impact (BACI) area interaction in the Analysis of Variance (ANOVA) model (interaction p−value > 0.1), an annual mean for all untreated areas was calculated and displayed with a solid green line.

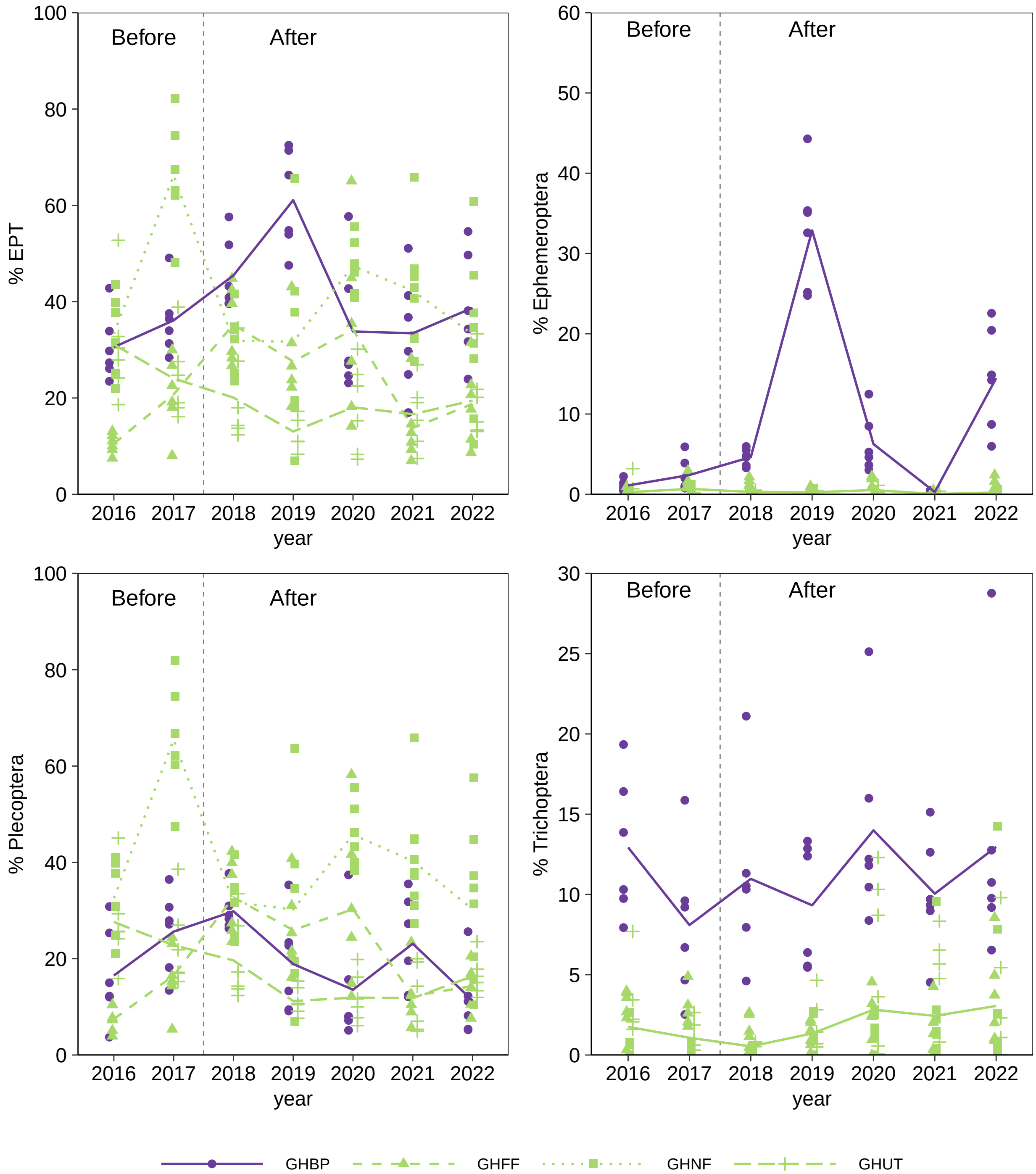

Figure 3.13: Benthic Invertebrate Endpoint Comparisons Before and After the Initiation of Antiscalant Treatment on Lower Greenhills Creek, 2016 to 2022

Notes: Purple represents the area on Lower Greenhills Creek that received treatment from 2017 to 2022. Green represents the areas on Upper Greenhills Creek that did not receive treatment from 2017 to 2022. Dashed or solid lines connect annual means for each area. When there was no Before−After−Control−Impact (BACI) area interaction in the Analysis of Variance (ANOVA) model (interaction p−value > 0.1), an annual mean for all untreated areas was calculated and displayed with a solid green line.

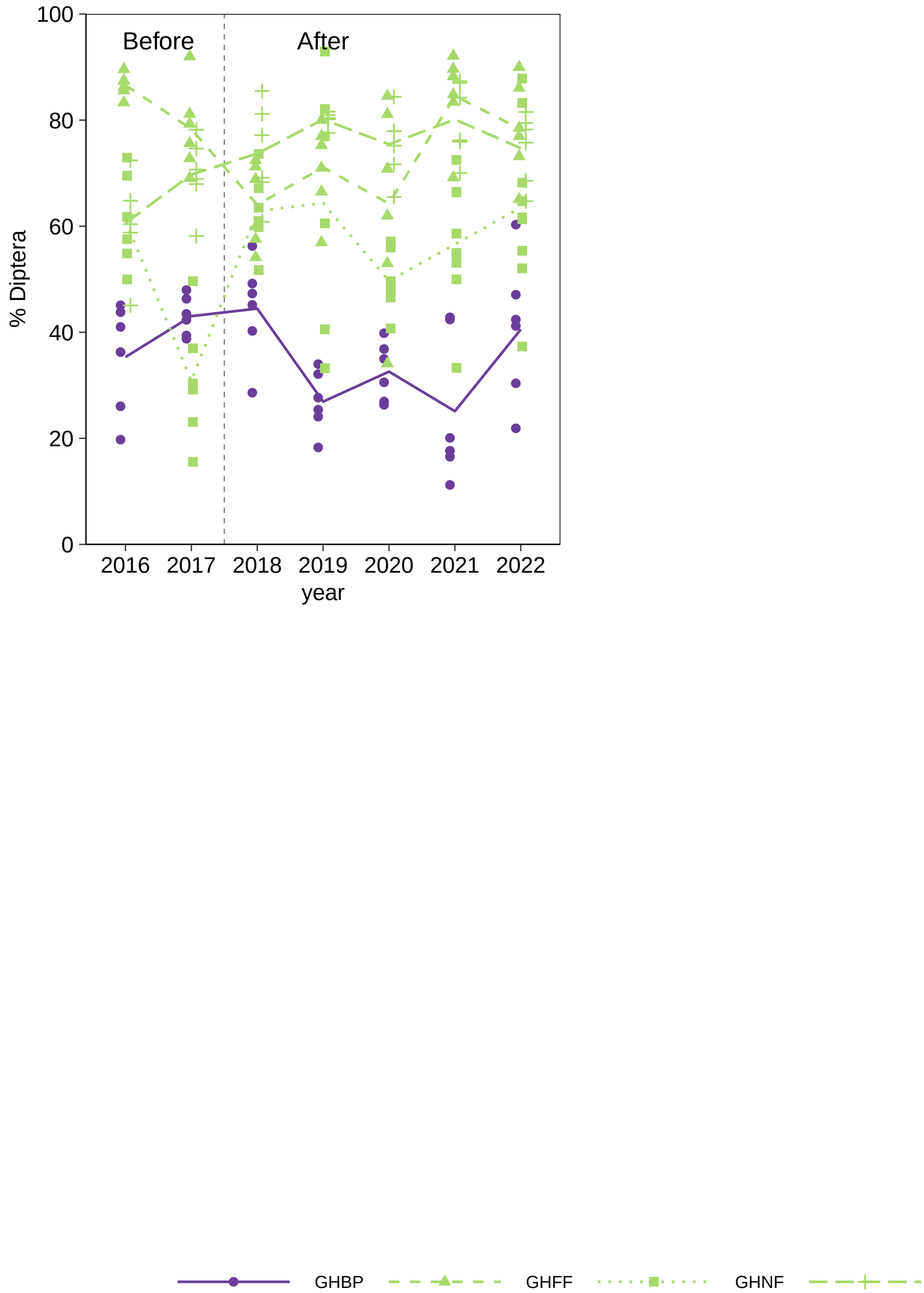

Figure 3.13: Benthic Invertebrate Endpoint Comparisons Before and After the Initiation of Antiscalant Treatment on Lower Greenhills Creek, 2016 to 2022

Notes: Purple represents the area on Lower Greenhills Creek that received treatment from 2017 to 2022. Green represents the areas on Upper Greenhills Creek that did not receive treatment from 2017 to 2022. Dashed or solid lines connect annual means for each area. When there was no Before−After−Control−Impact (BACI) area interaction in the Analysis of Variance (ANOVA) model (interaction p−value > 0.1), an annual mean for all untreated areas was calculated and displayed with a solid green line.

RG_GHCKD relative to RG_GHNF, despite LPL richness being similar between the two areas (Appendix Figures G.5 and G.6; Appendix Table G.22).

Total benthic invertebrate abundances were the lowest reported for timed kick samples collected from Lower Greenhills Creek (RG_GHCKD) in 2022 compared to previous years (Appendix Figure G.6). However, %Ephemeroptera was higher in Lower Greenhills Creek in 2022 relative to all years sampled except 2019, which is consistent with the results for the area-based samples (Figure 3.12).

3.3.3 Greenhills Creek Sedimentation Pond

Data collected in 2022 represent the fifth year of pre-treatment benthic invertebrate community data and associated field measurements for the Greenhills Creek Sedimentation Pond (Appendix Tables G.27 to G.32). Results for each endpoint were generally comparable from 2018 to 2022, except for density and total biomass which were lower in 2022 compared to previous years (Figure 3.14). Similar to previous years, %Diptera was much higher than %EPT, which is not unexpected for a pond environment, and EPT taxa were dominated by Ephemeroptera (Figure 3.14; Appendix Table G.28). Bivalves were the predominant taxonomic group in each of the n = 6 samples from Greenhills Creek Sedimentation Pond (i.e., 12 to 72% of organisms), followed by Diptera (i.e., 15 to 59% of organisms; Appendix Table G.28).

3.3.4 Biological Triggers

Percentages of EPT in the timed kick samples collected from RG_GHNF and RG_GHCKD on Greenhills Creek were compared to biological triggers for this endpoint (information pertaining to the determination of the biological trigger values can be found in Appendix H). Comparisons to biological triggers were completed based on available water quality predictions for monthly water quality monitoring stations GH_HWGH_BRB (paired with RG_GHNF) and GH_GH1 (paired with RG_GHCKD). In 2022, %EPT values in two of three samples from RG_GHNF and each of the three samples collected from RG_GHCKD exceeded the biological triggers based on the predicted Aquatic Data Integration Tool (ADIT) scores for each location (Appendix Figure H.1; Appendix Table H.1).

3.4 Benthic Invertebrate Tissue Chemistry

3.4.1 Gardine Creek

Selenium concentrations in composite taxa benthic invertebrate samples collected from lower Gardine Creek (RG_GANF) were significantly lower (MOD = 57%) relative to upper Gardine Creek (RG_GAUT) in September 2022 (Figure 3.15; Appendix Tables I.1 and I.2).

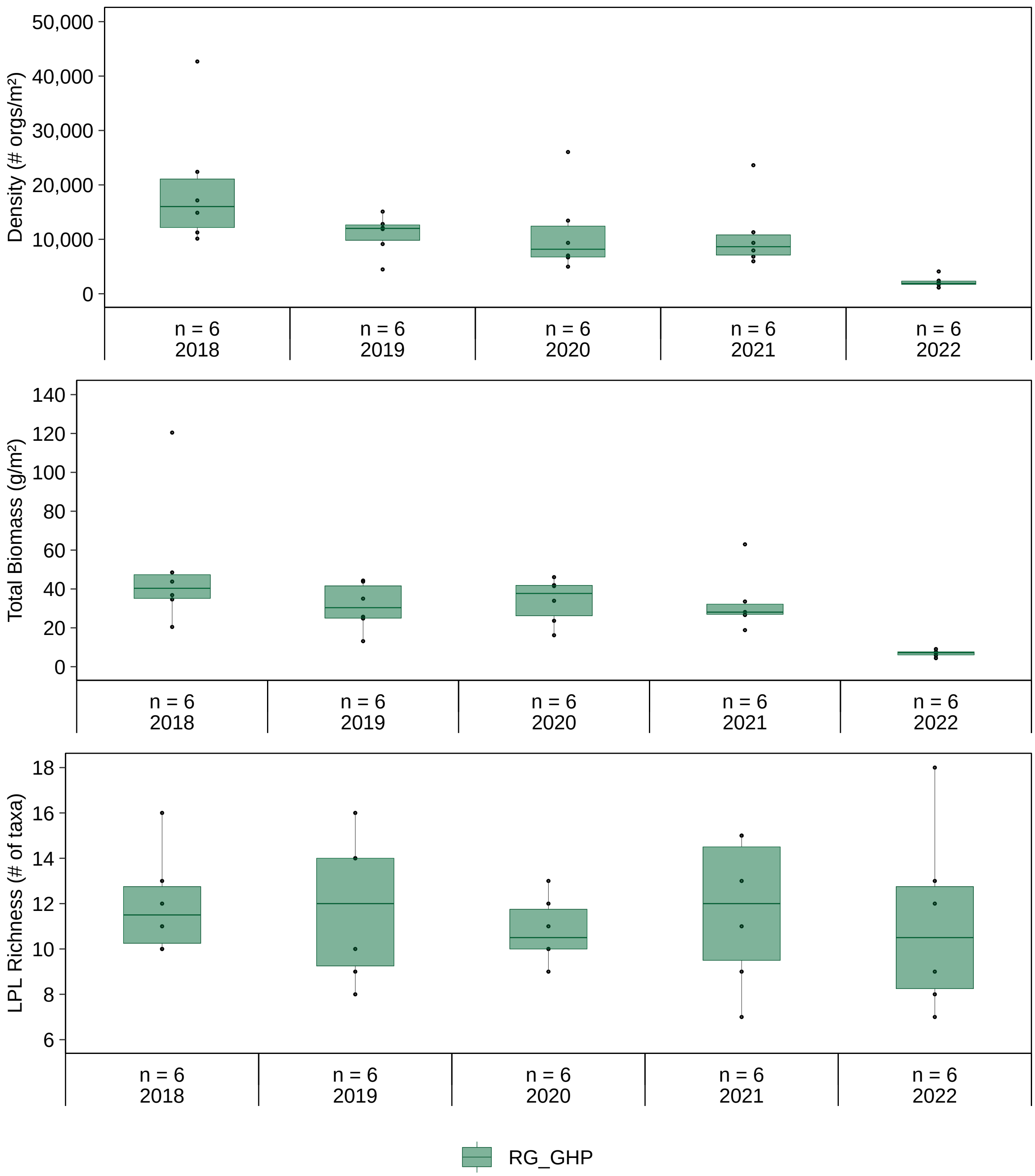

Figure 3.14: Benthic Invertebrate Community Endpoints for Greenhills Creek Sedimentation Pond, September 2018 to 2022

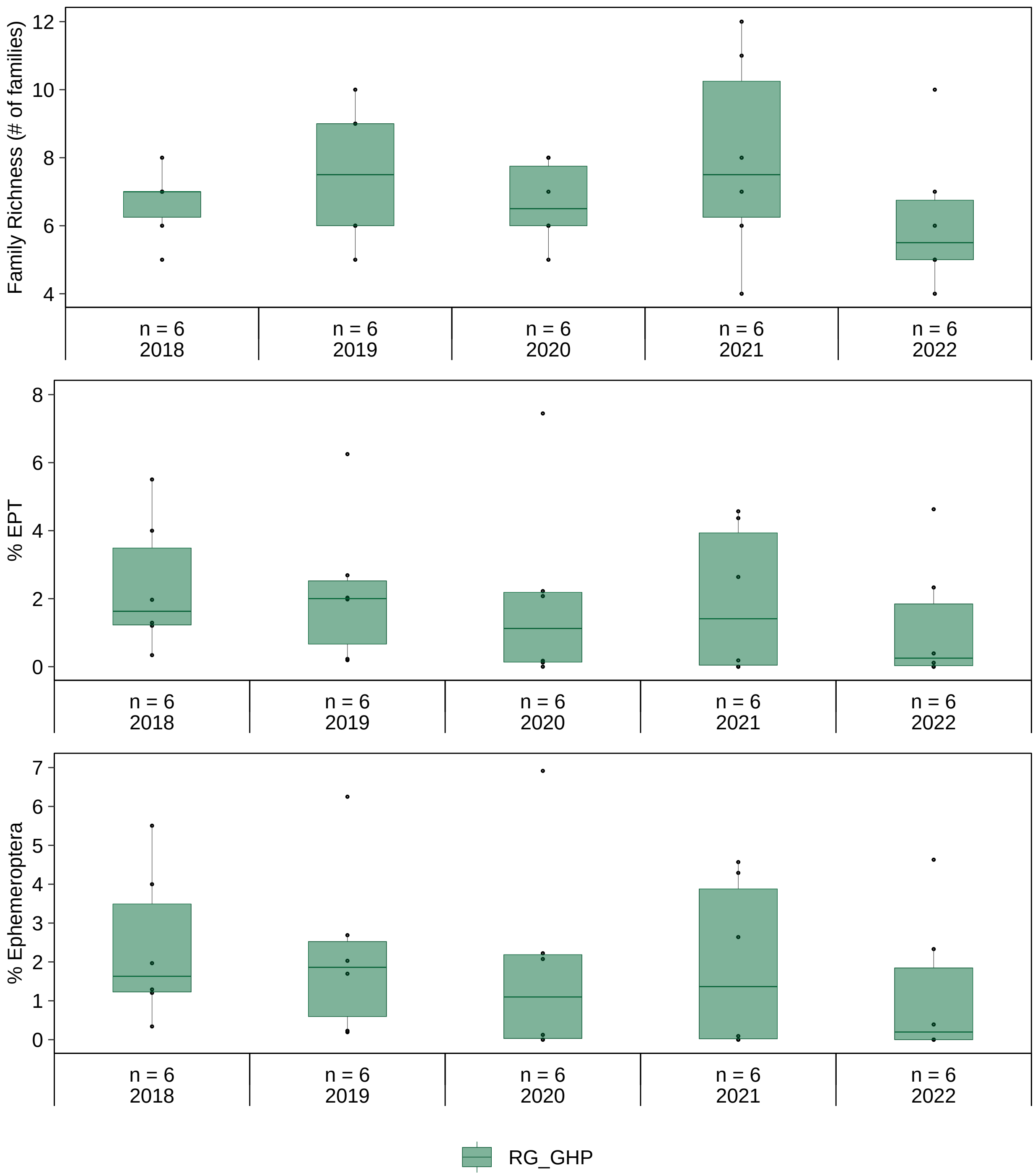

Figure 3.14: Benthic Invertebrate Community Endpoints for Greenhills Creek Sedimentation Pond, September 2018 to 2022

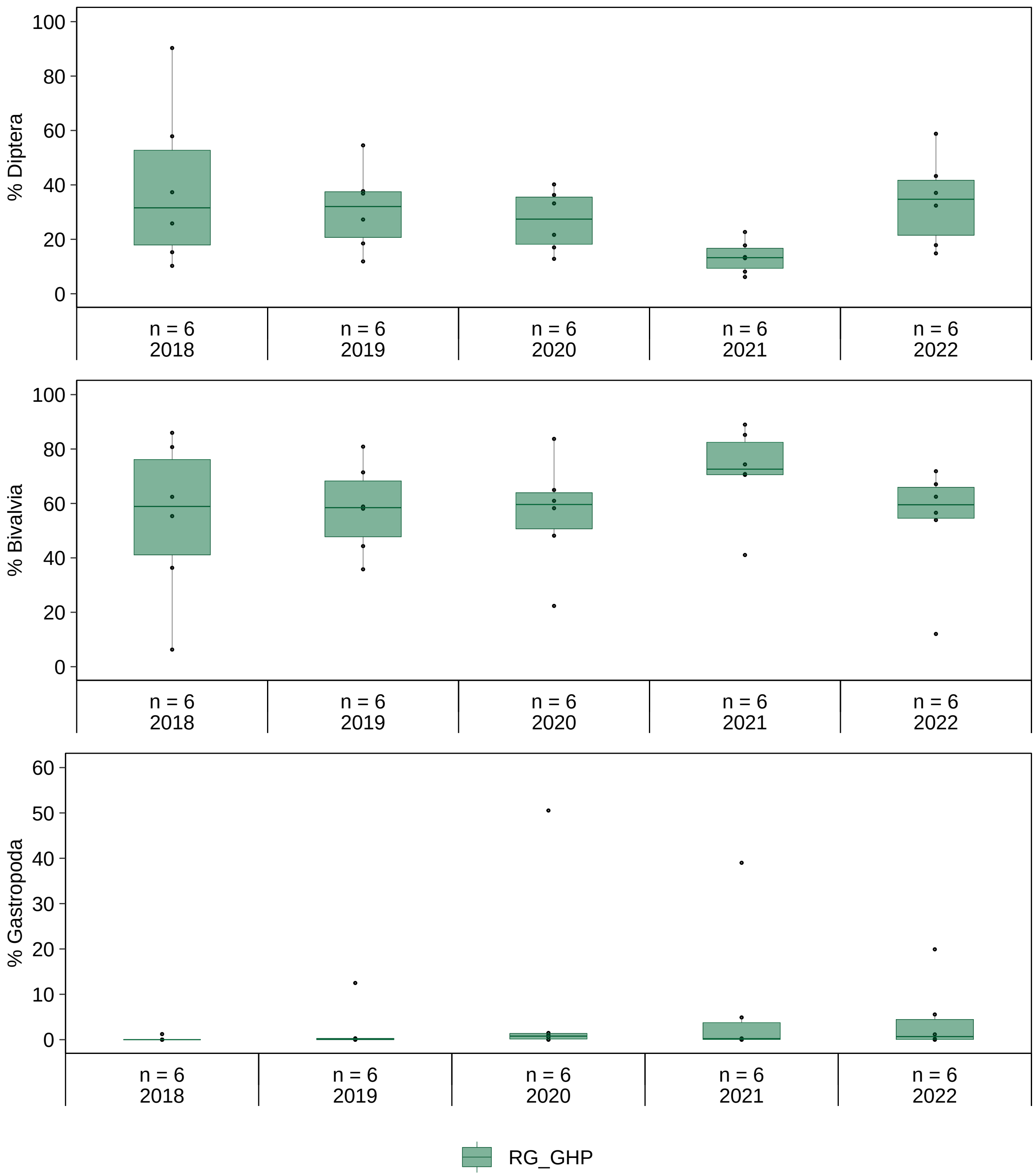

Figure 3.14: Benthic Invertebrate Community Endpoints for Greenhills Creek Sedimentation Pond, September 2018 to 2022

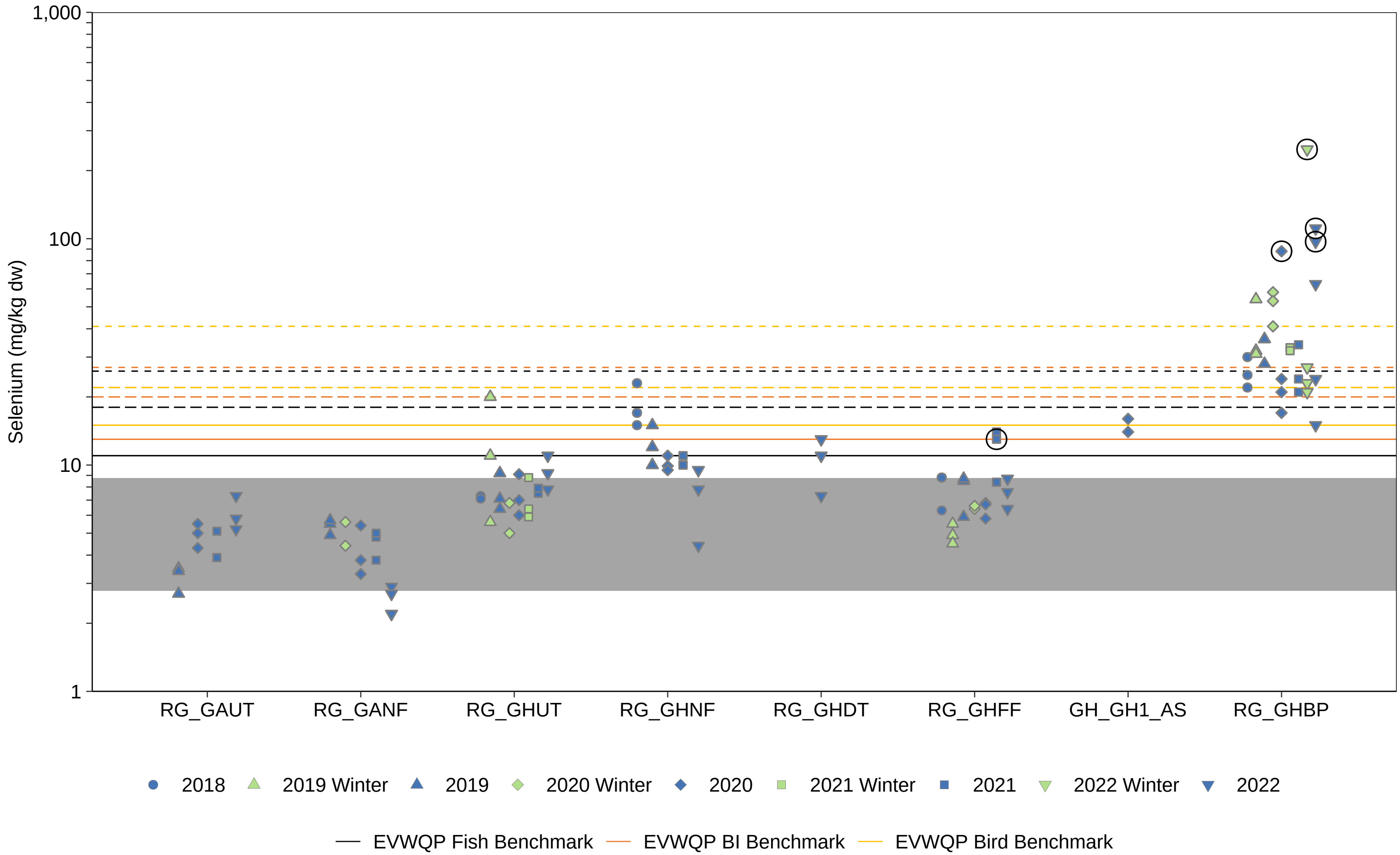

Figure 3.15: Selenium Concentrations in Composite-taxa Benthic Invertebrate Tissue Samples from Greenhills and Gardine Creeks, 2018 to 2022

Notes: Grey shading represents the reference area normal range defined as the 2.5th and 97.5th percentiles of the distribution of reference area data (pooled 1996 to 2019 data) from the Regional Aquatic Effects Monitoring Program (RAEMP). Solid line = Level 1 Benchmark, long hashed line = Level 2 Benchmark, short hashed line = Level 3 Benchmark. Annelid-only samples are included in the plot and are circled in black to differentiate them from the composite-taxa samples.

Previously (i.e., from 2019 to 2021), selenium concentrations in samples from RG_GAUT and RG_GANF were similar (Appendix Table I.2). Additionally, selenium concentrations in tissue samples from Gardine Creek were consistently within or below the reference area normal range and below EVWQP Benchmarks (Figure 3.15; Appendix Table I.1).

Selenium concentrations in composite-taxa benthic invertebrate tissue chemistry samples from Gardine Creek were not consistently aligned with expected based on water quality. Selenium concentrations in samples from RG_GAUT (upper Gardine Creek) were consistently with prediction interval limits based on the selenium bioaccumulation model and close to mean predicted concentrations generated using the B-tool (Figure 3.16; Appendix Tables I.4 and I.5). Selenium concentrations in samples from RG_GANF (lower Gardine Creek) were below the prediction interval limits associated with the selenium bioaccumulation model but close to mean predictions based on the B-tool (Figure 3.16; Appendix Tables I.4 and I.5).

3.4.2 Upper and Lower Greenhills Creek

Few spatial and temporal patterns in benthic invertebrate tissue selenium concentrations were identified for Greenhills Creek (Figure 3.17; Appendix Figure I.1; Appendix Tables I.2, I.3, and I.6). Selenium concentrations in composite-taxa benthic invertebrate tissue samples collected from Upper Greenhills Creek in September 2022 were comparable among stations (i.e., RG_GHUT, RG_GHNF, RG_GHDT, and RG_GHFF), but lower relative to Lower Greenhills Creek, which is downstream from the Greenhills Creek Sedimentation Pond (Figures 3.15 and 3.17; Appendix Tables I.1 and I.2). Concentrations in tissue samples from RG_GHNF on Upper Greenhills Creek decreased in 2021 (MOD = 43%) and 2022 (MOD = 68%) relative to 2018 (Figure 3.17; Appendix Table I.3).

Selenium concentrations in composite-taxa benthic invertebrate tissue samples from Upper Greenhills Creek were occasionally (i.e., in zero to two of the n = 3 samples per area) above the upper boundary of the reference area normal range and were only rarely (i.e., one sample from RG_GHDT) above EVWQP Level 1 Benchmarks (Figure 3.15; Appendix Table I.1).

Unlike Upper Greenhills and Gardine creeks, selenium concentrations in annelid-free composite-taxa samples collected from Lower Greenhills Creek (RG_GHBP) in 2022 were consistently above the reference area normal range and the EVWQP Level 2 Benchmark for growth, reproduction, and survival of benthic invertebrates (i.e., 20 milligrams per kilogram dry weight [mg/kg dw]) (Figure 3.15; Appendix Table I.1). One of the composite-taxa samples from February 2022 also had a selenium concentration (27 mg/kg dw) greater than the EVWQP Level 3 Benchmark for dietary effects to juvenile fish (i.e., 26 mg/kg dw). All but one of the five annelid-containing (composite and single -taxon) samples collected from Lower Greenhills Creek

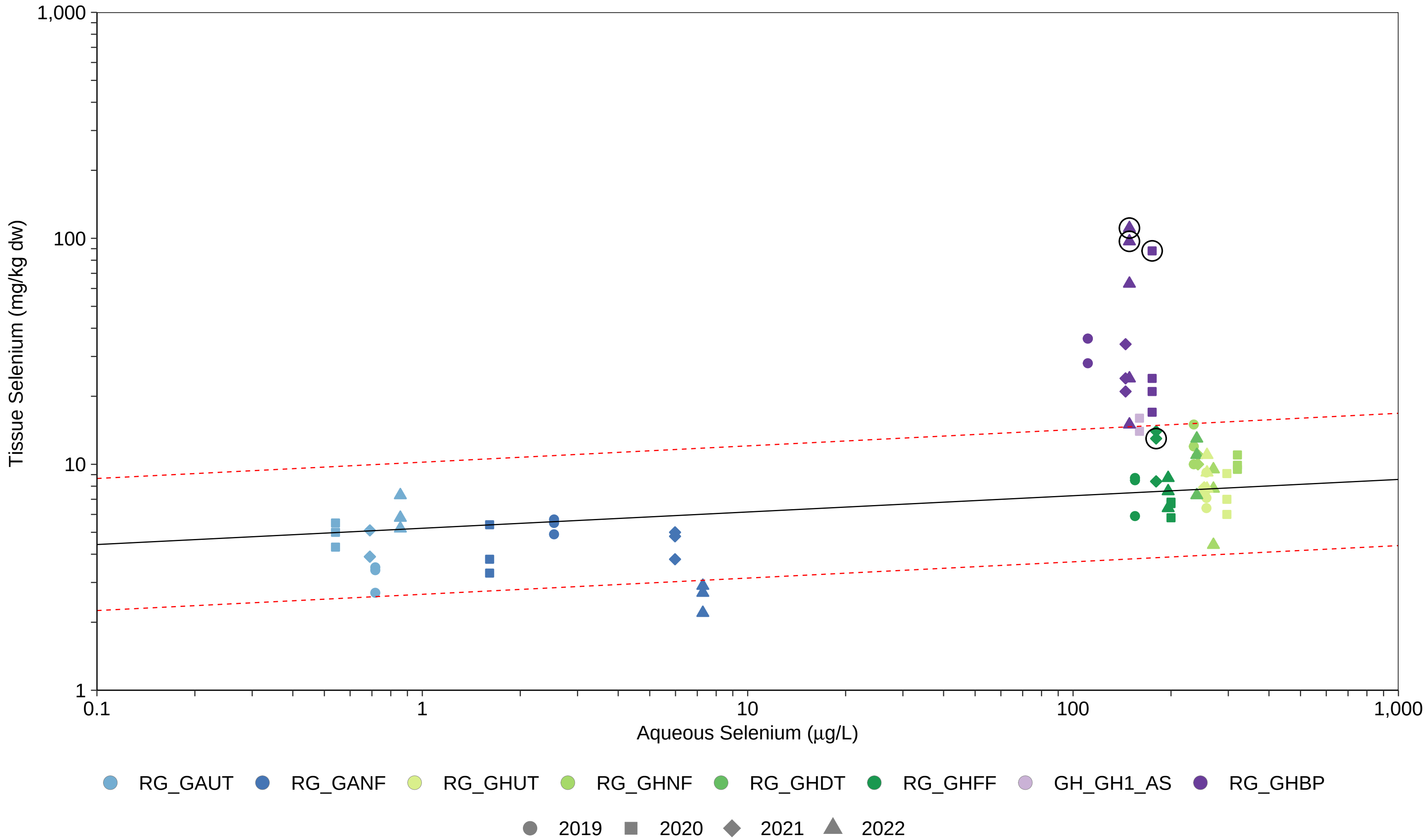

Figure 3.16: Selenium Concentrations in Benthic Invertebrate Tissues Relative to Predictions and Aqueous Selenium Concentrations, September 2018 to 2022

Notes: Mean benthic invertebrate selenium concentrations (solid black line) were estimated using a one−step water to benthic invertebrate selenium accumulation model: $\log_{10}[Se]_{benthic\ invertebrate} = 0.720 + 0.071 \times \log_{10}[Se]_{aqueous}$ (Golder 2020). The 95% prediction limits for a single value from the one −step water to benthic invertebrate selenium bioaccumulation model are plotted as dashed red lines. The annelid−containing samples are circled in black to differentiate them from the other samples.

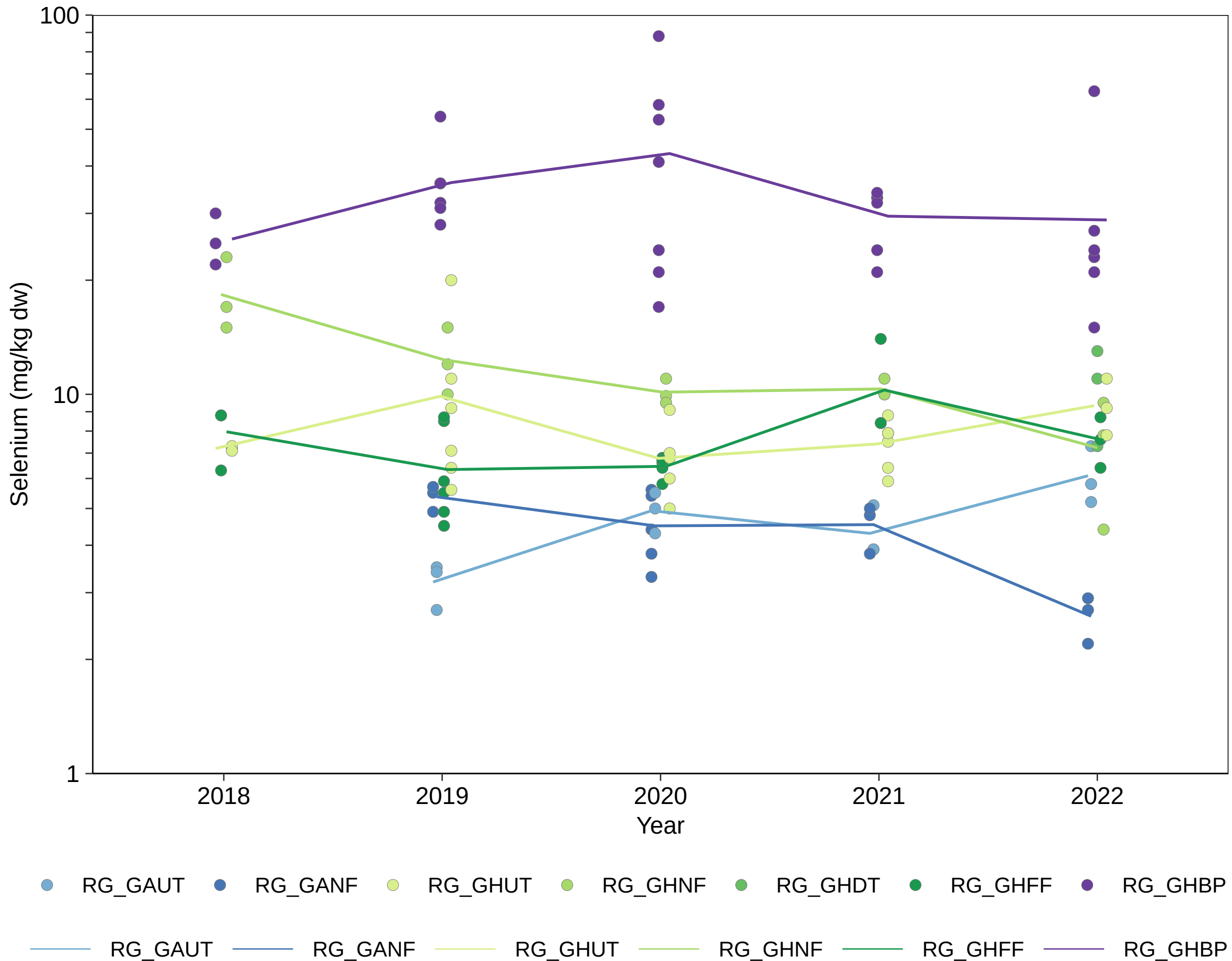

Figure 3.17: Comparisons of Selenium Concentrations in Composite−taxa Benthic Invertebrate Tissue Samples from Greenhills and Gardine Creeks, September 2018 to 2022

Notes: Solid lines connect annual means for each area. Biological monitoring area RG_GHDT was sampled for the first time in 2022.

in 2022 had selenium concentrations greater than the reference area normal range and EVWQP Level 3 Benchmarks in 2022 (Figure 3.15; Appendix Table I.1).

Selenium concentrations in composite-taxa benthic invertebrate tissue samples from Greenhills Creek were generally aligned with expectations based on water quality and conditions of organoselenium speciation. Specifically, selenium concentrations in samples from Upper Greenhills Creek were within prediction intervals generated using the selenium bioaccumulation model and close to mean B-tool predictions (Figure 3.16; Appendix Tables I.4 and I.5). In Lower Greenhills Creek, eight of the n = 9 benthic invertebrate tissue chemistry samples (composite-taxa, composite-taxa with annelids, and annelid-only) collected in 2022 had selenium concentrations that were above prediction limits based on the selenium bioaccumulation model and were closer to mean predicted values from the B-tool (Figures 3.16 and 3.18; Appendix Tables I.4 and I.5). The B-tool analysis results are as expected, given that Greenhills Creek Sedimentation Pond is a known source of organoselenium to the downstream environment in Lower Greenhills Creek.

Selenium concentrations in annelid-free, composite-taxa benthic invertebrate tissue samples from Lower Greenhills Creek (RG_GHBP) were within a factor of two of predicted mean values based on the B-tool, which is the criterion used by de Bruyn and Luoma (2021) to indicate reasonable alignment (Appendix Table I.5). It is considered likely that speciation is a contributing factor to the higher selenium concentrations observed in benthic invertebrate tissues. Lower Greenhills Creek is downstream from the Greenhills Creek Sedimentation Pond, which possesses characteristics of natural or naturalized lentic habitats that may be more conducive to enhanced formation of organoselenium species (ADEPT 2022; Golder 2021; Orr et al. 2006). The effects of the pond on selenium speciation are expected to carry over to Lower Greenhills Creek. In Lower Greenhills Creek, combined concentrations of dimethylselenoxide and methylseleninic acid in water were consistently greater than the draft screening value (0.025 µg/L) for detectable increases in selenium bioaccumulation in 2022 (Appendix Table E.3; ADEPT 2022). Aqueous concentrations of these two organoselenium species were notably higher in the pond and Lower Greenhills Creek relative to upstream biological monitoring areas and downstream sampling locations on the UFR in 2022 (Figure 3.19; Appendix Table E.3; see also the longitudinal study results in ADEPT et al. 2023).

3.4.3 Greenhills Creek Sedimentation Pond

Similar to 2021 (Minnow 2022a), selenium concentrations in the composite-taxa benthic invertebrate tissue chemistry sub-samples from Greenhills Creek Sedimentation Pond were higher than concentrations in the bivalve-only samples/sub-samples (Figure 3.20; Appendix Table I.7). Selenium concentrations in the bivalve-only samples were within the

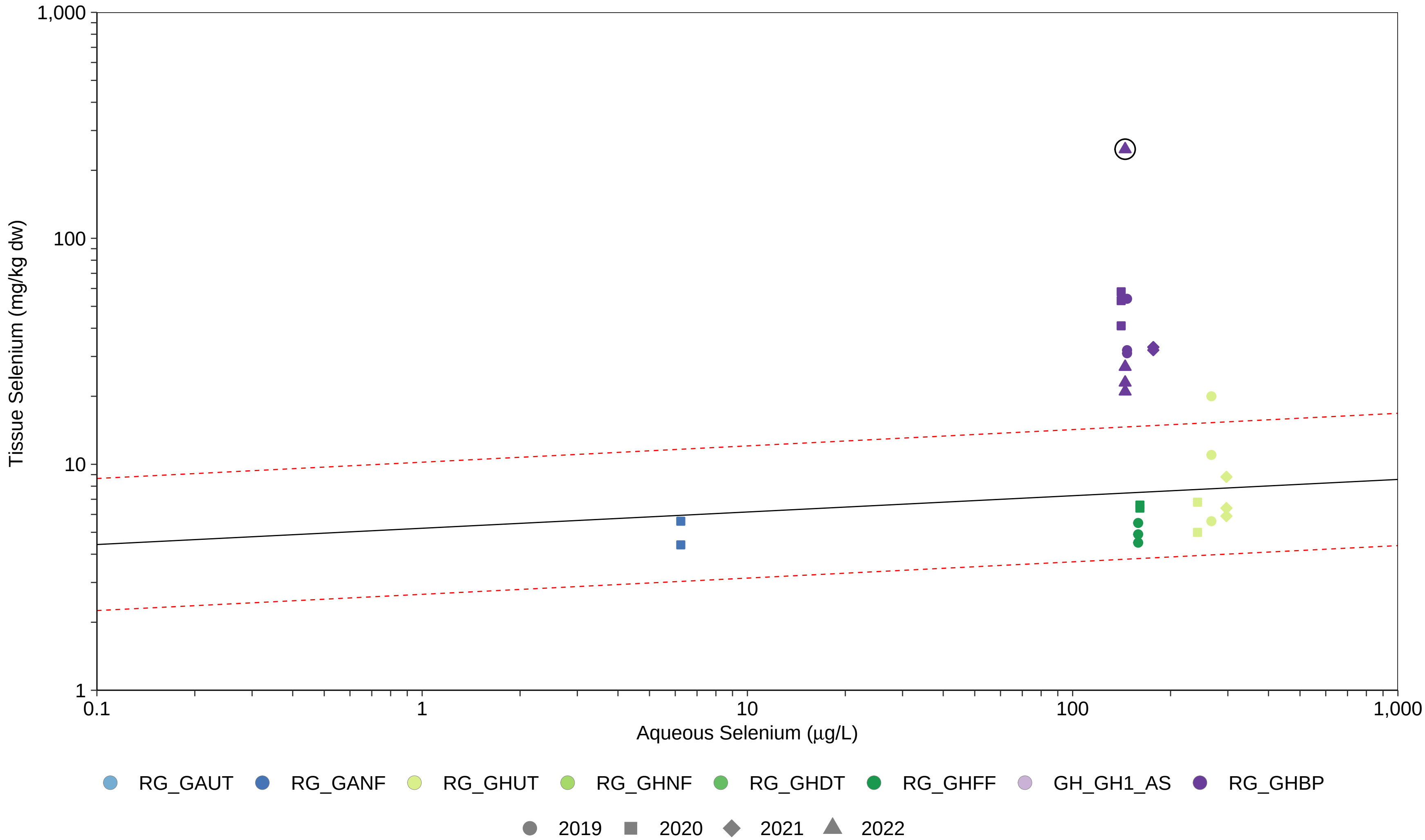

Figure 3.18: Selenium Concentrations in Benthic Invertebrate Tissues Relative to Predictions and Aqueous Selenium Concentrations, Feburary 2018 to 2022

Notes: Mean benthic invertebrate selenium concentrations (solid black line) were estimated using a one−step water to benthic invertebrate selenium accumulation model: $\log_{10}[Se]_{benthic\ invertebrate} = 0.720 + 0.071 \times \log_{10}[Se]_{aqueous}$ (Golder 2020). The 95% prediction limits for a single value from the one−step water to benthic invertebrate selenium bioaccumulation model are plotted as dashed red lines. The annelid−containing samples are circled in black to differentiate them from the other samples.

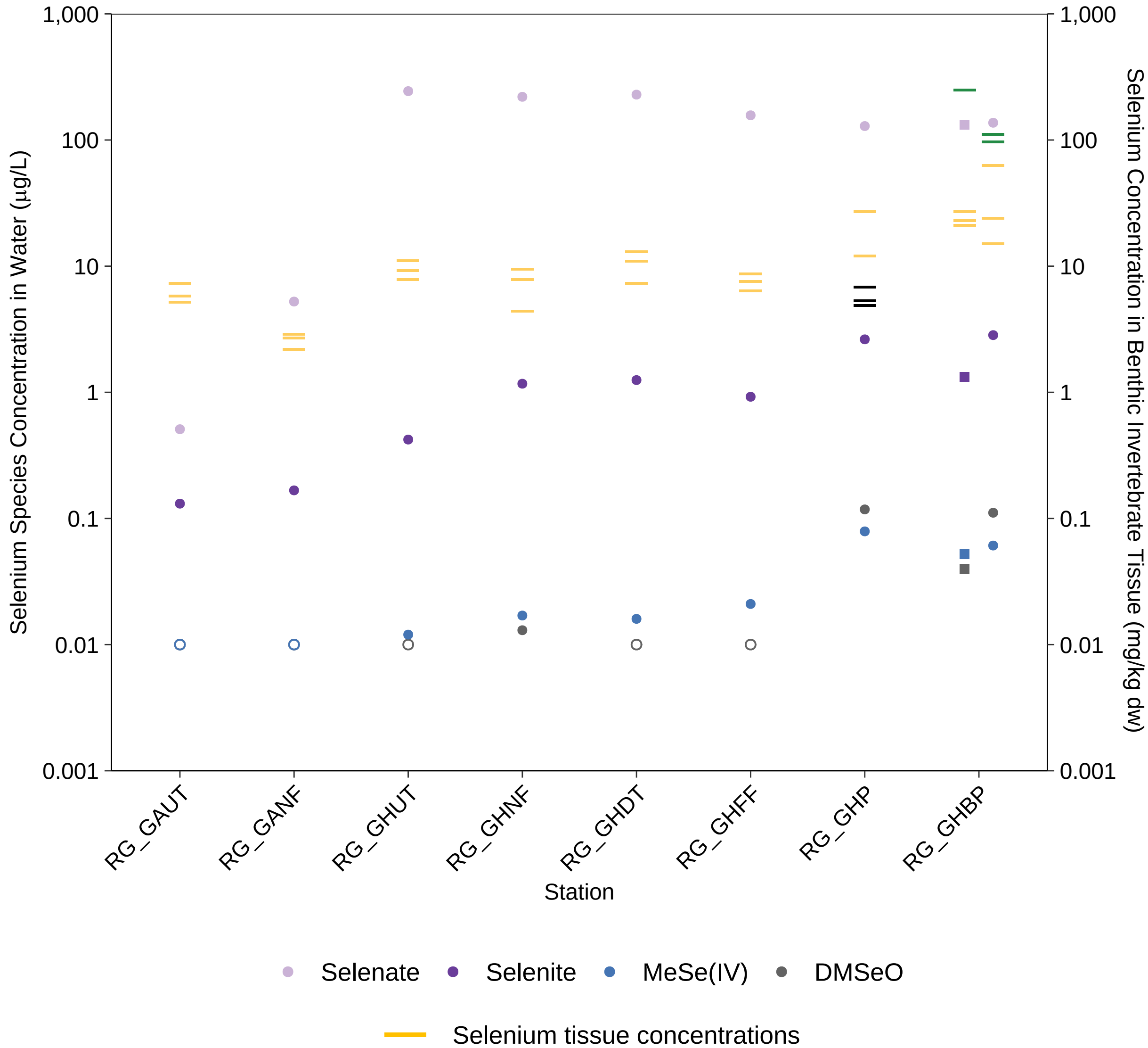

Figure 3.19: Concentrations of Selenium Species Measured in Water Samples Collected Concurrent with Benthic Invertebrate Tissue Samples, February (Squares) and September (Circles) 2022

Notes: Only species with detected values are shown and samples at the laboratory reporting limit (LRL) are plotted with an open symbol at the LRL. All tissue concentrations are for composite samples (orange), except n =3 annelid-only samples (green) and n = 3 bivalve-only samples (black).

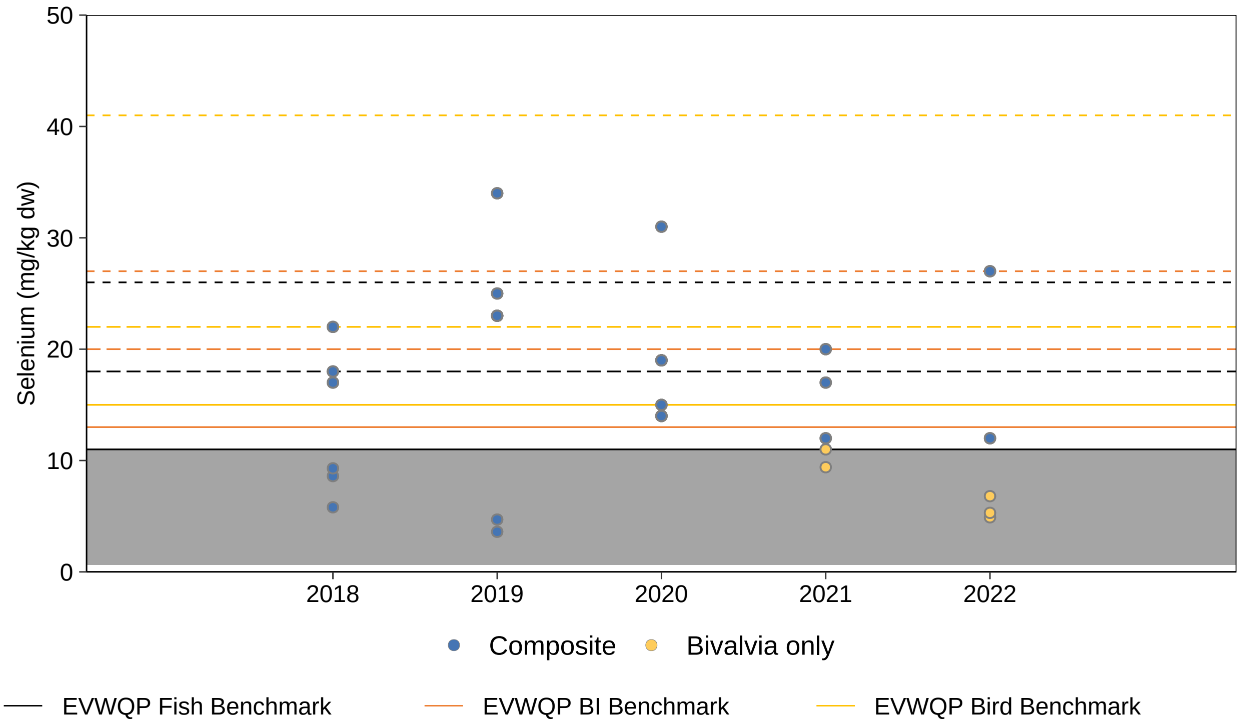

Figure 3.20: Selenium Concentrations in Composite-taxa Benthic Invertebrate Tissues from Greenhills Creek Sedimentation Pond, 2018 to 2022

Notes: Grey shading represents the reference area normal range defined as the 2.5th and 97.5th percentiles of the distribution of reference area data (pooled 1996 to 2019 data) from the Regional Aquatic Effects Monitoring Program (RAEMP). Solid line = Level 1 Benchmark, long hashed line = Level 2 Benchmark, short hashed line = Level 3 Benchmark. All samples were collected in September.

reference area normal range and less than EVWQP Benchmarks. Conversely, concentrations in the composite-taxa samples from RG_GHP-3 and RG_GHP-5 were above the reference area normal range and Level 1 and Level 3 Benchmarks, respectively (Figure 3.20; Appendix Table I.7).

Because selenium exposure of WCT occurs via dietary pathways, selenium concentrations in benthic invertebrate tissues are a useful proxy for understanding selenium exposure in WCT, and changes in concentrations over time within benthic invertebrate tissues are expected to provide an indication of changes in the level of potential risk to WCT. Concurrent benthic invertebrate and WCT tissue chemistry sampling within the Greenhills Creek Sedimentation Pond was last completed in 2018 (Minnow 2019). Ultimately, data for the community samples collected in 2018 and 2022 suggest the dominant taxa (i.e., bivalves and chironomids) were sufficiently similar in 2018 and 2022 to allow qualitative comparisons among years (Appendix Table G.32). Results of these comparisons suggest that potential selenium-related risks to WCT feeding on benthic invertebrates originating from within the Greenhills Creek Sedimentation Pond were likely similar to 2018 (Figure 3.20).

As indicated in Section 3.4.2, selenium concentrations in the benthic invertebrate tissues collected from the pond (RG_GHP) may have resulted, at least in part, from the presence of more bioavailable forms of aqueous selenium. Consistent with 2021 (Minnow 2022a), concentrations of dimethylselenoxide and methylseleninic acid in water were higher in the Greenhills Creek Sediment Pond than all other upstream monitoring areas (Figure 3.19). Observed selenium concentrations in tissues were below B-tool predictions, which are based on aqueous selenium speciation and sulphate data (Appendix Table I.5).

3.4.4 Biological Triggers

Selenium concentrations in benthic invertebrate tissues were also assessed relative to the biological triggers established for this endpoint (information pertaining to the evaluation of the biological triggers can be found in Appendix H). This was completed for each composite-taxa (excluding samples that contained annelids) benthic invertebrate community sample collected from biological monitoring areas RG_GHNF (Upper Greenhills Creek) and RG_GHCKD and RG_GHBP (Lower Greenhills Creek). Water quality predictions for monthly water quality monitoring stations GH_HWGH_BRB (Upper Greenhills Creek) and GH_GH1 (Lower Greenhills Creek) were also used. None of the samples collected from RG_GHNF on Upper Greenhills Creek in September 2022 (n = 3) exceeded the biological trigger for benthic invertebrate tissue selenium concentrations (Appendix Figure H.2; Appendix Table H.2). However, all of the annelid-free composite-taxa samples from Lower Greenhills Creek (n = 3 at RG_GHBP in February 2022 and n = 1 each at RG_GHBP and RG_GHCKD in September 2022) exceeded the biological trigger) (Appendix Figure H.2; Appendix Table H.2). The biological trigger exceedances for these monitoring locations are likely related to a combination of the factors discussed in the preceding sections, including proximity to the Greenhills Creek Sedimentation Pond discharge, which could influence selenium speciation.

3.5 Westslope Cutthroat Trout

Westslope cutthroat trout are the only fish species found in the Greenhills Creek watershed. There is a single, isolated population that can access and use habitats within Upper Greenhills and Gardine creeks and can move downstream into the Greenhills Creek Sedimentation Pond. A partial barrier at the conveyor culvert upstream from the Greenhills Creek Sedimentation Pond was identified in 2022, and acts as a potential barrier to upstream fish movement into Upper Greenhills and Gardine creeks (i.e., for some life stages under some flow conditions). Downstream from the Stilling Basin at the Greenhills Creek Sedimentation Pond outlet, there is a culvert with a duckbill outlet that is designed to prevent upstream movement of WCT from Lower Greenhills Creek. The WCT in Lower Greenhills Creek can access the UFR and are considered part of the UFR WCT population (Appendix C).

Redds, which can have more than a single nest, were observed in Upper and Lower Greenhills and Gardine creeks in 2022. The estimated number of unique nests in Lower Greenhills Creek was eight in 2022 and 20 in 2021. There were insufficient data to estimate the number of unique nests in Upper Greenhills or Gardine creeks in 2022. Comparisons to earlier years were not possible due to differences in survey methodology. Nest counts were lower throughout the UFR in 2022 relative to 2021, which may be associated with the cold early season water temperatures (Thorley et al. 2023b).

Lineal densities (i.e., densities calculated based on units of stream length, rather than stream area) of age-1 and age-2+ WCT were higher in Lower Greenhills and Gardine creeks relative to Upper Greenhills in 2022. This same pattern was observed based on consideration of all years with available data (Appendix C). Estimated abundance, which is calculated by multiplying density by the length of habitat, was higher in the isolated Upper Greenhills and Gardine creeks population (approximately 7 kilometres [km] of habitat) compared to Lower Greenhills (approximately 0.6 km of habitat). Densities are considered more reflective of local conditions than abundance, which is strongly driven by the amount of available habitat.

A qualitative assessment of the available density data (2015 to 2022[24]) from Greenhills and Gardine creeks indicated that densities of age-1 (2020 to 2022) and age-2+ (2021 and 2022) WCT were similar. Estimated densities in Lower Greenhills Creek were highest in 2017 (age-1: 29 fish per 100 m; age-2+: 41 fish per 100 m) then declined to approximately 9 fish per 100 m by 2022 (Thorley et al. 2023a). A decline of similar magnitude over the same time period was also observed for WCT densities in Upper Greenhills and Gardine creeks (Thorley et al. 2023a). The observed temporal decreases in WCT densities coincided with a 74% decrease in the average density of juvenile fish (i.e., WCT less than 200 mm long) within the UFR in 2019 relative to 2017 (Cope 2020). Although the age-1 WCT in Lower Greenhills Creek in 2019 would have been from the first cohort exposed to antiscalant treatment, Upper and Lower Greenhills Creek have exhibited similar temporal patterns in age-1 and age-2+ WCT densities over time since 2017. Densities of age-1 and age-2+ WCT within the Greenhills Creek watershed have not returned to their pre-2019 levels (Thorley et al. 2023a).

The estimated mean length of age-0 WCT was larger in Lower Greenhills Creek relative to all other areas monitored as part of the UFR WCT Population Monitoring Program, including Upper Greenhills Creek and the UFR main stem. No age-0 WCT were captured in Upper Greenhills Creek, but the age-1 WCT were estimated to be smaller than those in Lower Greenhills Creek. These differences were attributed to higher water temperatures downstream from the Greenhills Creek Sedimentation Pond (Appendix C).

Fish from Upper and Lower Greenhills Creek and Gardine Creek were in similar condition to WCT captured from other areas of the UFR watershed in 2022 (Appendix C). Compared to Upper Greenhills and Gardine creeks (1%, compatibility interval = -2% to 6%), estimated WCT condition was lower in Lower Greenhills Creek (-1%; compatibility interval = -5% to 2%), based on a 100 mm WCT in a typical year and sub-population. However, given the difference between areas is only 2% and the level of uncertainty in the estimates, it is considered unlikely that any potential spatial differences in WCT condition within the Greenhills Creek watershed are biologically meaningful.

The assessment of the estimated changes in fish condition over time identified similar temporal patterns in Upper and Lower Greenhills Creek (Appendix C). Specifically, estimated fish condition decreased between 2017 and 2021 (i.e., from 9% to -6%) in Upper Greenhills Creek and between 2017 and 2020 (i.e., from 3% to -6%) in Lower Greenhills Creek, relative to a typical year and UFR sub-population. Fish condition in both monitoring areas improved in the years that followed.

[24] Although WCT monitoring was completed in the Greenhills Creek watershed in 2018, neither density nor abundance estimates for 2018 are available in the current UFR model because no WCT monitoring was completed in the main stem of the UFR in 2018 (Thorley et al. 2023a).

In 2022, the condition of a 100 mm fish from Upper Greenhills Creek was estimated to be 5% higher relative to a typical year and UFR sub-population. Similarly, condition of WCT from Lower Greenhills Creek in 2022 was estimated to be 1% higher relative to a typical year and sub-population (Appendix C).

No external anomalies or parasites were reported for the WCT captured from within the Greenhills Creek watershed in 2022 (*unpublished data*).

4 SUMMARY

This report summarizes the 2022 results of the GC LAEMP. Data collected to support the GC LAEMP in 2022 were compiled and summarized along with data from previous years of monitoring and other relevant studies (e.g., the Regional Calcite Monitoring Program and RAEMP) to address three key questions:

1. *What is the current status of aquatic health in Greenhills and Gardine creeks, as evidenced by physical, chemical, and biological conditions?*

2. *Have physical, chemical, and/or biological conditions indicative of aquatic health in Greenhills and Gardine creeks changed over time and are the changes unexpected based on the activities and projects occurring in the watershed?*

3. *Can observed changes be linked to: antiscalant addition in Lower Greenhills Creek; activities to support relocation of the antiscalant addition facility to Upper Greenhills Creek; or initiation of antiscalant addition on Upper Greenhills Creek starting in October[25], 2022.*

Monitoring was undertaken in 2022 to describe current conditions in Greenhills and Gardine creeks and the Greenhills Creek Sedimentation Pond (Question 1) and support comparisons to historical monitoring data (Question 2). To address Question 3, comparisons were made among the treated area on Lower Greenhills Creek versus untreated areas on Upper Greenhills Creek before and after initiation of treatment in 2017 and, where appropriate, reported results were also examined in light of relocation of the AAS to Upper Greenhills Creek in fall 2022.

Characterizing conditions within the Greenhills Creek watershed and addressing the three study questions highlighted the following key findings for Upper Greenhills and Gardine creeks:

- Aqueous concentrations of TDS, sulphate, and dissolved nickel were above screening values, updated EC, and proposed benchmarks, respectively, more frequently in Greenhills Creek relative to Gardine Creek, and Gardine Creek was a source of dilution for some constituents.

- Condition estimates for WCT from Upper Greenhills and Gardine creeks were higher in 2022 versus 2021 and were comparable to those for WCT captured elsewhere in the UFR watershed in 2022.

Aqueous concentrations of TDS, sulphate, and dissolved nickel were above screening values, updated EC, and proposed benchmarks, respectively, more frequently in Greenhills Creek relative

[25] The AAS has been operating intermittently on Upper Greenhills Creek since November 7, 2022.

to Gardine Creek, and upper Gardine Creek in particular. Of these constituents, dissolved nickel was the only one that exhibited a consistent spatial pattern within Greenhills Creek; concentrations decreased within increasing distance downstream and exhibited patterns of dilution downstream from the Gardine Creek confluence. Although there are upstream-to-downstream differences in water quality within Gardine Creek that are attributed to the seeps from the GHO Coarse Coal Rejects, Gardine Creek continues to act as an overall source of dilution for some mine-related constituents in Upper Greenhills Creek.

The WCT that can access and use habitats in Upper Greenhills and Gardine creeks and the Greenhills Creek Sedimentation Pond represent an isolated population. Total benthic invertebrate abundances on Upper Greenhills Creek were typically below the reference area normal range, potentially due to water quality and/or calcite conditions. Benthic invertebrate biomass on Upper Greenhills Creek was also lower relative to Lower Greenhills Creek. However, in 2022, fish condition estimates for WCT from Upper Greenhills and Gardine creeks were higher relative to 2021, and were comparable to those for WCT captured elsewhere in the UFR watershed in 2022.

The key findings for the Greenhills Creek Sedimentation Pond are as follows:

- Consistent with 2021, there is evidence for enhanced formation of organoselenium species resulting from processes within the pond and carry-over effects to lotic habitats downstream.
- Potential selenium-related risks to WCT feeding on benthic invertebrates originating from within the pond in 2022 were likely similar to 2018, when selenium concentrations in benthic invertebrate tissues were above EVWQP Level 1 Benchmarks and mean estimated WCT ovary selenium concentrations were above the EVWQP Level 2 Benchmark for reproductive effects.

Aqueous concentrations of mine-related constituents in the Greenhills Creek Sedimentation Pond were generally comparable to those reported upstream and downstream; however, concentrations of organoselenium species tended to be higher downstream from the pond in 2022. These results are consistent with 2021, as are the results for selenium concentrations in benthic invertebrate tissues, which tended to reflect spatial patterns in aqueous selenium speciation (i.e., tissue selenium concentrations were higher within and downstream from the pond relative to upstream).

Selenium concentrations in benthic invertebrate tissues provide insight into potential risks to WCT and how risks related to dietary selenium exposure vary among areas and/or over time within an area. Concurrent benthic invertebrate and WCT tissue chemistry sampling within the pond was last completed in 2018 and the results were indicative of potential risks to WCT reproduction. Although no WCT tissue sampling has been completed in the pond since 2018, the benthic invertebrate tissue selenium data suggest that WCT consuming invertebrates originating from within the pond were likely exposed to similar dietary selenium concentrations in 2018 and 2022.

In addressing the three study questions for 2022, the following key findings were identified for Lower Greenhills Creek:

- Concentrations of mine-related constituents (except molybdenum) in Lower Greenhills Creek have not changed significantly over time relative to upstream following antiscalant addition (October 2017 to August 2022).
- Calcite presence and concretion were lower in Lower Greenhills Creek relative to Upper Greenhills Creek in 2022 and, due to the effectiveness of antiscalant addition, C_c values in Lower Greenhills Creek have decreased relative to 2017 (i.e., relative to pre-treatment).
- Based on comparisons to pre-treatment data, %Ephemeroptera in benthic invertebrate community samples from Lower Greenhills Creek (treated) have increased relative to Upper Greenhills Creek (untreated).
- Condition estimates for WCT from Lower Greenhills Creek were higher in 2022 versus 2020 and were comparable to those for WCT captured elsewhere in the UFR watershed in 2022.
- Age-0 WCT from Lower Greenhills Creek were estimated to be longer relative to age-0 fish elsewhere in the UFR watershed, likely due to warmer water temperatures downstream from the pond.

Aqueous concentrations of mine-related constituents downstream from the AAS have not changed significantly over time relative to Upper Greenhills Creek following treatment. Molybdenum is the only exception, but molybdenum is a component of the antiscalant compound and, although concentrations were higher following treatment, they were below the BC WQG. Concentrations of mine-related constituents in Lower Greenhills Creek have not undergone unexpected changes relative to upstream following the application of antiscalant and adverse effects to aquatic biota following antiscalant addition are considered unlikely.

Calcified substrates were present throughout Greenhills Creek in 2022; however, C_p and C_c values were significantly lower downstream from the historical AAS location relative to Upper Greenhills Creek. Since 2017, C_p values within Lower Greenhills Creek have remained fairly consistent, but C_c values showed signs of improvement starting in 2019. These results indicate that antiscalant addition between October 2017 and August 2022 was successful at preventing further calcite deposition in Lower Greenhills Creek, and recent monitoring results indicate that C_c has decreased between 2021 and 2022.

The %Ephemeroptera in benthic invertebrate community samples from Lower Greenhills Creek have increased relative Upper Greenhills Creek based on comparisons to data for 2016 and 2017. The increases in %Ephemeroptera, which are less tolerant of degraded conditions, following initiation of antiscalant addition in Lower Greenhills Creek are considered indicative of improvements in calcite conditions downstream from the AAS (i.e., prevention of further calcite deposition and lower C_c scores). The higher benthic invertebrate biomass in Lower Greenhills Creek suggests that the availability of food for fish was potentially better in Lower Greenhills Creek relative to upstream in 2022.

Lower Greenhills Creek is accessible to WCT from the UFR population and is used for spawning. Additionally, the warmer water temperatures downstream from the pond appear to support age-0 WCT in achieving larger body sizes relative to age-0 WCT in other areas of the UFR watershed. By achieving larger body sizes before their first winter, age-0 fish are expected to have a better chance of overwintering survival, and may also be able to better withstand other stressors. Finally, condition estimates for WCT from Lower Greenhills Creek in 2022 were higher relative to 2020 and were comparable to those for WCT captured elsewhere in the UFR watershed. However, fish that feed within Lower Greenhills Creek may be at greater risk of selenium-associated reproductive effects, given the elevated selenium concentrations in benthic invertebrates originating from within the Greenhills Creek Sedimentation Pond and Lower Greenhills Creek.

The results of the 2022 GC LAEMP will be summarized in Teck's upcoming AMP reports, as appropriate. The results of this study also supported the evaluation of biological triggers, which are intended to identify unexpected monitoring results that may lead to responses under the AMP framework.

Biological triggers for %EPT were exceeded on Upper (RG_GHNF) and Lower (RG_GHCKD) Greenhills Creek in 2022, whereas the biological trigger for selenium concentrations in benthic invertebrate tissues was only exceeded on Lower Greenhills Creek (RG_GHCKD and RG_GHBP). Because the exact cause of the biological responses associated with the %EPT biological trigger are uncertain, monitoring of biological triggers and community endpoints will continue in 2023, along with other efforts (i.e., predictive modelling) to resolve uncertainty around effects of mine-related stressors on benthic invertebrate communities. The biological trigger exceedances for benthic tissue selenium at the monitoring areas on Lower Greenhills Creek are likely attributed to their proximity to, and being downstream from, the Greenhills Creek Sedimentation Pond discharge.

5 RECOMMENDATIONS

In completing the data collection, analysis, and interpretation steps associated with the 2022 annual report for the GC LAEMP, the study team identified needs and opportunities to adjust the 2023 study design to best capture the influences and activities within the Greenhills Creek watershed. Additionally, the 2023 study design represents an opportunity to adapt the GC LAEMP to reflect our current understanding of the watershed (i.e., what questions have been answered, with confidence, and which questions still need to be addressed?). The study design for the 2023 GC LAEMP program will be submitted to the Director and EMC prior to implementation in September 2023; however, the study team has the following recommendations, which were discussed with the EMC on May 2, 2023:

- **Sediment chemistry analyses to evaluate differences among areas and years should focus on bulk sediment samples and SEA should be discontinued at all GC LAEMP sampling areas starting in 2023.** Overall, the distribution of constituent concentrations among the sediment fractions has been comparable among years, and adding additional years of data is not expected to provide additional information. The bulk sediment chemistry data (moisture, particle sizes, TOC, metals, and PAHs) will allow for spatial and temporal contrasts (2019 to 2023) that can then be used to address the GC LAEMP study questions.

- **The focus of data analyses for the effects assessment associated with antiscalant addition should shift to Upper Greenhills Creek, where the AAS is currently operating.** The BACI analyses (e.g., for water chemistry) and other comparisons should be adjusted so that monthly water quality monitoring stations and biological monitoring areas downstream from the current AAS location (e.g., RG_GHDT and RG_GHFF) are included in the “treated” rather than “untreated” data set.

- **The biological triggers analysis for Upper Greenhills Creek should be updated to better reflect the availability of water quality projections and biological data.** In the May 2, 2023 EMC meeting, the study team proposed pairing biological data for RG_GHNF and RG_GHDT with water quality projections for GH_CTF and GH_HWGH_BRB, respectively. However, the study team has since confirmed that there is no water quality modelling node at GH_CTF and GH_HWGH_BRB is the most appropriate pairing for both RG_GHNF and RG_GHDT. The approach to evaluating biological triggers for Lower Greenhills Creek in 2023 will remain unchanged relative to 2022.

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APPENDIX A
DETAILED METHODS

APPENDIX A DETAILED METHODS

A1 WATER QUALITY

A1.1 Overview

Permit 107517 requires that Teck Coal Limited (Teck) prepare annual reports that summarize water quality monitoring data collected during the preceding calendar year at all sampling locations specified in the permit and as part of Local Aquatic Effects Monitoring Programs (LAEMPs). Within the Greenhills Creek Aquatic Effects Assessment and Monitoring Program (GC LAEMP) and each of the other LAEMPs identified in Permit 107517, water chemistry and aqueous selenium speciation samples are collected at biological monitoring areas, concurrent with benthic invertebrate community and/or tissue chemistry sampling. Methods employed as part of the GC LAEMP in 2022 are described in the following sub-sections, along with key methodological details for monitoring completed by Teck (e.g., monthly water quality sampling) or as part of other programs (e.g., the Selenium Speciation Monitoring Program).

A1.2 Field Sampling

A1.2.1 Creeks

Water samples and associated *in situ* measurements are collected monthly at each of Teck's routine monitoring stations (and weekly for certain constituents at GH_GH1 on Lower Greenhills Creek from March 15 to July 31) (see Section A.1.3). *In situ* water quality measurements include temperature, dissolved oxygen (DO), pH, specific conductance, and turbidity.

Water chemistry and aqueous selenium speciation samples were collected at each targeted biological monitoring area in February and September 2022 to support GC LAEMP. Sample collection procedures were consistent with those outlined in the British Columbia Field Sampling Manual (Province of British Columbia 2013). *In situ* water quality measurements including temperature, DO, pH, and specific conductance were taken concurrent with all water chemistry and selenium speciation samples. A calibrated YSI ProDSS (handheld multi-parameter meter equipped with four Digital Sampling System sensors; YSI Inc., Yellow Springs, Ohio) was used to collect *in situ* water quality data.

Water samples were collected by wading into a mid-channel area, moving from downstream to upstream, so as not to collect water downstream of disturbed substrates. Samples were collected from mid-depth by inverting sample bottles below the surface of the water. Samples were taken to shore prior to field filtering or addition of any applicable preservatives. Water samples for analysis of dissolved constituents were filtered in the field using a clean syringe affixed with a 0.45 micrometre (µm) filter membrane and then preserved immediately in the manner specified by the analytical laboratory. Information pertaining to the station location (i.e., Global Positioning System [GPS] coordinates) and the sample date, time, and identifier were recorded on field sheets. Samples were kept cold until analysis. Samples were shipped to the analytical laboratory daily or every other day to achieve compliance with recommended analytical hold times.

A1.2.2 Greenhills Creek Sedimentation Pond

The approach for collecting water chemistry and selenium speciation samples from RG_GHP, which represents deeper, depositional locations within Greenhills Creek Sedimentation Pond, was dependent on conditions encountered in the pond at the time of sampling. First, a calibrated YSI ProDSS was used to take a water quality profile at the deepest part of the pond to determine if stratification was present. Profile measurements (temperature, DO, pH, and specific conductance) were taken at 1 metre (m) intervals. Because no stratification was observed in 2022, a single grab sample was collected from just below the water surface.[1] Subsequent steps related to field notetaking and sample filtration, preservation, labelling, storage, and shipping were consistent with those described above for creek samples (Section A1.2.1).

A1.3 Laboratory Analysis

Water chemistry samples were shipped to ALS Environmental (ALS) in Calgary, Alberta (AB), which is a third-party analytical laboratory accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA). The requested analyses were completed in accordance with procedures described in the most recent edition of the "British Columbia Laboratory Methods Manual" (Austin 2020) per Permit 107517 requirements (see also Table A.1). Laboratory quality assurance/quality control (QA/QC) included an assessment of the laboratory sensitivity (e.g., an evaluation of laboratory reporting limits [LRLs] and blank samples), accuracy (e.g., matrix spikes and laboratory control samples), and precision (e.g., laboratory duplicates).

Selenium speciation samples collected as part of the GC LAEMP in February and September 2022 were analyzed by Brooks Applied Labs, which is located in Seattle, Washington and is accredited by the National Environmental

[1] If distinct "layers" of water with differing temperature (e.g., an upper, warmer layer over a deeper, colder layer), DO concentration, pH, or specific conductance were evident from the profile measurements, then the water in Greenhills Creek Sedimentation Pond would have been considered "stratified". In this case, two separate water samples would have been collected: one from just below the surface and another just off the bottom of the pond.

Table A.1: Analytical Methods for Water Samples

Constituent	Units	Method	Reference
pH	pH units	pH electrode	APHA 4500 H-electrode
Turbidity	NTU	Nephelometric	APHA 2130 B
Hardness (as $CaCO_3$)	mg/L	Calculation	APHA 2340B
Total Suspended Solids	mg/L	Gravimetric	APHA 2540 D
Total Dissolved Solids	mg/L	Gravimetric	APHA 2540 C
Alkalinity	mg/L	Potentiometric Titration	APHA 2320 B
Ammonia (as N)	mg/L	Fluorescence	Fialab 100, 2018
Bromide (Br)	mg/L	Ion Chromatography	EPA 300.1
Chloride (Cl)	mg/L	Ion Chromatography	EPA 300.1
Fluoride (F)	mg/L	Ion Chromatography	EPA 300.1
Total Kjeldahl Nitrogen	mg/L	Fluorescence	FIAlab 100 (FIAlab 2018)
Nitrate (as N)	mg/L	Ion Chromatography	EPA 300.1
Nitrite (as N)	mg/L	Ion Chromatography	EPA 300.1
Phosphorus (P)-Total	mg/L	Colourimetrically	APHA 4500-P E
Orthophosphate	mg/L	Colourimetrically	APHA 4500-P F (filtered through a 0.45 µm filter)
Sulphate (SO_4)	mg/L	Ion Chromatography	EPA 300.1
Dissolved Organic Carbon	mg/L	Combustion	APHA 5310 B TOC (filtered through a 0.45 µm filter)
Total Organic Carbon	mg/L	Combustion	APHA 5310 B TOC
Total and Dissolved Metals	mg/L	CRC-ICPMS	APHA 3030 B/EPA 6020B, EPA 200.2/6020B (dissolved metals filtered through a 0.45 µm filter)
Total and Dissolved Mercury	mg/L	CVAAS, CVAFS	APHA 3030B/EPA 1631E, EPA 1631E (dissolved mercury filtered through a 0.45 µm filter)

Notes: APHA = American Public Health Association; NTU = nephelometric turbidity units; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; EPA = United States Environmental Protection Agency; µm = micrometres; TOC = total organic carbon; CRC-ICPMS = collision reaction cell inductively coupled plasma-mass spectrophotometry; CVAAS = cold vapour atomic absorption spectroscopy; CVAFS = cold vapour atomic fluorescence spectroscopy.

Laboratory Accreditation Program (NELAP). Concentrations of selenium species (dimethylselenoxide, methylseleninic acid, methaneselenonic acid, selenate, selenite, selenocyanate, selenomethionine, selenosulphate, and unknown selenium species) were quantified using ion chromatography inductively coupled plasma collision reaction cell mass spectrometry (IC-ICP-CRC-MS). This approach results in greater retention of methylseleninic acid and selenomethionine and subsequently improved quantitation of these selenium species. Laboratory QA/QC included an assessment of laboratory sensitivity (e.g., an evaluation of LRLs and blank samples), accuracy (e.g., matrix spikes and blank spikes) and precision (e.g., laboratory duplicates and matrix spike duplicates).

Laboratory QA/QC procedures associated with routine water sampling are described by Teck in annual water quality reports submitted under Permit 107517 and 6248. Laboratory QA/QC results for samples collected specifically to support the February and September 2022 GC LAEMP programs are evaluated in Appendix B of the main 2022 GC LAEMP report.

A1.4 Data Analysis

Preparation of the Elk Valley Water Quality Plan (EVWQP) required derivation of science-based benchmarks for nitrate, sulphate, cadmium, and selenium (Teck 2014). Risks associated with these constituents depend on their concentrations, concentrations of other water chemistry parameters known as exposure and toxicity modifying factors (ETMFs), and the sensitivity of aquatic receptors that could be exposed. The EVWQP benchmarks were derived, using a large body of published and site-specific information available at that time, to represent scientific best estimates of concentrations associated with no effects and defined levels of potential effect on chronic, sublethal endpoints for sensitive aquatic species. Margins of safety were incorporated in benchmark derivation to account for uncertainty and Teck committed to undertaking further studies and periodic updates to progressively reduce that uncertainty and improve confidence in the benchmarks.

Studies conducted to progressively reduce uncertainty in benchmarks have included additional chronic toxicity studies of nitrate, sulphate, cadmium, and selenium individually and in mixtures; annual evaluation of water quality under the regional chronic toxicity monitoring program; updates to selenium bioaccumulation models in 2017 and 2022; development of new tools to predict bioaccumulation in relation to selenium speciation; and, most recently, an extensive program of validation and updates to the science-based benchmarks under Teck's Adaptive Management Plan (AMP). This program was undertaken to answer Management Question (MQ) two under the AMP: "*Will the aquatic ecosystem be protected by meeting the long-term site performance objectives?*" and associated Key Uncertainty (KU) 2.1: "*How will the science-based benchmarks be validated* *and updated?"*. The MQ2 program was developed with input from the Elk Valley Environmental Monitoring Committee (EMC) and results have been shared with the EMC on an ongoing basis since the program began.

A key outcome of the MQ2 program was the development of an updated compilation of chronic toxicity information for nitrate, sulphate, and selenium, including information available at the time of EVWQP development and studies conducted after the EVWQP was finalized in 2014. For nitrate and sulphate, the updated compilation represented a substantial increase in available toxicity information for key test species. This updated compilation was used to validate the EVWQP benchmarks and, where warranted, to derive updated Effect Concentrations (EC) that incorporate this new information (Golder 2022a). As in the EVWQP, the objective was to derive scientific best estimates of concentrations associated with no effects or defined levels of potential chronic, sublethal effect to sensitive species and life stages relevant to the Elk Valley. The analysis concluded that the updated EC for nitrate and sulphate are supported by a larger data set covering a wider range of conditions than was available at the time of the EVWQP, and thereby provide an improved basis for evaluating potential effects of these constituents (Golder 2022a). Data set comparisons for the EVWQP and updated EC for nitrate and sulphate are summarized in Table A.2.

Another key outcome of the MQ2 program was the implementation of updated selenium bioaccumulation models to translate between tissue-based effects benchmarks and associated aqueous selenium concentrations. Golder (2022a) concluded that tissue-based benchmarks derived for the EVWQP remain supported as a reliable basis for evaluating potential effects of bioaccumulated selenium. However, studies conducted since the EVWQP have provided an improved understanding of bioaccumulation, warranting a re-evaluation of aqueous selenium benchmarks. The bioaccumulation model developed for the EVWQP incorporated site-specific data from dozens of locations and decades of study and provided an accurate characterization of regional patterns of bioaccumulation in terms of mean selenium concentrations in biota and the observed variability around that mean. More recent study has provided an understanding of the factors driving variability around the modelled mean, which allows substantially more accurate predictions of bioaccumulation for any given location. In particular, it is now apparent that aqueous selenium speciation dominates patterns of bioaccumulation. Modelling approaches that account for speciation now represent the best available science and should be used to relate tissue and aqueous concentrations whenever possible.

Studies were not undertaken under the MQ2 program to update benchmarks for cadmium because work had already been conducted by the British Columbia Ministry of Environment

Table A.2: Approach for Updating Nitrate and Sulphate Effect Concentrations [a]

Test Species [b]	EVWQP Data Set and Approach	Updated Data Set and Approach
Nitrate		
Ceriodaphnia dubia	Geometric mean of two (Elk River) or three (Fording River) tests; hardness slope from literature	Pooled analysis of 11 test and 11 hardness values; hardness-response model
Rainbow trout	One test in Fording River water; hardness slope from literature	Pooled analysis of four tests at four hardness values; hardness-response model (Golder 2022a) [c]
Amphibians	Literature data for two species	Northern leopard frog testing in simulated Fording River water; hardness-adjusted using pooled slope from EVWQP (1.0003)
Sulphate		
Ceriodaphnia dubia	Geometric mean of lowest unbounded values from two rounds of site testing	Concentration-response analysis of pooled data from eight site water tests
Neocloeon triangulifer [d]	Concentration-response analysis of pooled data from one site-specific water test	Concentration-response analysis of pooled data from one site-specific site water test and site-relevant test from the literature
Rainbow trout	Geometric mean of literature and site-specific data	Concentration-response analysis of pooled data from four site water tests (Golder 2022a) [c]
Amphibians	Literature data for Pacific tree frog	Northern leopard frog testing in simulated Fording River water

Notes: EVWQP = Elk Valley Water Quality Plan; EC = Effect Concentration; EMC = Environmental Monitoring Committee.

[a] Modified from Golder (2022).

[b] Updated EC were not calculated for *Hyalella azteca* (nitrate) because no new site-specific testing for this species was conducted subsequent to the EVWQP benchmark derivation (Teck 2014).

[c] Per discussions with the EMC on June 23, 2021 and analyses presented in Golder (2022a), replicates with microbial observations were excluded from the models used to derive updated EC. A fifth nitrate test was conducted (GH_FR1-HH), but was excluded because of reduced survival in all treatments, including the unamended water (Golder 2022a).

[d] Inclusion of updated EC for *Neocloeon triangulifer* exposed to sulphate was not discussed at the June 2019 EMC meeting but was incorporated after identifying a site-relevant literature study.

and Climate Change Strategy (ENV/BCMOECCS) that supported the protectiveness of cadmium benchmarks and site performance objectives (SPOs). The British Columbia Water Quality Guideline (BC WQG) for cadmium, which was developed after the EVWQP, adopted a slightly higher concentration as protective of all species and stages of aquatic life across the province. Furthermore, Teck's water quality monitoring data have indicated that cadmium concentrations are consistently below both guidelines and SPOs, and cadmium has not been implicated in aquatic effects through chronic toxicity or biological monitoring programs in the Elk Valley.

In addition to the EVWQP and MQ2 programs, Teck has continued to develop tools to support the assessment and management of key water quality parameters. Most notably, Teck has undertaken a multi-year program to develop benchmarks for nickel. This work was prompted by unexpected and unexplained responses in invertebrate toxicity monitoring combined with observed changes in benthic invertebrate community structure immediately downstream of the Coal Mountain Mine. Initial investigations identified nickel as the most likely cause. A program was undertaken that combined published and site-specific toxicity testing with biological monitoring data from across the Elk Valley to derive benchmarks that would support an interpretation for nickel similar to the EVWQP benchmarks and updated EC discussed above. Studies were developed with input from the EMC and results were shared with the EMC throughout the program. Proposed nickel benchmarks were reported in 2022 (Golder 2022b) and submitted to the EMC and ENV/BCMOECCS per permit 107517 requirements.

To support the GC LAEMP in 2022, water quality data from Teck's monthly (routine) monitoring stations were compared to the EVWQP benchmark for dissolved cadmium, screening values for total dissolved solids (TDS), updated EC[2], the proposed benchmark for nickel, BC WQG for the protection of freshwater aquatic life, and the Canadian Council of Ministers of the Environment (CCME) guideline for total mercury[3] (BCMOECCS 2021a,b; BCMWLRS 2023; CCME 2003; Golder 2022a,b; Teck 2014), as appropriate. Water chemistry and selenium speciation data collected from biological monitoring areas in 2022 were also compared to applicable benchmarks, updated EC, BC WQG, and the CCME guideline for total mercury but were not subjected to statistical analyses due to limited sample sizes.

[2] There are BC WQG and updated EC for nitrate and sulphate; however, comparisons were made to the updated EC because these are considered more relevant and site-specific than the BC WQG.

[3] The CCME guidelines for mercury were used in lieu of the BC WQG because mercury inputs (total and methyl) in the Elk River watershed are not related to mine activities (Azimuth 2019) and Teck received approval to use the CCME guideline from ENV/BCMOECCS on January 17, 2022.

Selenium speciation data collected as part of the Selenium Speciation Monitoring Program were used, as appropriate, to support data interpretation (ADEPT et al. 2023).

Water chemistry data were compared among Teck's routine monitoring stations on Greenhills and Gardine creeks to evaluate potential mine-related influences on water quality. The analyses focused on constituents with Early Warning Triggers (EWTs; Azimuth 2018; Teck 2018, 2021) (i.e., TDS, nitrate, nitrite, sulphate, total antimony, total barium, total boron, total lithium, total manganese, total molybdenum, total nickel, total selenium, total uranium, total zinc, dissolved cadmium, and dissolved cobalt). Concentrations of these constituents were plotted with applicable benchmarks, updated EC, and guidelines to allow for qualitative comparisons among stations. Statistical comparisons were based on monthly mean concentrations and were completed using a censored regression Analysis of Variance (ANOVA) fit using Maximum Likelihood Estimation with an assumed log-normal distribution. When the overall p-value from the ANOVA was significant, the *post hoc* Tukey's Honestly Significant Difference (HSD) Test was used to compare among individual stations.

Concentrations of mine-related water quality constituents with EWTs were compared among years for each one of Teck's routine monitoring stations. Data collected from 2016 to 2022 were used; however, the analysis was restricted to years with at least six months of data and stations with at least two years of data. Differences in monthly mean concentrations over the years for each station were tested using a censored regression ANOVA with factors *Year* and *Month*, assuming a log-normal distribution. Monthly mean concentrations were estimated using the Kaplan-Meier (K-M) method. The method involves transforming the left censored (i.e., less than [<] value) data set to a right censored (i.e., greater than [>] value) data set, and then using the K-M estimator (used to estimate the mean survival time in survival analysis) to estimate the mean. The calculations were completed using the survfit() function in the survival package (Therneau 2017) in R (R Core Team 2022) and involved calculating the area under the K-M survival curve. The K-M method is non-parametric and can accommodate multiple LRLs. This method of estimating the mean is equivalent to using the distribution of detectable values below the LRL to represent values that are <LRL. If there is only one LRL and no detected values below the LRL, then the K-M estimate of the mean is equivalent to replacing the value below the LRL with the LRL (i.e., the best estimate for the values <LRL is the LRL).

For each year, a percent magnitude of difference (MOD) relative to the base year (i.e., first year with at least six months of data) was calculated as:

$$\frac{Year_i - Base\ Year}{Base\ Year} \times 100\ \%$$

with the annual concentrations represented by the estimated marginal means from the ANOVA model. Significant differences between the study year of interest (*Year$_i$*) and all other years were assessed.

Potential effects to water quality from antiscalant addition on Lower Greenhills Creek were evaluated by comparing May to September means for water quality constituents measured in samples collected from 2017 to 2022 (Minnow 2022a,b).[4] Differences in aqueous concentrations of mine-related constituents observed downstream from the antiscalant addition system (AAS) on Lower Greenhills Creek relative to upstream both before and after the introduction of antiscalant treatment were compared using a Before-After-Control-Impact [BACI] design. A two-way ANOVA with factors *Area* and *Year* were used to evaluate the difference between monthly mean values at GH_GH2 and GH_GH1, which are downstream and upstream from the AAS on Lower Greenhills Creek, respectively. Water chemistry data collected prior to initiation of calcite management on October 23, 2017, were used to represent the "before" period and data collected thereafter were used to represent the "after" period. Because sampling at GH_GH2 started in May 2017, an evaluation of seasonal differences between GH_GH1 and GH_GH2 in the absence of calcite management could not be completed for this study. Hence, the analyses completed to date for Lower Greenhills Creek have focused on May to September data.

When the overall p-value from the ANOVA was significant, the *post hoc* Tukey's HSD Test was used to compare among years. For significant comparisons, a MOD was calculated as the relative difference between observed and predicted post-treatment concentrations at GH_GH2:

$$MOD = \frac{GH\_GH2_{observed\ post-treatment} - GH\_GH2_{predicted\ post-treatment}}{GH\_GH2_{predicted\ post-treatment}} \times 100\%$$

where $GH\_GH2_{observed\ post-treatment}$ is the geometric mean for monthly mean constituent concentrations calculated for GH_GH2 post-treatment, and $GH\_GH2_{predicted\ post-treatment}$ is the predicted mean concentration for GH_GH2. The predictions assume that the ratio of concentration of GH_GH1 to GH_GH2 is the same as pre-treatment:

[4] The AAS was not operating in May 2018, September 2019, or May 2020; consequently, data for these months were excluded from the "after" data set, consistent with previous years (Minnow 2020, 2021, 2022b). Additionally, since the AAS ceased to operate on Lower Greenhills Creek in August 2022, the September 2022 data were excluded from the "after" data set.

$$GH\_GH2_{predicted\ post-treament} = 10\verb|^|[log_{10}(GH\_GH2_{post-treatment}) + log_{10}(GH\_GH2_{pre-treatment}) - \ log_{10}(GH\_GH1_{pre-treatment})]$$

Potential differences between 2017 and each of the post-treatment years (i.e., 2018 to 2022) were assessed.

All data analyses were completed using R statistical software (R Core Team 2022).

A2 SUBSTRATE QUALITY

A2.1 Overview

Aquatic habitats of the Elk River watershed are predominantly lotic with coarse bottom substrates (e.g., cobbles and gravels). Calcite (calcium carbonate precipitate) has been observed in several creeks within the Elk River watershed downstream from Teck's mines and, to a lesser extent, in reference creeks unaffected by mining. In parts of some creeks, including Greenhills Creek, calcite precipitation completely covers portions of the creek bed, making the substrate largely immovable. Permit 107517 requires that Teck monitor and report on calcite conditions within mine-exposed creeks in the Elk River watershed, and this reporting is completed annually as part of the Regional Calcite Monitoring Program and LAEMPs.[5]

The main mine-related constituents (e.g., nitrate, selenium, sulphate) are highly soluble, chemically stable in water, and do not tend to adsorb to particles, so potential effects to aquatic organisms from these substances are expected to occur predominantly via water rather than sediment exposure pathways (and predominantly from dietary exposure for selenium). Additionally, off-channel areas such as oxbows, wetlands, ponds, and small lakes, where fine sediments can accumulate over time, are sparsely distributed, and represent a relatively small proportion of the aquatic habitat within the watershed (IRCL 2008). However, in the sparsely distributed lentic areas with elevated oxygen demand and longer residence time (relative to lotic areas) aqueous selenate near the sediment-water interface may be microbially reduced to insoluble forms (e.g., selenides). As a result, sediments in these lentic environments can act as a sink for selenium (Martin et al. 2011).

A2.2 Calcite

A2.2.1 Field Sampling

Calcite in Greenhills and Gardine creeks was monitored at the following locations in 2022 as part of the Regional Calcite Monitoring Program for Teck:

- GREE3-25, GREE3-50, GREE3-75, GREE4-25, GREE4-50, and GREE4-75 on Upper Greenhills Creek;

[5] Data are also collected annually as part of Teck's Regional Aquatic Effects Monitoring Program (RAEMP); however, RAEMP data are reported on a three-year, rather than annual, cycle.

- GREE1-25, GREE1-50, and GREE1-75 on Lower Greenhills Creek; and
- GARD1-25, GARD1-50, and GARD1-75 on Gardine Creek.

Calcite monitoring methods employed for the Regional Calcite Monitoring Program in 2022 were consistent with those described previously by Lotic Environmental Ltd. (Lotic) (Smit and Robinson 2023; Zathey et al. 2021). From 2015 to 2020, data collected from Reach 1 of Gardine Creek as part of the Regional Calcite Monitoring Program were reported as an average of three stations. However, data for 2021 and 2022 were reported separately for each of the three stations (i.e., GARD1-25, GARD1-50, and GARD1-75) on Gardine Creek (Robinson et al. 2022; Smit and Robinson 2023).

As part of the September 2022 GC LAEMP sampling, field staff from Minnow Environmental Inc. (Minnow) collected calcite data from the immediate vicinity of each area-based benthic invertebrate creek sampling station (i.e., RG_GHUT, RG_GHNF, RG_GHDT, RG_GHFF, RG_GHBP, RG_GAUT, and RG_GANF [six stations per biological monitoring area]). The goal was to support direct comparisons of benthic invertebrate community endpoints with calcite index (CI) and calcite index prime (CI') values. Calcite measurements were made on 50 randomly selected pebbles, rather than 100[6], at each benthic invertebrate community sampling station (i.e., for a total of 300 pebbles per biological monitoring area, which is consistent with the resolution applied for LAEMP and Regional Aquatic Effects Monitoring [RAEMP] areas).

Calcite index measurements were made using methods that were described in detail by Zathey et al. (2021) and summarized in Lotic (2021). Briefly, the presence (C_p; score = 1) or absence (score = 0) of calcite was recorded to estimate CI, consistent with previous years (Minnow 2020a, 2021, 2022b). The proportional presence score (i.e., calcite presence prime [C_p']) was also recorded; C_p' represents the proportion of a given particle's surface area that is covered in calcite (e.g., C_p' = 0.2 for a particle with 20 percent [%] calcite coverage). If calcite is absent, C_p' = 0 and for full coverage, C_p' = 1 (Zathey et al. 2021). Next, the degree of concretion (C_c) was recorded based on the particle being removed with negligible resistance (not concreted; score = 0), removed with noticeable resistance but removable (partially concreted; score = 1), or immovable (fully concreted; score = 2). If distinct particles were not visible due to heavy calcification, values of 1 (for presence) and 2 (for concretion) were recorded. If a thick (i.e., >1 centimetre [cm]) layer of fines was present and calcite presence could not be visually confirmed, then the fines were pinched between the thumb and

[6] For the other LAEMPs and the RAEMP, 100 pebbles are counted at each of three stations per biological monitoring area, for a total of 300 pebbles per biological monitoring area, consistent with the GC LAEMP.

fingers and evaluated for calcite presence (i.e., rubbed to detect the presence of brittle, calcite conglomerates). If the fines consisted of calcified conglomerates in loose sediment, then values of 0 (for concretion) and 1 (for presence) were recorded (Lotic 2021). If conglomerates were not observed, then concretion and presence values were recorded as 0. If moss was present on a particle, the moss was removed to determine if calcite was present. If calcite was present, values of 1 (for presence) and 0 (for concretion, when moss was easily removed) were recorded. If the moss could not be removed, but there was calcite-induced resistance, a value of 1 (for concretion) was recorded. If the moss was fully encrusted and immovable, values of 2 (for concretion) and 1 (for presence) were recorded (Lotic 2021). If a rock was visible under fines, the rock was selected for calcite index measurements.

A2.2.2 Data Analysis

Two different methods were used to calculate calcite indices for the biological monitoring areas sampled as part of the GC LAEMP in 2022. The first method relied on the binary (0 [absent] or 1 [present]) C_p scores used historically and in 2021 (e.g., Minnow 2020a, 2021, 2022b; see also Teck 2016). The second method, which was first implemented as part of the GC LAEMP in 2021 (Minnow 2022b), was based on the updated methods described by Zathey et al. (2021) (see also Lotic 2021). The updated methods required the use of C_p' (proportional score) in place of C_p (binary score), to quantify calcite presence.

Using the methods from Teck (2016), the CI were calculated as:

$CI = C_p + C_c$

where:

$$CI = Calcite\ Index$$

$$C_p \ = \ Calcite\ Presence\ Score = \frac{Number\ of\ particles\ with\ calcite}{Number\ of\ particles\ counted}$$

$$C_c = Calcite\ Concretion\ Score = \frac{Sum\ of\ particle\ concretion\ scores}{Number\ of\ particles\ counted}$$

Using the updated methods described by Zathey et al. (2021), CI' was calculated as:

$$CI' = C_p' + C_c$$

where:

$$CI' = Calcite\ Index\ Prime$$

$$C_p{}' = Calcite\ Presence\ Score\ Prime = \frac{Sum\ of\ proportional\ presence\ scores}{Number\ of\ particles\ counted}$$

$$C_c = Calcite\ Concretion\ Score = \frac{Sum\ of\ particle\ concretion\ scores}{Number\ of\ particles\ counted}$$

Differences in calcite presence and concretion scores among areas and years were compared using a Generalized Linear Mixed Model (GLMM) with factors *Area* and *Year* and *Area x Year*. A negative binomial distribution was assumed and a random effects term (replicate nested in area) was used to account for replicated counts within an area. *Post hoc* contrasts were conducted when the main effects or interaction terms were significant ($\alpha = 0.05$). For significant *post hoc* comparisons among years, the MOD was calculated as:

$$\frac{Score_{year} - Score_{2017}}{Score_{2017}} \times 100\ \%$$

where $Score_{year}$ is the estimated calcite presence or concretion score in a given year and $Score_{2017}$ is the presence or concretion score in the baseline (i.e., pre-treatment) year (i.e., 2017). Similarly, the MODs between areas with significant *post hoc* contrasts were calculated as:

$$\frac{Score_{untreated} - Score_{RG\_GHBP}}{Score_{RG\_GHBP}} \times 100\ \%$$

where $Score_{untreated}$ represents the estimated calcite presence or concretion score for an area other than RG_GHBP (i.e., any area that is on Upper Greenhills Creek and was therefore not yet subject to antiscalant addition) and $Score_{RG\_GHBP}$ is the presence or concretion score for RG_GHBP (the area on Lower Greenhills Creek that was receiving antiscalant treatment).

Statistical analyses were completed in R (R Core Team 2022). Calcite presence (C_p and C_p') and concretion scores were also plotted by area to support visual (i.e., qualitative) comparisons among areas and over time within areas. Additionally, CI and CI' were used to support interpretation of benthic invertebrate community data (i.e., by correlation analysis of benthic invertebrate community endpoints and calcite scores). Lastly, results from the 2022 Regional Calcite Monitoring Program were integrated into the interpretation of calcite data for the GC LAEMP, as appropriate.

A2.3 Sediment

A2.3.1 Field Sampling

A2.3.1.1 Creeks

Sediment chemistry samples (five replicates per area) were collected from Lower Greenhills Creek (RG_GHBP) and Gardine Creek (RG_GAUT and RG_GANF) in September 2022. Sampling was completed by individuals on foot and sampling locations were approached in such a way as to avoid disturbance of sediments before sampling. To the extent possible, the same locations sampled for sediment in previous years (i.e., 2017 to 2021) were sampled again in 2022. A handheld GPS was used to mark the Universal Transverse Mercator (UTM) coordinates of each sediment sampling location. A stainless-steel spoon was used to sample the top 1 to 2 cm of fine sediment deposits.[7] Sediment was collected until sufficient volume was obtained for the required analyses. The sediment collected from a given sampling location was deposited into a clean plastic tub, homogenized, photographed, and divided between a 250 millilitre (mL) glass jar and a large, labelled plastic bag provided by the analytical laboratory (i.e., ALS). Samples were placed in a cooler with ice following collection and transferred to a refrigerator until shipment to the analytical laboratory. Details pertaining to the samples (e.g., depth, substrate characteristics, colour, texture, and presence of aquatic vegetation) and observations of calcite presence (e.g., based on sample texture and colour) were recorded on field sheets. Field QA/QC measures included the collection of field duplicates at a minimum frequency of 10% of total samples collected during the sampling program.

A2.3.1.2 Greenhills Creek Sedimentation Pond

Sediment samples were collected from Greenhills Creek Sedimentation Pond, which represents the main deposition area for fine sediments originating from Upper Greenhills Creek, by deploying a stainless-steel Petite Ponar grab sampler from a boat. A single sample, consisting of a composite of the top 2 cm of five to 10 grabs was collected at each of six sediment sampling stations (i.e., RG_GHP-1, RG_GHP-2, RG_GHP-3, RG_GHP-4, RG_GHP-5 and RG_GHP-6) in 2022. Care was taken so that each grab captured the surface material and was full to each edge. Incomplete grabs were discarded. Grabs deemed to be of sufficient fullness and quality were deposited into a clean plastic tub, homogenized, photographed, and split between a 250 mL glass jar and a large, labelled plastic

[7] On one occasion at RG_GHBP, sediment had to be collected by brushing sediment off rocks.

bag provided by the analytical laboratory (i.e., ALS). Sample storage, field data recording, and QA/QC procedures were consistent with those described above in Section A2.3.1.1.

A2.3.2 Laboratory Analysis

Sediment chemistry samples were sent to ALS, a CALA-certified laboratory, in Calgary, AB for analysis. The laboratory was instructed to thoroughly homogenize each sediment sample, as per standard laboratory protocols, so that sub-samples were representative and comparable. Separate sub-samples were taken from samples submitted in plastic bags for analysis of moisture content, particle size, total organic carbon (TOC), and bulk metals. Additional sub-samples were also taken from the plastic bags and subjected to sequential extraction analysis (SEA) for metals (see below). Sediment sample fractions submitted in glass jars were used for analysis of polycyclic aromatic hydrocarbons (PAHs).

Bulk sediment chemistry samples were analyzed using the following methods:

- Metals by Collision Reaction Cell Inductively Coupled Plasma-Mass Spectrometry (CRC-ICPMS; United States Environmental Protection Agency [EPA] 6020B mod);
- Mercury by Cold Vapour Atomic Absorption Spectroscopy (CVAAS; EPA 200.2/1631 Appendix mod);
- TOC calculated from total and inorganic carbon (Canadian Society of Soil Science [CSSS] [2008] 21.2)[8];
- Inorganic Carbon as a calcium carbonate ($CaCO_3$) equivalent calculation;
- PAHs by tumbler extraction using hexane/acetone (EPA 8270E (mod)) followed by capillary column gas chromatography with mass spectrometric detection (GC/MS);
- Particle size distribution by dry sieving (coarse particles), wet sieving (sand), and the pipette sedimentation method (fine particles);
- pH by 1:2 soil:water extraction (Austin 2020); and
- Moisture content by gravimetry (i.e., weighing the sample before and after drying at 105 degrees Celsius [°C]).

The SEA were performed in accordance with Tessier et al. (1979). The method involves five sequential extraction steps; each extraction step represents a different fraction of

[8] Total carbon and inorganic carbon content are determined by combustion methods (CSSS [2008] 21.2 (mod)) and reaction with acetic acid (CSSS [2008] 20.2), respectively.

sediment-associated metals that could potentially be released under specific conditions. These include:

1. Fraction 1 (exchangeable and adsorbed metals fraction) – potentially released due to changes in ionic strength;
2. Fraction 2 (carbonate fraction) – potentially released due to changes in pH;
3. Fraction 3 (easily reducible metals and metals bound to iron and manganese oxides) – potentially released under reducing conditions;
4. Fraction 4 (metals bound to organic matter) – potentially released under oxidizing conditions; and
5. Fraction 5 (residual metals) – metals resistant to the first four digestion steps (Tessier et al. 1979).

Extraction of the residual metals fraction (fraction 5) involves digestion with a strong acid (an equal (1:1) mix of 1:1 nitric and 1:1 hydrochloric acids) to mobilize metals resistant to the first four digestion steps, and is the same digest used to extract total metals in the conventional chemical characterization of "total" or bulk metals in sediments.

Laboratory QA/QC included an assessment of sensitivity (e.g., evaluations of LRLs and blank samples), accuracy (laboratory control samples and internal reference materials), and precision (e.g., laboratory duplicates) (see Appendix B of the main report).

A2.3.3 Data Analysis

Metal and PAH concentrations in sediment samples were tabulated and plotted to support comparisons to applicable BC Working Sediment Quality Guidelines[9] (BC WSQG; BCMOECCS 2021b). Concentrations in bulk sediment and the sums of concentrations in sediment fractions 1 to 4 were included in the comparisons.[10] The upper and lower BC WSQG were included in the evaluation, recognizing that the BC WSQG are based on co-occurrence analysis, rather than on cause-effect studies, (BCMOECCS 2021b). The lower BC WSQG represent concentrations below which adverse biological effects would not be expected to occur under most circumstances and are considered comparable to or are set equal to the CCME Threshold Effects Levels or Interim Sediment Quality Guidelines

[9] Including the alert concentration for selenium (see BCMOE 2014 and BCMOECCS 2021a).

[10] Comparison of the sum of sediment fractions 1 to 4 to the BC WSQG is considered to be a conservative screening of the potentially mobile, and therefore potentially bioavailable, sediment constituents. It would take highly unusual/aggressive reducing and oxidizing conditions, respectively, to mobilize fractions 3 and 4 and these conditions are not likely to occur in the Greenhills Creek watershed.

(ISQG; BCMOECCS 2021b). In contrast, the upper BC WSQG are considered equivalent to or are set equal to the CCME's Probable Effects Level (CCME 2001), which represent a concentration above which effects to aquatic biota may be more frequently observed (BCMOECCS 2021b).

Regional reference area normal ranges, which represent the 2.5th and 97.5th percentiles of the reference area data for a particular constituent, were included in the plots of metal and PAH concentrations in sediments (Minnow 2020b,c). For lotic areas, regional reference area normal ranges calculated based on sediment chemistry data collected from creek habitats as part of the RAEMP (Minnow 2020b) were used.[11] Reference area normal ranges derived as part of the Lentic Area Supporting Study (Minnow 2020c) were applied to the Greenhills Creek Sedimentation Pond (RG_GHP). Although Greenhills Creek Sedimentation Pond is not a natural or naturalized lentic area, this approach was used because the pond possesses a number of lentic characteristics (e.g., longer water retention time relative to creek habitats, areas of dense vegetation). It is also recognized that, in the Elk River watershed, the concentrations of many constituents in sediment from areas considered to be in reference condition (i.e., areas unexposed to mine-influence) are above the lower BC WSQG (Minnow 2020b,c). Consequently, the upper limits of regional reference normal ranges for both lotic and lentic areas are greater than the respective lower BC WSQG for many constituents, including selenium (Minnow 2020c; Minnow 2021b).

Differences in sediment particle sizes, TOC content, and chemistry (bulk and SEA) among biological monitoring areas were evaluated using censored regression two-way ANOVAs with factors *Area*, *Year*, and *Area x Year*. Although the censored regressions allowed and accounted for censored data (i.e., values at the LRL), constituents that had >75% censored values were excluded from the analyses. *Post hoc* contrasts were completed when the main effects (*Area* or *Year*) or interaction terms were significant, and p-values were corrected accordingly. When the *Area x Year* term was insignificant, the MOD was calculated as:

$$MOD = (EMM_{area\ 2} - EMM_{area\ 1}) /\ EMM_{area\ 1} \times 100\%$$

where EMM is the estimated marginal mean from the censored regression ANOVA model based on all years combined. When the *Area x Year* term was significant, the MOD was calculated using the same equation as above, but for comparisons within each year, rather than all years combined.

[11] The most up-to-date regional reference area normal ranges for lotic sediments were first reported in the 2020 Greenhills Operations (GHO) LAEMP report (Minnow 2021b).

Temporal differences in particle sizes, TOC content, and concentrations of metals and PAHs for bulk sediments were also evaluated using a censored regression two-way ANOVA with factors *Area*, *Year*, and *Area x Year*. Similar comparisons were completed for metal and calcium[12] concentrations in SEA fractions 1 to 5. When the *Area x Year* term was insignificant, the MOD was calculated as:

$$MOD = (EMM_{year\ 2} - EMM_{year\ 1}) / EMM_{year\ 1} \times 100\%$$

where EMM is the estimated marginal mean from the censored regression ANOVA model based on all areas combined. When the *Area x Year* term was significant, the MOD was calculated using the same equation as above, but for comparisons within each area, rather than all areas combined.

The two-way ANOVAs were restricted to the years 2019 to 2022 to standardize the sizes of the bulk sediment chemistry and SEA data sets among areas and years (i.e., because sediment chemistry sampling did not commence on Gardine Creek until 2019). Within each two-way ANOVA, there is a test for interactions (i.e., between *Area* and *Year*). If the interaction is not significant, then the temporal comparisons, for example, would continue by combining data for all areas (i.e., RG_GHBP, RG_GAUT, RG_GANF, and RG_GHP in the case of bulk sediment chemistry data analysis) within a year to support the comparison among years (e.g., to compare 2022 to 2019). If a similar temporal comparison between the bulk sediment chemistry results for 2022 and 2017 was completed, the results would not be very meaningful. This is because pooled data for RG_GHBP, RG_GAUT, RG_GANF, and RG_GHP (2022) would be compared to RG_GHBP and RG_GHP only (i.e., the biological monitoring areas on Gardine Creek were not sampled for sediment chemistry in 2017).

Potential effects to sediment chemistry from antiscalant addition in Lower Greenhills Creek were evaluated by comparing differences in concentrations of constituents in bulk sediment before (2017) and after (2018 to 2022) initiation of treatment. A censored regression ANOVA with a nested design with factors *BA*, which denotes before versus after treatment, and *Year*, which is nested within *BA*, was used. Within the nested design, the nested *Year* term represents differences among years in the "after" period. If significant, *post hoc* tests were completed to compare each "after" year (i.e., one of 2018 to 2022) to the "before" year (i.e., 2017). For significant differences, a MOD was calculated as:

$$MOD_{after\ year} = (MCT_{after\ year} - MCT_{2017}) / MCT_{2017} \times 100\%$$

[12] Calcium is a correlate for calcite (see Minnow 2021a).

where the *MCT* is the measure of central tendency or, more specifically, the EMM from the censored regression ANOVA model. If the *BA* term was significant in the absence of a year effect, the marginal means were estimated for the grouped "after" years and the MOD was calculated as:

$$MOD_{year} = (MCT_{after} - MCT_{before}) / MCT_{before} \times 100\%$$

All censored regressions were conducted in R (R Core Team 2022).

To support conclusions regarding overall sediment quality (i.e., all constituents considered together), Sediment Quality Indices (SQI) were calculated by year within each area, based on concentrations of metals and PAHs measured in bulk sediment samples. The SQI are standardized to a scale of 0 to 100 with SQI approaching zero ("0") representing relatively poor sediment quality and SQI approaching 100 representing relatively good overall sediment quality. Calculations were completed in R (R Core Team 2022) following the approach of the CCME Sediment Quality Index 1.0 (CCME 2002, 2014; see also Minnow 2020c). The SQI integrate the following qualities of guideline exceedances:

- scope (i.e., percentage of constituents that did not meet their respective guidelines [number of constituents with failed samples/total number of constituents*100]);
- frequency (percentage of samples that did not meet guidelines [number of failed samples/total number of samples*100]); and
- amplitude (i.e., normalized sum of extent above guidelines, scaled between 0 and 100).

The lower BC WSQG were used, to be more conservative in the calculation of the SQI, along with the alert concentration for selenium (BCMOECCS 2021a,b).[13] The SQI were reviewed to support identification of biological monitoring areas where overall sediment quality has changed over time, as well as differences among sampling areas.

[13] The ISQG from the CCME (2002) and lower BC WSQG (BCMOECCS 2021b) are equivalent for most constituents, with the exception of iron, manganese, nickel, silver, benzo(g,h,i)perylene, benzo(k)fluoranthene, and indeno(1,2,3-c,d)pyrene, for which there are no CCME guidelines. Additionally, the selenium alert concentration is unique to the BC WSQG.

A3 BENTHIC INVERTEBRATE COMMUNITY

A3.1 Overview

Benthic invertebrates are a key component of the aquatic ecosystem of the Elk River watershed. In addition to having intrinsic value, benthic invertebrate communities can be used as indicators of localized food availability (i.e., based on abundance or densities and biomass) and habitat quality (i.e., based on richness, as well as proportions and relative abundances of major taxonomic groups) for receptors at higher trophic levels.

Benthic invertebrate community samples were collected to address study questions related to community structure and productivity. Consistent with other LAEMPs and the RAEMP, benthic invertebrate community sampling was completed in September 2022.

A3.1.1 Field Sampling

A3.1.1.1 Greenhills and Gardine Creeks

Area-based kick sampling was completed at six stations per biological monitoring area to support estimations of benthic invertebrate densities and productivity (biomass), which are considered general indicators of food availability for westslope cutthroat trout (WCT; *Oncorhynchus clarkii lewisi*). Each of the area-based benthic invertebrate community samples was collected by kick sampling an area of approximately 1/3 square metres (m^2) into a 400 µm mesh net with a triangular aperture measuring 36 cm per side. This is a modification of the Canadian Aquatic Biomonitoring Network (CABIN) technique wherein a defined area is sampled rather than sampling for a predetermined period of time. Other methods of area-based sampling, such as Hess or Surber sampling, cannot be completed effectively in Greenhills Creek (and parts of Gardine Creek) due to the calcification of the substrates. During sampling, the net was held immediately downstream of the sampler's feet so that all detritus and invertebrates disturbed from the substrate were passively collected in the kick-net by the stream current. After sampling, the kick-net was rinsed with water to move all debris and invertebrates into the collection cup at the bottom of the net. The collection cup was then removed, and the contents were rinsed into a labelled plastic jar with both external and internal station identification labels. Samples were preserved to a level of 10% buffered formalin in ambient water.

In addition to the area-based kick sampling, three-minute CABIN kick (i.e., timed kick) sampling was completed at RG_GHNF and RG_GHDT (three stations each) on Upper Greenhills Creek to support comparisons to reference area normal ranges and, in the case of RG_GHNF, the assessment of biological triggers for %EPT (see Section 2.4.3 and Appendix G of the main report).[14] The timed kick sampling on Upper Greenhills Creek was completed using methods consistent with CABIN protocols (Environment Canada 2012a) and the RAEMP (Minnow 2021c). However, the field crew noted that no true riffle habitat was present at RG_GHNF at the time of the 2022 sampling due to the presence of barrage tufa that blocked flow and formed cascades and calcite terraces. Larger areas of riffle-like habitat were identified at RG_GHDT relative to RG_GHNF; however, substrates in these areas were predominantly calcified (see Section 3.2.1 of the main report). Regardless, travelling timed kicks were completed using a net with a triangular aperture of 36 cm per side and a 400 µm mesh. During sampling, the field crew member moved across the stream channel (from bank to bank, depending on the width and depth of the creek and the presence of hazards/calcite terraces) in an upstream direction. The net was held immediately downstream of the sampler's feet so that detritus and invertebrates were passively collected in the kick-net. After sampling, the kick-net was rinsed to move all debris and invertebrates into the collection cup at the bottom of the net. The collection cup was removed, and the contents were rinsed into a labelled plastic jar with both external and internal station identification labels. Samples were preserved to a level of 10% buffered formalin in ambient water.

Supporting habitat information consistent with CABIN sampling (e.g., water velocity and depth, *in situ* water quality [temperature, DO, pH, and specific conductance], canopy cover) was collected concurrent with, and at the same locations as, benthic invertebrate community samples. As described in Section A2.2.1, CI and CI' measurements were made on a total of 50 undisturbed pebbles in the immediate vicinity of each area-based benthic invertebrate community sampling station on Greenhills and Gardine creeks (i.e., for a total of 300 pebbles per biological monitoring area).

A3.1.1.2 Greenhills Creek Sedimentation Pond

Benthic invertebrate community sampling in Greenhills Creek Sedimentation Pond was completed using a stainless-steel Petite Ponar grab sampler deployed from a boat. A single sample, consisting of a composite of five Petite Ponar grabs (i.e., a total sampling area of 0.116 m^2), were collected at each station. Care was taken so that each grab captured the surface material and was full to each edge. Any incomplete grabs were discarded. Each acceptable grab was then field-sieved using a 500 µm mesh sieve bag.

[14] For Lower Greenhills Creek, the assessment of biological triggers for %EPT relied on data collected from RG_GHCKD (Greenhills Creek downstream of sediment pond) as part of the annual RAEMP sampling (three stations; Minnow 2021c, 2022a). This is consistent with the approach for Lower Greenhills Creek in 2020 and 2021 (Minnow 2021a, 2022b).

After five acceptable grabs were added to the sieve bag and fully sieved free of debris smaller than 500 µm, the retained material was transferred into one or more plastic sampling jar(s) containing both external and internal station identification labels. Benthic invertebrate community samples were preserved to a level of 10% buffered formalin in ambient water.

Supporting habitat information (e.g., water depth and *in situ* water quality [temperature, DO, pH, and specific conductance]) were collected concurrent with, and at the same locations as, each benthic invertebrate community sample.

A3.1.2 Laboratory Analysis

Area-based benthic invertebrate community samples were sent to ZEAS Inc. (ZEAS) in Nobleton, Ontario for analysis. At the laboratory, preserved organisms in each sample were sorted from the sample debris and identified to the lowest practical level (LPL) of taxonomy (typically genus or species) using methods described by Environment Canada (2014). Organisms were then grouped at the family level of taxonomy for weighing (i.e., preserved wet weight biomass). Each family group of organisms were gently placed onto a fine cloth or paper towel to drain excess surface moisture (water and preservative) before being weighed to the nearest 0.1 milligram (mg). Total and family-level biomass and the density of each taxon were reported for each of the area-based samples. Laboratory QA/QC procedures included assessments of sub-sampling accuracy and precision, as well as percent organism recovery (see Appendix B of the main report).

Timed kick samples were sent to Cordillera Consulting (Cordillera) in Summerland, BC for sorting and taxonomic identification. Organisms were identified to the LPL of taxonomy (typically genus or species). At the beginning of the sorting process, each sample was examined and evaluated to estimate the total invertebrate number. If the total number was estimated to be >600, then the laboratory's subsampling protocol was followed. The whole sample was processed for samples estimated to have <600 individuals. Samples were sorted using methods consistent with those described by Environment Canada (2014) and CABIN requirements (i.e., a minimum of 5% of each sample was sorted and at least 300 organisms were counted in every sample). Sorting efficiency and sub-sampling accuracy and precision were quantified using methods specified by Environment Canada (2012b, 2014; see also Appendix B).

A3.1.3 Data Analysis

Data for area-based samples collected from Greenhills Creek, Gardine Creek, and the Greenhills Creek Sedimentation Pond were summarized by calculating the following endpoints:

- density (number of organisms per square metre [no./m^2]);
- biomass (grams per square metre [g/m^2]);
- LPL richness and family richness; and
- the density and/or proportions of major taxa (i.e., EPT combined, as well as Ephemeroptera, Plecoptera, Trichoptera, and Diptera).

Total abundance, LPL richness, family richness, and abundances and/or proportions of major taxa (i.e., EPT combined, as well as Ephemeroptera, Plecoptera, Trichoptera, and Diptera) were calculated for the timed kick samples collected from Upper Greenhills Creek (RG_GHNF and RG_GHDT). These endpoints were also calculated for the RAEMP monitoring area (RG_GHCKD) on Lower Greenhills Creek to support interpretation of biological data for RG_GHBP, comparisons to reference area normal ranges, and the biological trigger evaluation for %EPT (see below). However, the RAEMP report will be the main venue for reporting and interpreting data for RG_GHCKD.

Differences in benthic invertebrate community endpoints among areas and years were evaluated based on area-based samples using an ANOVA with factors *Area* and *Year* and *Area x Year*. The best transformation was chosen (i.e., $\log_{10}$, rank, or untransformed) for which a Shapiro-Wilk's test on the residuals gives the highest p-value. Appropriate *post hoc* contrasts were completed when the main effects (*Area* or *Year*) or interaction terms were significant ($\alpha = 0.1$) based on p-values corrected for the number of comparisons. For significant, *post hoc* comparisons among years, the MOD was calculated in standard deviations (SD) of the reference year as:

$$\frac{MCT_{year} - MCT_{2016}}{SD_{2016}}$$

where MCT_{year} is the MCT for a given year after 2016[15] and MCT_{2016} is the MCT in 2016. Similarly, the MODs between areas with significant *post hoc* comparisons were calculated as:

$$\frac{MCT_{untreated} - MCT_{RG\_GHBP}}{SD_{RG\_GHBP}}$$

Where $MCT_{untreated}$ is the MCT for a given biological monitoring area that was not treated with antiscalant in the years and months leading up to September 2022 and MCT_{RG_GHBP} is the MCT for the treated (i.e., from October 2017 to August 2022) area on Lower Greenhills Creek.

[15] The first year of baseline benthic invertebrate community monitoring for Greenhills Creek.

Differences in benthic community endpoints that could potentially be attributed to antiscalant addition on Lower Greenhills Creek were evaluated using a BACI design (Green 1979). An ANOVA model was used to fit the data for each area from pre- and post-application of antiscalant as follows:

$$Y = CI + BA + BA \times CI + Area(CI) + Year(BA) + Year(BA) \times CI + Area(CI) \times BA + Area(CI) \times Year(BA) + \epsilon$$

where:

- Y = response variable;
- CI = a fixed factor for area type with two levels (use of antiscalant; no use of antiscalant);
- BA = a fixed factor with two levels: before (2016 and 2017) and after (2018 to 2022) use of antiscalant;
- $BA \times \mathrm{CI}$ = the interaction between BA and CI with a significant effect suggesting the difference between pre-antiscalant and post-antiscalant varies among areas where the antiscalant was applied;
- $Area(CI)$ = a fixed factor for area (nested in CI because each area can only be assigned to one level of CI);
- $Year(BA)$ = a fixed categorical factor for year (nested in BA because each year can only be assigned to one level of BA);
- $CI \times Year(BA)$ = the interaction between CI and $Year$;
- $BA \times Area(CI)$ = the interaction between BA and $Area$;
- $Area(CI) \times Year(BA)$ = the interaction between $Area$ and $Year$; and
- ϵ = the error term.

The BACI effects were assessed by testing the significance of the interaction terms containing the BA and CI terms. A p-value of 0.1 was used to test the significance of the interaction terms.

Interpretation of the ANOVA table began by assessing the significance of the interaction between $Area(CI)$ and $Year(BA)$. If the interaction was significant, then the differences among areas changed over time (i.e., a BACI effect), although this was dependent on which years and areas were compared. *Post hoc* contrasts were conducted, as appropriate, to determine the areas and years with significant differences.

If the full interaction term was not significant, then the interpretation of the ANOVA table continued by assessing the significance of the interaction between CI and $Year(BA)$ and the interaction between BA and $Area(CI)$. These terms in the model assess whether the relative difference among areas depends on which year and group (antiscalant or no antiscalant) are compared (i.e., is there a BACI effect that depends on which years are compared?) and whether a change in the differences between groups is dependent on which area and period (before or after) are compared (i.e., is there a BACI effect that depends on which areas are compared?). If these interaction terms were significant, contrasts were conducted to determine where the interaction was occurring.

If these interaction terms were not significant, the interaction between BA and CI was assessed for significance. If this interaction was significant, the relative differences between the treated and untreated areas were dependent on the time period (before or after), indicating that the treated areas were responding similarly in showing a greater or lesser difference from untreated areas in the after period compared to the before period (i.e., there is a consistent BACI effect that does not depend on which year and group are compared).

If significant differences were found, the MOD was calculated as:

$$\frac{((After\ Year_{treated} - After\ Year_{untreated}) - (Before\ Year_{treated} - Before\ Year_{untreated}))}{SD}$$

where:

- $After\ Year_{treated} - After\ Year_{untreated}$ = difference between treated and untreated areas in the after treatment time period;
- $Before\ Year_{treated} - Before\ Year_{untreated}$ = difference between treated and untreated areas in the before treatment time period; and
- SD = the standard deviation of the residuals in the ANOVA on the transformed scale, where appropriate.

If the interaction term between BA and CI was not significant, then it was concluded that there were no BA effects that could be attributed to treatment with antiscalant.

Potential relationships between benthic invertebrate community endpoints and calcite measurements (CI, CI', and concretion scores) and water chemistry data were examined by correlation analysis. Specific endpoints included density, biomass, LPL richness, family richness, %EPT, %Ephemeroptera, %Plecoptera, %Trichoptera, and %Diptera. These endpoints were compared with co-located and concurrent calcite indices, concretion scores, and water chemistry data collected in 2022, and from 2017 to 2022 (i.e., all data combined). Water quality data for constituents with EWTs were included in the correlation analyses. Significant correlations were assessed at $\alpha = 0.05$ and Bonferroni corrections were used to account for the number of independent comparisons. Correlation analyses were completed in R (R Core Team 2022).

Comparisons to regional reference area normal ranges from the RAEMP (Minnow 2020b) were completed for the timed kick samples collected from RG_GHNF and RG_GHDT on Upper Greenhills Creek and RG_GHCKD (RAEMP area) on Lower Greenhills Creek. The regional reference area normal ranges for benthic invertebrate community endpoints were calculated using all the timed kick data collected from reference areas between 2012 and 2019 and represent the 2.5th and 97.5th percentiles of the reference area data set (Minnow 2020b). Data from area-based kicks completed in 2022 were not compared to regional reference area normal ranges because the methods underlying the reference area normal ranges (i.e., three-minute CABIN) and the area-based (1/3 m^2) benthic invertebrate community kicks are not comparable or compatible (Minnow 2022b).

Comparisons to the %EPT biological triggers (Teck 2018, 2021) were made for the timed kick samples, specifically those from RG_GHNF on Upper Greenhills Creek (n = 3 replicates) and from RAEMP area RG_GHCKD on Lower Greenhills Creek (n = 3 replicates) (see Appendix G of the main report). Data for these biological monitoring areas were paired with water quality projections from Teck's routine stations GH_HWGH_BRB (RG_GHNF) and GH_GH1 (RG_GHCKD). The use of projections from GH_HWGH_BRB represents a deviation from the 2022 study design (Minnow 2022a). The study team planned to pair RG_GHNF with projections for GH_USAAS, which, like RG_GHNF, is located upstream from the current AAS location on Upper Greenhills Creek. However, water quality monitoring at GH_USAAS did not start until November 2022 and no projections are available for that station. Consequently, RG_GHNF was paired with projections from GH_HWGH_BRB, which is located downstream from the AAS on Upper Greenhills Creek, consistent with the 2021 GC LAEMP report (Minnow 2022b). Similarly, RG_GHCKD is on Greenhills Creek downstream from the historical (i.e., from October 2017 to August 2022) AAS operation location whereas GH_GH1 is on Lower Greenhills Creek upstream from the historical AAS operation location.

A4 BENTHIC INVERTEBRATE TISSUE CHEMISTRY

A4.1 Overview

As indicated in Section A3.1, benthic invertebrates are a key component of the aquatic ecosystem of the Elk River watershed. Benthic invertebrate tissue chemistry samples were collected in 2022 to address study questions related to accumulation of selenium in benthic invertebrate tissues and to evaluate potential risks to vertebrate consumers like fish and birds. Benthic invertebrate tissue chemistry sampling was completed in February (Lower Greenhills Creek) and September (Greenhills Creek, Gardine Creek, and the Greenhills Creek Sedimentation Pond) 2022.

A4.1.1 Greenhills and Gardine Creeks

Benthic invertebrate tissue chemistry samples were collected using the kick sampling method described in Section A3.1.1.1, except that sampling was not timed or limited to 1/3 m^2 (i.e., kicks were completed until the desired mass of benthic invertebrate tissue was obtained). Following each kick, the contents of the net were emptied into a white plastic tub and examined visually to document the presence of annelids, which can increase variability in selenium chemistry results if included in the composite-taxa samples for tissue chemistry analyses (Golder 2021; Luoma 2021). If annelids were present in a given sample, the field crew estimated the abundance (i.e., number) of annelids in the sample as well as the proportion (%) of total invertebrate biomass represented by annelids (Golder 2021). If annelids represented less than or equal to (≤) 5% of the total invertebrate biomass in the sample, annelids were excluded from the composite-taxa tissue chemistry sample. If annelids represented >5% of the invertebrate biomass in the sample, they were included in the composite-taxa sub-sample for tissue chemistry analysis, such that the proportion of annelid biomass in the composite-taxa sub-sample was representative of annelid biomass in the parent kick sample (Golder 2021). Additionally, separate "annelid-only" tissue chemistry samples were collected and labelled appropriately to differentiate them from any tissue chemistry samples identified as containing annelids and other taxa. For all samples, tweezers were used to carefully remove organisms until a target sample mass of 1 to 2 grams (g) wet weight was obtained. Each sample for tissue chemistry analysis was photographed and the dominant taxa (in terms of biomass) within the sample was noted on the field sheet. Samples were placed into labelled scintillation vials and stored in a cooler with ice until they could be transferred to a freezer later in the day.

A4.1.2 Greenhills Creek Sedimentation Pond

Three composite-taxa benthic invertebrate tissue chemistry samples were collected from depositional areas within Greenhills Creek Sedimentation Pond (RG_GHP). Each of the three samples correspond with one of six benthic invertebrate community sampling locations and were collected using the same methods described in Section A3.1.1.2. Each benthic invertebrate tissue chemistry sample was assessed visually for the presence of annelids. If annelids were identified in the sample, sub-sampling was completed as described in Section A4.1.1 (Golder 2021). Procedures for documenting the taxonomic composition of the samples and sample storage were consistent with those described above in Section A4.1.2.

A4.1.3 Laboratory Analysis

Frozen benthic invertebrate samples were shipped on ice to TrichAnalytics Inc. (Trich), which is a CALA-accredited laboratory, in Saanichton, BC. At the laboratory, two of the three benthic invertebrate tissue samples from Greenhills Creek Sedimentation Pond were identified as being bivalve-dominated (RG_GHP-3 and RG_GHP-5) and bivalves were confirmed as the only taxon in the third sample (RG_GHP-6). Because the high calcium content of the bivalves' shells could significantly impact the analytical results for multiple constituents (e.g., strontium, barium, lead, and possibly selenium), the samples from stations RG_GHP-3 and RG_GHP-5 were split into "bivalve-only" and "all other taxa" sub-samples prior to analysis, consistent with the protocol followed in 2021 (Minnow 2022b). Each of the samples/sub-samples collected in February and September 2022 were dehydrated (<60°C) and then analyzed for metal concentrations using laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS). Results were reported on a dry weight basis along with moisture content.

Laboratory QA/QC procedures employed by Trich included assessments of sensitivity (i.e., evaluation of LRLs), accuracy (i.e., recoveries of certified reference material), and precision (laboratory duplicates) (see Appendix B of the main report).

A4.1.4 Data Analysis

Selenium concentrations in composite-taxa benthic invertebrate tissue chemistry samples collected in September were compared using ANOVA with factors *Area* and *Year* and *Area x Year*, as described in Section A3.1.3. However, if the main effect term was significant (p-value <0.05), and subsequent *post hoc* contrasts were also significant, the MODs were expressed as a percent difference from the base year or area, rather than in standard deviations. More specifically, the MODs for comparisons over time and among areas were calculated as:

$$MOD = (MCT_{year\ 2} - MCT_{year\ 1}) / MCT_{year\ 1} \times 100\%$$

or

$$MOD = (MCT_{area\ 2} - MCT_{area\ 1}) / MCT_{area\ 1} \times 100\%$$

respectively, where the MCT is the back-transformed estimated marginal mean.

A separate comparison of tissue selenium concentrations measured in composite-taxa samples from February and September was completed for each year (i.e., 2019 to 2022; no winter sampling was completed in 2018) to determine if tissue concentrations differ in fall (September) versus winter (February). An ANOVA with factors *Area*, *Year, Month*, and their interactions was used. If the main effect term was significant (p-value <0.05), and subsequent *post hoc* contrasts were also significant, the MODs were expressed as a percent difference from February of a given year. More specifically, the MODs for the comparisons were calculated as:

$$MOD = (MCT_{February} - MCT_{September}) / MCT_{February} \times 100\%$$

where the MCT is the measure of central tendency (i.e., the back-transformed EMM).

Concentrations of selenium in composite-taxa benthic invertebrate tissue chemistry samples collected from lotic habitats in 2022 were compared to prediction intervals generated from the regional lotic bioaccumulation model (Golder 2020) and total aqueous selenium concentrations measured in samples collected concurrent with tissue sample collection. The bioaccumulation model is as follows:

$$log_{10}[Se]_{benthic\ invertebrate} = 0.720 + 0.071 \times log_{10}[Se]_{aqueous}$$

The observed selenium concentrations in benthic invertebrate tissue samples collected from lotic habitats were compared to predicted results from the bioaccumulation model, as well as their 95% prediction intervals. If observed concentrations were higher than the upper prediction interval limits, tissue concentrations were considered higher than expected.

Biological triggers developed for selenium concentrations in benthic invertebrate tissues, as part of Teck's AMP (Teck 2018, 2021), were applied to RG_GHNF on Upper Greenhills Creek and RG_GHBP on Lower Greenhills Creek (see Appendix G of the main report). Biological monitoring areas RG_GHNF and RG_GHBP are in proximity to routine water quality monitoring locations with water quality projections (i.e., GH_HWGH_BRB[16] and

[16] As discussed in Section A3.1.3, the use of projections for GH_HWGH_BRB instead of GH_USAAS represents a deviation from the 2022 study design (Minnow 2022a). However, the use of projections for GH_HWGH_BRB is considered acceptable for 2022, given that the AAS was not operational on Upper Greenhills Creek until November 2022.

GH_GH1, respectively). These biological monitoring areas were also included in the assessment of biological triggers for 2020 (RG_GHBP) and 2021 (RG_GHNF and RG_GHBP; Minnow 2021a, 2022b). Historically, interpretation of biological triggers for RG_GHBP was completed in consideration of the fact that GH_GH1 was upstream from the AAS and RG_GHBP was downstream from the AAS. This will be the case again for 2022, given that the AAS ceased to operate on Lower Greenhills Creek less than a month prior to the September sampling program.

Selenium concentrations in composite-taxa benthic invertebrate tissue samples were also interpreted in consideration of site-specific aqueous selenium speciation and sulphate data (see Section A1) and compared to regional reference area normal ranges, EVWQP Benchmarks, and relevant effect concentrations. Selenium concentrations in benthic invertebrate tissues collected from lotic habitats and the Greenhills Creek Sedimentation Pond in 2022 were compared to outputs (predictions) of the selenium speciation bioaccumulation tool (B-tool; de Bruyn and Luoma 2021). The B-tool relies on aqueous selenium speciation and sulphate concentration data and is meant to support improved understanding of the relationship between aqueous selenium speciation and selenium concentrations in benthic invertebrate tissues. Comparisons to EVWQP Benchmarks included the Level 1, 2, and 3 Benchmarks for effects to growth, reproduction, and survival of benthic invertebrates, and dietary effects to juvenile fish and birds (Golder 2014).[17,18] Comparisons to the ENV/BCMOECCS interim guideline (i.e., 4 milligrams per kilogram dry weight [mg/kg dw]) were not made because the EVWQP Benchmarks are considered more site-specific and therefore more relevant (BCMOE 2014; Golder 2014).

[17] However, the site-specific EVWQP Level 1 Benchmark for dietary effects to growth of juvenile fish (i.e., 11 mg/kg dw) is not applicable to juvenile WCT and WCT are the only fish species known to occur in Greenhills and Gardine Creeks (Teck 2014).

[18] The GC LAEMP study design submitted in August 2022 indicated that a 45 mg/kg dw preliminary benchmark for maternal amphibian diet would also be used (Massé et al. 2015). Given that this preliminary benchmark does not represent the current state of the science (Golder 2022a) and amphibian habitat is limited within the study area, this comparison was excluded from the 2022 report.

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APPENDIX B
DATA QUALITY REVIEW

APPENDIX B DATA QUALITY REVIEW

B1 INTRODUCTION

B1.1 Background

A variety of factors can influence the physical, chemical, and biological measurements made in an environmental study and thus affect the accuracy and/or precision of the data. Inconsistencies in sampling or laboratory methods, use of instruments that cannot measure to the desired level of accuracy or precision, and contamination of samples in the field or laboratory are among potential factors that can lead to the reporting of data that do not accurately reflect environmental conditions. Depending on their magnitude, inaccuracy or imprecision have the potential to affect the reliability of any conclusions made from the data. Therefore, it is important to confirm that monitoring programs incorporate appropriate steps to control the non-natural sources of data variability (i.e., minimize the variability that does not reflect natural spatial and temporal variability in the environment).

Data quality, as a concept, is meaningful only when it relates to the intended use of the data. That is, one must know the context in which the data will be interpreted to establish a relevant basis for judging whether the data set is adequate. A Data Quality Review (DQR) involves comparisons of field and laboratory measurement performance to Data Quality Objectives (DQOs) established for a particular study, such as evaluation of Laboratory Reporting Limits (LRLs), blank sample data, data precision (based on field and laboratory duplicate samples), and data accuracy (based on matrix spike [MS] recoveries and/or analysis of standards or certified reference materials [CRM]).

Chemistry analyses were completed by laboratories accredited by the Canadian Association for Laboratory Accreditation (CALA) or the United States National Environmental Laboratory Accreditation Program (NELAP). The DQOs for the project were set equal to the laboratory DQOs to reflect reasonable and achievable performance expectations (Appendix Table B.1). Programs involving many samples and constituents usually have some results that exceed the DQOs. This is particularly so for multi-parameter scans (e.g., scans for metals[1]) because the analytical conditions are not necessarily optimal for every element included in the scan.

A DQR was completed for all laboratory data reported in support of the 2022 Greenhills Creek Aquatic Effects Assessment and Monitoring Program (GC LAEMP). The objective of the DQR was to define the overall quality of the data presented in the annual report, and, by extension,

[1] For ease of presentation, metals, metalloids, and non-metals typically included in a multi-parameter scan are collectively referred to as "metals" throughout this DQR.

Table B.1: Data Quality Objectives for the Greenhills Creek Aquatic Effects Assessment and Monitoring Program, 2022

<table>
<tr><th rowspan="3">Quality Control Measure</th><th rowspan="3" colspan="2">QC Sample Type/Check</th><th colspan="3">Study Component</th></tr>
<tr><th>Water Chemistry</th><th>Selenium Speciation</th><th>Sediment Chemistry</th></tr>
<tr><th>ALS</th><th>Brooks</th><th>ALS</th></tr>
<tr><td>Analytical LRL</td><td colspan="2">Compare actual LRL versus target LRL</td><td>LRL for each parameter should be at least as low as applicable guidelines, benchmarks, and/or effect concentrations (ideally ≤1/10th of the value)</td><td>LRL for each parameter should be at least as low as applicable guidelines, benchmarks, and effect concentrations</td><td>LRL for each parameter should be at least as low as applicable guidelines or the alert concentration for selenium (ideally ≤1/10th of the value)</td></tr>
<tr><td>Blank Analysis</td><td colspan="2">Field or Laboratory Blank</td><td>Concentrations measured in blank samples should be <LRL [a]</td><td>Concentrations measured in blank samples should be <LRL [a]</td><td>Concentrations measured in blank samples should be <LRL [a]</td></tr>
<tr><td rowspan="6">Laboratory Precision</td><td rowspan="3">Laboratory Duplicates</td><td>Concentrations <4-times the LRL:</td><td>No DQO set</td><td rowspan="3">≤20% RPD (total selenium)
≤25% RPD (selenium species)</td><td>No DQO set</td></tr>
<tr><td>Concentrations 4 to 10-times the LRL:</td><td>Difference ≤2-times the LRL</td><td>Difference ≤2-times the LRL</td></tr>
<tr><td>Concentrations >10-times the LRL:</td><td>≤4% RPD (pH)
≤10% RPD (conductivity)
≤20% RPD (all remaining constituents)</td><td>≤5% RPD (pH)
≤20% RPD (moisture, total and inorganic carbon)
≤30% RPD (all other metals)
≤40% RPD (aluminum, barium, lead, mercury, molybdenum, potassium, strontium, titanium)
≤50% RPD (PAHs)</td></tr>
<tr><td colspan="2">Repeatability of Reference Material Recoveries</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Taxonomic Precision</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Organism Sub-Sampling Precision</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td rowspan="6">Accuracy</td><td colspan="2">Recovery of Blank Spike/Laboratory Control Sample</td><td>60 to 140% (total and dissolved silicon)
75 to 125% (TKN)
80 to 120% (all remaining constituents)
85 to 115% (TSS, TDS, turbidity, alkalinity, ammonia, bromide)
90 to 110% (conductivity, chloride, fluoride, nitrate, nitrite, sulphate)
98.6 to 101% (pH)</td><td>75 to 125% recovery (methylseleninic acid, selenate, selenite, selenocyanate, selenomethionine, total selenium)</td><td>50 to 130% (naphthalene)
60 to 130% (PAHs)
70 to 130% (leachable metals)
80 to 120% (bulk metals)
90 to 110% (moisture, total and inorganic carbon)
97-103% (pH)</td></tr>
<tr><td colspan="2">Recovery of Matrix Spike</td><td>70 to 130% (all remaining constituents)
75 to 125% (ammonia, bromide, chloride, fluoride, nitrate, nitrite, sulphate)</td><td>75 to 125% recovery (selenate, selenite, selenocyanate, selenomethionine, total selenium)</td><td>50 to 140% (PAHs)</td></tr>
<tr><td colspan="2">Matrix Spike Duplicate</td><td>-</td><td>75 to 125% recovery (selenate, selenite, selenocyanate, selenomethionine, total selenium)
≤20% RPD (total selenium)
≤25% RPD (selenate, selenite, selenocyanate, selenomethionine)</td><td>-</td></tr>
<tr><td colspan="2">Recovery of Certified Reference Material, QC Standards</td><td>-</td><td>75 to 125% (total selenium)</td><td>40 to 160% (boron, thallium)
70 to 130% (remaining metals) [b]
80 to 120% (total and inorganic carbon)
96 to 104% (pH)</td></tr>
<tr><td colspan="2">Organism Recovery</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Organism Sub-Sampling Accuracy</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Notes: QC = quality control; ALS = ALS Environmental; Brooks = Brooks Applied Laboratory; Trich = TrichAnalytics Inc.; Cordillera = Cordillera Consulting; ZEAS = ZEAS Inc.; LRL = Laboratory Reporting Limit; ≤ = less than or equal to; - = not applicable; < = less than; DQO = Data Quality Objective; % = percent; RPD = relative percent difference; > = greater than; PAHs = polycyclic aromatic hydrocarbons; TKN = total Kjeldahl nitrogen; TSS = total suspended solids; TDS = total dissolved solids; CABIN = Canadian Aquatic Biomonitoring Network.

[a] Only applies to QC samples at concentrations <LRL or >5-times the LRL.

[b] However, for multi-element scans, <10% of constituents may exceed the quoted limit by <10% before the laboratory considers the results as having not met DQO

Table B.1: Data Quality Objectives for the Greenhills Creek Aquatic Effects Assessment and Monitoring Program, 2022

Quality Control Measure	QC Sample Type/Check		Study Component		
			Benthic Invertebrate Chemistry	Benthic Invertebrate Community	
			Trich	Cordillera	ZEAS
Analytical LRL	Compare actual LRL versus target LRL		LRL for each parameter should be at least as low as applicable guidelines, benchmarks, and effect concentrations	-	-
Blank Analysis	Field or Laboratory Blank		-	-	-
Laboratory Precision	Laboratory Duplicates	Concentrations <4-times the LRL:	No DQO set	-	-
		Concentrations 4 to 10-times the LRL:			
		Concentrations >10-times the LRL:	≤40% RPD (all remaining constituents) ≤60% RPD (calcium, strontium)		
	Repeatability of Reference Material Recoveries		≤20% RPD	-	-
	Taxonomic Precision		-	≤5% (identification error rate, differences in enumeration and taxonomic disagreement)	-
	Organism Sub-Sampling Precision		-	≤20% difference between sub-samples; minimum of 5% of each sample must be analyzed	≤20% difference between sub-samples; minimum of 5% of each sample must be analyzed
Accuracy	Recovery of Blank Spike/Laboratory Control Sample		-	-	-
	Recovery of Matrix Spike		-	-	-
	Matrix Spike Duplicate		-	-	-
	Recovery of Certified Reference Material, QC Standards		60 to 140% (antimony, barium, boron, silver, tin, titanium) 70 to 130% (all other constituents) 90 to 110% (selenium)	-	-
	Organism Recovery		-	≥95% recovery (CABIN)	≥90% recovery
	Organism Sub-Sampling Accuracy		-	≤20% difference between total organism counts from sub-samples and actual total organism count in whole sample	≤20% difference between density estimates from sub-samples and actual density in whole sample

Notes: QC = quality control; ALS = ALS Environmental; Brooks = Brooks Applied Laboratory; Trich = TrichAnalytics Inc.; Cordillera = Cordillera Consulting; ZEAS = ZEAS Inc.; LRL = Laboratory Reporting Limit; ≤ = less than or equal to; - = not applicable; < = less than; DQO = Data Quality Objective; % = percent; RPD = relative percent difference; > = greater than; PAHs = polycyclic aromatic hydrocarbons; TKN = total Kjeldahl nitrogen; TSS = total suspended solids; TDS = total dissolved solids; CABIN = Canadian Aquatic Biomonitoring Network.

[a] Only applies to QC samples at concentrations <LRL or >5-times the LRL.
[b] However, for multi-element scans, <10% of constituents may exceed the quoted limit by <10% before the laboratory considers the results as having not met DQO

the confidence with which that data can be used to derive conclusions. The intent of the DQR is not to reject measurements that did not meet the DQO, but to confirm that questionable data received more scrutiny to determine what effects, if any, were had on interpretation of results within the context of the monitoring program.

B1.2 Laboratory Reporting Limits

An LRL is the lowest concentration of a constituent that can be reported with a reasonable degree of accuracy and precision and is ideally synonymous with the lower limit of quantitation (LLOQ). The LLOQ is the lowest concentration of a constituent that can be reliably measured within specific limits of precision and accuracy during routine operating conditions, as opposed to being detected which, in most cases, is the lowest concentration on the calibration curve. The LRL is typically three to ten times the method detection limit (MDL). However, to facilitate comparisons to environmental quality guidelines (e.g., for water, sediment, or tissue), particularly those that are low (i.e., near the MDL), the LRL is equal to the MDL to report the guideline. Achieving satisfactory LRLs is important when comparing concentrations to guidelines for that medium. If the LRL is above the guideline, the data cannot be accurately interpreted. Consistency is also important for LRLs when taking consecutive samples. Changes in LRLs between laboratory reports can affect summary calculations and also introduce confounding factors when assessing trends. For the 2022 GC LAEMP report, LRLs were screened against guidelines for the protection of freshwater aquatic life, Elk Valley Water Quality Plan (EVWQP) benchmarks, updated effect concentrations (EC), and other site-specific benchmarks, as appropriate.

B1.3 Quality Control Samples

Typically, a DQR involves the examination of analytical results associated with several types of Quality Control (QC) samples that are collected (or prepared) in the field and laboratory. Quality control samples collected for the GC LAEMP in 2022, and a description of each QC sample type, are as follows:

- **Blanks** are samples of de-ionized water and/or appropriate reagent(s) that are handled and analyzed in the same way as regular samples. These samples reflect contamination of samples occurring in the field (in the case of field or trip blanks) or in the laboratory (in the case of laboratory or method blanks). Concentrations of constituents should be less than the LRL.
- **Field Duplicates** are samples collected from a randomly selected field station that are homogenized to the extent possible, split, and analyzed separately in the laboratory. The duplicate samples are handled and analyzed in an identical manner in

the laboratory. These samples reflect variability introduced during the handling of field samples (e.g., during homogenization), both in the field and laboratory, and therefore provide a measure of field sampling and laboratory precision.

- **Laboratory Duplicates** are replicate sub-samples created in the laboratory from randomly selected field samples that are sub-sampled and then analyzed independently using identical analytical methods. The laboratory duplicate sample results reflect variability introduced during laboratory sample handling and analysis and thus provide a measure of laboratory precision.
- **Spike Recovery Samples** are created in the laboratory by adding a known amount/concentration of a given constituent (or mixture of constituents) to a randomly selected test sample previously divided to create two sub-samples. The spiked and regular sub-samples are then analyzed in an identical manner. The spike recovery represents the difference between the measured spike amount (total amount in spiked sample minus amount in original sample) relative to the known spike amount (as a percentage). Two types of spike recovery samples are commonly analyzed. Spiked blanks are created using laboratory control materials, whereas MS are created using field-collected samples. The analysis of spiked samples provides an indication of the accuracy of analytical results.
- **CRM** are commercially prepared (or commercially homogenized) samples containing known chemical concentrations that are processed and analyzed along with batches of environmental samples. The sample results are then compared to target results to provide a measure of analytical accuracy. The results are reported as the percent of the known concentration that was recovered in the analysis.

B1.4 Other Quality Control Checks

Three additional types of QC checks were completed for the benthic invertebrate community samples collected as part of the 2022 GC LAEMP. These included:

- **Sub-sampling Error**, which is assessed whenever benthic invertebrate community samples require sub-sampling (due to excessive sample volume and/or invertebrate density). By comparing the numbers of benthic invertebrates recovered from at least two sub-samples, this measure provides an evaluation of how effective the sub-sampling method was in evenly dividing the original sample. Therefore, sub-sampling error provides a measure of analytical accuracy and precision.

- **Organism Recovery Checks** that involve the re-processing of previously sorted material from a randomly-selected benthic invertebrate community sample to determine the number of invertebrates that were not recovered during the original sample processing. The reprocessing is completed by an analyst who was not involved during the original processing to reduce bias. This check allows for the determination of accuracy through assessment of recovery efficiency.
- **Taxonomic Error** is assessed to provide an estimate of overall taxonomic precision. A minimum of 10 percent (%) of samples undergo re-identification and re-enumeration by someone other than the original taxonomist. This second taxonomist will document errors related to misidentification, incorrect enumeration, and/or questionable/insufficient taxonomic resolution and calculate an overall identification error rate.

B2 WATER CHEMISTRY

B2.1 Laboratory Reporting Limits

The analytical reports from ALS Environmental (ALS) for 2022 (Appendix C) were examined to provide an inventory of constituents for which the sample results were equal to or less than the target LRL (Appendix Table B.2). The LRLs for these constituents were also assessed relative to the approved and working British Columbia Water Quality Guidelines (BC WQG) for the protection of freshwater aquatic life (BCMOECCS 2021a,b; BCMWLRS 2023), the Canadian Council of Ministers of the Environment (CCME) mercury guidelines for the protection of freshwater aquatic life (CCME 2003), EVWQP Level 1 benchmarks, updated EC, and the proposed benchmark for nickel (Appendix Table B.2).[2] The CCME guidelines for mercury were used in lieu of the BC WQG because mercury inputs (total and methyl) in the Elk River watershed are not related to mine activities (Azimuth 2019) and Teck Coal Limited (Teck) received approval to use the CCME guideline from the British Columbia Ministry of Environment and Climate Change Strategy (ENV/BCMOECCS) on January 17, 2022.

Multiple constituents were consistently (i.e., in 100% of samples) reported at concentrations less than the LRL in 2022, including:

- bromide;
- total beryllium, bismuth, mercury, silver, and tin; and
- dissolved beryllium, bismuth, cobalt, iron, lead, mercury, silver, tin, titanium, and vanadium (Appendix Table B.2).

Additionally, the LRLs achieved for all water chemistry constituents were lower than applicable BC WQG, CCME guidelines for mercury, EVWQP Level 1 benchmarks, updated EC, and the proposed benchmark for nickel (Appendix Table B.2). Overall, the achieved LRLs were appropriate for this study.

B2.2 Field, Trip, and Laboratory Blanks

A total of two field blank samples and two trip blank samples were used to assess field sampling contamination in 2022 (Appendix Table B.3). The constituents measured in the blanks were not consistent among samples (e.g., in February 2022, concentrations of total metals were not measured in the trip blank due to bottle breakage/bottles being lost in transit);

[2] There are BC WQG and updated EC for nitrate and sulphate; comparisons were made to the updated EC because these are considered more relevant and site-specific than the BC WQG.

Table B.2: Laboratory Reporting Limit (LRL) Evaluation for Water Chemistry Analyses, 2022[a]

Constituent	Units	BC WQG/ CCME WQG [b]		Teck Screening Value/ Benchmark/ Updated Effect Concentrations [c]	Range of LRLs [d]		No. Sample Results <LRL [e]	
		Long-term Average	Short-term Maximum		February	September	February	September
Physical Tests								
Specific Conductance	µS/cm	-	-	-	2.0	2.0	0	0
Hardness (as $CaCO_3$)	mg/L	-	-	-	0.50	0.50	0	0
pH	pH	6.5 to 9.0		-	0.10	0.10	0	0
Total Suspended Solids	mg/L	-	-	-	1.0	1.0	1 (50%)	0
Total Dissolved Solids	mg/L	-	-	1,000	20	20 to 40	0	0
Turbidity	NTU	-	-	-	0.10	0.10	0	0
Anions and Nutrients								
Alkalinity, Total (as $CaCO_3$)	mg/L	>20	-	-	1.0	1.0	0	0
Ammonia, Total (as N) [f]	mg/L	0.75 to 1.9	3.9 to 13	-	0.0050	0.0050	0	5 (50%)
Bromide	mg/L	-	-	-	0.25	0.050 to 0.25	2 (100%)	10 (100%)
Chloride	mg/L	150	600	-	0.50	0.10 to 0.50	0	0
Fluoride [g]	mg/L	-	1.7 to 1.9	-	0.10	0.020 to 0.10	0	3 (30%)
Nitrate (as N)	mg/L	3.0	33	10 to 36	0.025	0.0050 to 0.0250	0	0
Nitrite (as N) [h]	mg/L	0.020 to 0.040	0.060 to 0.12	-	0.0050	0.0010 to 0.0050	0	6 (60%)
Total Kjeldahl Nitrogen	mg/L	-	-	-	0.050	0.050 to 0.50	0	4 (40%)
Orthophosphate-Dissolved (as P)	mg/L	-	-	-	0.0010	0.0010	0	5 (50%)
Total Phosphorus	mg/L	-	-	-	0.0020	0.0020	0	0
Sulphate (SO_4) [g]	mg/L	429	-	617	1.5	0.30 to 1.5	0	0
Organic/Inorganic Carbon								
Total Organic Carbon	mg/L	-	-	-	0.50	0.50	0	0
Dissolved Organic Carbon	mg/L	-	-	-	0.50	0.50	0	0
Total Metals								
Aluminum (Al) [i]	mg/L	0.12 to 0.23	-	-	0.0030	0.0030 to 0.0060	0	0
Antimony (Sb)	mg/L	0.0090	-	-	0.00010	0.00010 to 0.00020	0	0
Arsenic (As)	mg/L	-	0.0050	-	0.00010	0.00010 to 0.00020	0	0
Barium (Ba)	mg/L	1.0	-	-	0.00010	0.00010 to 0.00020	0	0
Beryllium (Be)	mg/L	0.00013	-	-	0.000020	0.000020 to 0.000040	2 (100%)	10 (100%)
Bismuth (Bi)	mg/L	-	-	-	0.000050	0.000050 to 0.00010	2 (100%)	10 (100%)
Boron (B)	mg/L	1.2	-	-	0.010	0.010 to 0.020	0	4 (40%)
Cadmium (Cd)	mg/L	-	-	-	0.0000050	0.0000050 to 0.000010	0	0
Calcium (Ca)	mg/L	-	-	-	0.050	0.050 to 0.10	0	0
Chromium (Cr) [j]	mg/L	0.0010	-	-	0.00010	0.00010 to 0.00020	0	1 (10%)
Cobalt (Co)	mg/L	0.0040	0.11	-	0.00010	0.00010 to 0.00020	2 (100%)	7 (70%)
Copper (Cu)	mg/L	-	-	-	0.00050	0.00050 to 0.0010	2 (100%)	6 (60%)
Iron (Fe)	mg/L	-	1.0	-	0.010	0.010 to 0.020	2 (100%)	6 (60%)
Lead (Pb) [g]	mg/L	0.013 to 0.020	0.25 to 0.42	-	0.000050	0.000050 to 0.00010	2 (100%)	7 (70%)
Lithium (Li)	mg/L	-	-	-	0.0010	0.0010 to 0.0020	0	0
Magnesium (Mg)	mg/L	-	-	-	0.0050	0.0050 to 0.010	0	0
Manganese (Mn)	mg/L	1.7 to 2.6	3.2 to 3.4	-	0.00010	0.00010 to 0.00020	0	0
Mercury (Hg)	mg/L	0.000026	-	-	0.00000050	0.0000050	2 (100%)	10 (100%)
Molybdenum (Mo)	mg/L	7.6	46	-	0.000050	0.000050 to 0.00010	0	0
Nickel (Ni)	mg/L	-	-	-	0.00050	0.00050 to 0.0010	0	0
Potassium (K)	mg/L	-	-	-	0.050	0.050 to 0.10	0	0
Selenium (Se)	mg/L	-	-	-	0.000050	0.000050 to 0.00010	0	0
Silicon (Si)	mg/L	-	-	-	0.10	0.10 to 0.20	0	0
Silver (Ag) [g]	mg/L	0.0015	0.0030	-	0.000010	0.000010 to 0.000020	2 (100%)	10 (100%)
Sodium (Na)	mg/L	-	-	-	0.050	0.050 to 0.10	0	0
Strontium (Sr)	mg/L	-	-	-	0.00020	0.00020 to 0.00040	0	0
Thallium (Tl)	mg/L	0.00080	-	-	0.000010	0.000010 to 0.000020	2 (100%)	7 (70%)
Tin (Sn)	mg/L	-	-	-	0.00010	0.00010 to 0.00020	2 (100%)	10 (100%)
Titanium (Ti)	mg/L	-	-	-	0.00030	0.00030 to 0.00060	2 (100%)	5 (50%)
Uranium (U)	mg/L	0.0085	-	-	0.000010	0.000010 to 0.000020	0	0
Vanadium (V)	mg/L	-	-	-	0.00050	0.00050 to 0.0025	2 (100%)	5 (50%)
Zinc (Zn) [g]	mg/L	0.12 to 0.19	0.15 to 0.34	-	0.0030	0.0030 to 0.0060	2 (100%)	7 (70%)

Notes: BC = British Columbia; WQG = Water Quality Guidelines; CCME = Canadian Council of Ministers of the Environment; Teck = Teck Coal Limited; LRL = Laboratory Reporting Limit; No. = number; < = less than; µS/cm = microSiemens per centimetre; - = no data/not applicable; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; % = percent; NTU = Nephelometric Turbidity Units; µg/L = micrograms per litre; EC = Effect Concentration; DOC = dissolved organic carbon.

[a] The number of significant digits reported in the table is consistent with source material (e.g., BCMOECCS 2021a,b) and laboratory reports.

[b] Approved (BCMOECCS 2021a), working (BCMOECCS 2021b), and updated aluminum (BCMWLRS 2023) BC WQG for the protection of freshwater aquatic life or the long-term CCME mercury WQG (CCME 2003) for the protection of freshwater aquatic life. The BC WQG for total selenium were excluded because tissue-based benchmarks are considered more appropriate for screening selenium data.

[c] Where more than one screening value, benchmark, or updated EC was applicable, the most conservative (lowest) value was used. For nitrate and sulphate, LRLs were evaluated relative to the updated EC, which are considered more site-specific and relevant than the BC WQG.

[d] The LRLs for all constituents were consistently less than the applicable WQG, screening values, benchmarks, or updated EC.

[e] The total number of samples in February 2022 was n = 2 (n = 1 water sample and n = 1 duplicate sample); in September 2021, the total number of samples was n = 10 (n = 9 water samples and n = 1 duplicate sample). Data for field and trip blanks are summarized in Appendix Table B.3.

[f] Ammonia guidelines were calculated based on the temperature and pH of individual water samples.

[g] Hardness-based guidelines, benchmarks, and/or updated EC were calculated based on the hardness of individual water samples.

[h] Nitrite guidelines were calculated based on chloride concentrations in individual water samples.

[i] Total aluminum guidelines were calculated based on the pH, DOC, and hardness of individual water samples (BCMWLRS 2023).

[j] Guideline for chromium VI (0.001 mg/L) was selected because this is the principal species found in surface waters.

[k] Dissolved copper guidelines were calculated based on the Biotic Ligand Model (BCMOECCS 2021a).

Table B.2: Laboratory Reporting Limit (LRL) Evaluation for Water Chemistry Analyses, 2022[a]

Constituent	Units	BC WQG/ CCME WQG [b]		Teck Screening Value/ Benchmark/ Updated Effect Concentrations [c]	Range of LRLs [d]		No. Sample Results <LRL [e]	
		Long-term Average	Short-term Maximum		February	September	February	September
Dissolved Metals								
Aluminum (Al)	mg/L	-	-	-	0.0010	0.0010 to 0.0020	2 (100%)	5 (50%)
Antimony (Sb)	mg/L	-	-	-	0.00010	0.00010 to 0.00020	0	1 (10%)
Arsenic (As)	mg/L	-	-	-	0.00010	0.00010 to 0.00020	0	2 (20%)
Barium (Ba)	mg/L	-	-	-	0.00010	0.00010 to 0.00020	0	0
Beryllium (Be)	mg/L	-	-	-	0.000	0.000020 to 0.000040	2 (100%)	10 (100%)
Bismuth (Bi)	mg/L	-	-	-	0.000050	0.000050 to 0.00010	2 (100%)	10 (100%)
Boron (B)	mg/L	-	-	-	0.010	0.010 to 0.020	2 (100%)	7 (70%)
Cadmium (Cd) [g]	mg/L	0.00041 to 0.00046	0.0015 to 0.0028	0.00028 to 0.0013	0.0000	0.0000050 to 0.000010	1 (50%)	3 (30%)
Calcium (Ca)	mg/L	-	-	-	0.050	0.050 to 0.10	0	0
Chromium (Cr)	mg/L	-	-	-	0.00010	0.00010 to 0.00020	1 (50%)	9 (90%)
Cobalt (Co)	mg/L	-	-	-	0.00	0.00010 to 0.00020	2 (100%)	9 (100%)
Copper (Cu) [k]	mg/L	0.00070 to 0.0016	0.0041 to 0.0099	-	0.00020	0.00020 to 0.00040	2 (100%)	3 (30%)
Iron (Fe)	mg/L	-	0.35	-	0.010	0.010 to 0.020	2 (100%)	100 (100%)
Lead (Pb)	mg/L	-	-	-	0.000050	0.000050 to 0.00010	2 (100%)	100 (100%)
Lithium (Li)	mg/L	-	-	-	0.0010	0.0010 to 0.0020	0	0
Magnesium (Mg)	mg/L	-	-	-	0.0050	0.0050 to 0.010	0	0
Manganese (Mn)	mg/L	-	-	-	0.00010	0.00010 to 0.00020	0	0
Mercury (Hg)	mg/L	-	-	-	0.0000005	0.00000050	2 (100%)	10 (100%)
Molybdenum (Mo)	mg/L	-	-	-	0.000050	0.000050 to 0.00010	0	0
Nickel (Ni)	mg/L	-	-	0.0052 to 0.0089	0.00050	0.00050 to 0.0010	0	0
Potassium (K)	mg/L	-	-	-	0.050	0.050 to 0.10	0	0
Selenium (Se)	mg/L	-	-	-	0.000	0.000050 to 0.00010	0	0
Silicon (Si)	mg/L	-	-	-	0.050	0.050 to 0.10	0	0
Silver (Ag)	mg/L	-	-	-	0.000010	0.000010 to 0.000020	2 (100%)	10 (100%)
Sodium (Na)	mg/L	-	-	-	0.050	0.050 to 0.10	0	0
Strontium (Sr)	mg/L	-	-	-	0.00020	0.00020 to 0.00040	0	0
Thallium (Tl)	mg/L	-	-	-	0.000010	0.000010 to 0.000020	2 (100%)	8 (80%)
Tin (Sn)	mg/L	-	-	-	0.00010	0.00010 to 0.00020	2 (100%)	100 (100%)
Titanium (Ti)	mg/L	-	-	-	0.000	0.00030 to 0.00060	2 (100%)	100 (100%)
Uranium (U)	mg/L	-	-	-	0.000010	0.000010 to 0.000020	0	0
Vanadium (V)	mg/L	-	-	-	0.00050	0.00050 to 0.0010	2 (100%)	100 (100%)
Zinc (Zn)	mg/L	-	-	-	0.0010	0.0010 to 0.0020	1 (50%)	7 (70%)

Notes: BC = British Columbia; WQG = Water Quality Guidelines; CCME = Canadian Council of Ministers of the Environment; Teck = Teck Coal Limited; LRL = Laboratory Reporting Limit; No. = number; < = less than; µS/cm = microSiemens per centimetre; - = no data/not applicable; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; % = percent; NTU = Nephelometric Turbidity Units; µg/L = micrograms per litre; EC = Effect Concentration; DOC = dissolved organic carbon.

a The number of significant digits reported in the table is consistent with source material (e.g., BCMOECCS 2021a,b) and laboratory reports.

b Approved (BCMOECCS 2021a), working (BCMOECCS 2021b), and updated aluminum (BCMWLRS 2023) BC WQG for the protection of freshwater aquatic life or the long-term CCME mercury WQG (CCME 2003) for the protection of freshwater aquatic life. The BC WQG for total selenium were excluded because tissue-based benchmarks are considered more appropriate for screening selenium data.

c Where more than one screening value, benchmark, or updated EC was applicable, the most conservative (lowest) value was used. For nitrate and sulphate, LRLs were evaluated relative to the updated EC, which are considered more site-specific and relevant than the BC WQG.

d The LRLs for all constituents were consistently less than the applicable WQG, screening values, benchmarks, or updated EC.

e The total number of samples in February 2022 was n = 2 (n = 1 water sample and n = 1 duplicate sample); in September 2021, the total number of samples was n = 10 (n = 9 water samples and n = 1 duplicate sample). Data for field and trip blanks are summarized in Appendix Table B.3.

f Ammonia guidelines were calculated based on the temperature and pH of individual water samples.

g Hardness-based guidelines, benchmarks, and/or updated EC were calculated based on the hardness of individual water samples.

h Nitrite guidelines were calculated based on chloride concentrations in individual water samples.

i Total aluminum guidelines were calculated based on the pH, DOC, and hardness of individual water samples (BCMWLRS 2023).

j Guideline for chromium VI (0.001 mg/L) was selected because this is the principal species found in surface waters.

k Dissolved copper guidelines were calculated based on the Biotic Ligand Model (BCMOECCS 2021a).

Table B.3: Field Blank and Trip Blank Evaluation for Water Chemistry Analyses, 2022 [a]

Constituent	Units	BC WQG/ CCME WQG [b]		Teck Screening Value/ Benchmark/ Updated Effect Concentrations [c]	Range of LRLs [d]		Field Blank <LRL [e]		Trip Blank <LRL [e]	
		Long-term Average	Short-term Maximum		February	September	February	September	February	September
Physical Tests										
Specific Conductance	µS/cm	-	-	-	2.0	2.0	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Hardness (as $CaCO_3$)	mg/L	-	-	-	0.50	0.50	1 (100%)	1 (100%)	1 (100%)	1 (100%)
pH	pH	6.5 to 9.0		-	0.10	0.10	0	0	0	0
Total Suspended Solids	mg/L	-	-	-	1.0	1.0	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Total Dissolved Solids	mg/L	-	-	1,000	10	10	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Turbidity	NTU	-	-	-	0.10	0.10	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Anions and Nutrients										
Alkalinity, Total (as $CaCO_3$)	mg/L	>20	-	-	1.0	1.0	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Ammonia, Total (as N) [f]	mg/L	0.75 to 1.9	3.9 to 13	-	0.0050	0.0050	1 (100%)	1 (100%)	1 (100%)	0 (0%)
Bromide	mg/L	-	-	-	0.050	0.050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Chloride	mg/L	150	600	-	0.10	0.10	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Fluoride [g]	mg/L	-	1.7 to 1.9	-	0.020	0.020	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Nitrate (as N)	mg/L	3.0	33	10 to 36	0.0050	0.0050	1 (100%)	1 (100%)	0 (0%)	1 (100%)
Nitrite (as N) [h]	mg/L	0.020 to 0.040	0.060 to 0.12	-	0.0010	0.0010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Total Kjeldahl Nitrogen	mg/L	-	-	-	0.050	0.050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Orthophosphate-Dissolved (as P)	mg/L	-	-	-	0.0010	0.0010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Total Phosphorus	mg/L	-	-	-	0.0020	0.0020	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Sulphate (SO_4) [g]	mg/L	429	-	617	0.30	0.30	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Organic/Inorganic Carbon										
Total Organic Carbon	mg/L	-	-	-	0.50	0.50	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Dissolved Organic Carbon	mg/L	-	-	-	0.50	0.50	1 (100%)	1 (100%)	-	-
Total Metals										
Aluminum (Al) [i]	mg/L	0.12 to 0.23	-	-	0.0030	0.0030	1 (100%)	1 (100%)	-	1 (100%)
Antimony (Sb)	mg/L	0.0090	-	-	0.00010	0.00010	1 (100%)	1 (100%)	-	1 (100%)
Arsenic (As)	mg/L	-	0.0050	-	0.00010	0.00010	1 (100%)	1 (100%)	-	1 (100%)
Barium (Ba)	mg/L	1.0	-	-	0.00010	0.00010	1 (100%)	1 (100%)	-	1 (100%)
Beryllium (Be)	mg/L	0.00013	-	-	0.000020	0.000020	1 (100%)	1 (100%)	-	1 (100%)
Bismuth (Bi)	mg/L	-	-	-	0.000050	0.000050	1 (100%)	1 (100%)	-	1 (100%)
Boron (B)	mg/L	1.2	-	-	0.010	0.010	1 (100%)	1 (100%)	-	1 (100%)
Cadmium (Cd)	mg/L	-	-	-	0.0000050	0.0000050	1 (100%)	1 (100%)	-	1 (100%)
Calcium (Ca)	mg/L	-	-	-	0.050	0.050	1 (100%)	1 (100%)	-	1 (100%)
Chromium (Cr) [j]	mg/L	0.0010	-	-	0.00010	0.00010	1 (100%)	1 (100%)	-	1 (100%)
Cobalt (Co)	mg/L	0.0040	0.11	-	0.00010	0.00010	1 (100%)	1 (100%)	-	1 (100%)
Copper (Cu)	mg/L	-	-	-	0.00050	0.00050	1 (100%)	1 (100%)	-	1 (100%)
Iron (Fe)	mg/L	-	1.0	-	0.010	0.010	1 (100%)	1 (100%)	-	1 (100%)
Lead (Pb) [g]	mg/L	0.013 to 0.020	0.25 to 0.42	-	0.000050	0.000050	1 (100%)	1 (100%)	-	1 (100%)
Lithium (Li)	mg/L	-	-	-	0.0010	0.0010	1 (100%)	1 (100%)	-	1 (100%)
Magnesium (Mg)	mg/L	-	-	-	0.0050	0.0050	1 (100%)	1 (100%)	-	1 (100%)
Manganese (Mn)	mg/L	1.7 to 2.6	3.2 to 3.4	-	0.00010	0.00010	1 (100%)	1 (100%)	-	1 (100%)
Mercury (Hg)	mg/L	0.000026	-	-	0.00000050	0.0000050	1 (100%)	1 (100%)	-	1 (100%)
Molybdenum (Mo)	mg/L	7.6	46	-	0.000050	0.000050	1 (100%)	1 (100%)	-	1 (100%)
Nickel (Ni)	mg/L	-	-	-	0.00050	0.00050	1 (100%)	1 (100%)	-	1 (100%)
Potassium (K)	mg/L	-	-	-	0.050	0.050	1 (100%)	1 (100%)	-	1 (100%)
Selenium (Se)	mg/L	-	-	-	0.000050	0.000050	1 (100%)	1 (100%)	-	1 (100%)
Silicon (Si)	mg/L	-	-	-	0.10	0.10	1 (100%)	1 (100%)	-	1 (100%)
Silver (Ag) [g]	mg/L	0.0015	0.0030	-	0.000010	0.000010	1 (100%)	1 (100%)	-	1 (100%)
Sodium (Na)	mg/L	-	-	-	0.050	0.050	1 (100%)	1 (100%)	-	1 (100%)
Strontium (Sr)	mg/L	-	-	-	0.00020	0.00020	1 (100%)	1 (100%)	-	1 (100%)
Thallium (Tl)	mg/L	0.00080	-	-	0.000010	0.000010	1 (100%)	1 (100%)	-	1 (100%)
Tin (Sn)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)	-	1 (100%)
Titanium (Ti)	mg/L	-	-	-	0.00030	0.00030	1 (100%)	1 (100%)	-	1 (100%)
Uranium (U)	mg/L	0.0085	-	-	0.000010	0.000010	1 (100%)	1 (100%)	-	1 (100%)
Vanadium (V)	mg/L	-	-	-	0.00050	0.00050	1 (100%)	1 (100%)	-	1 (100%)
Zinc (Zn) [g]	mg/L	0.12 to 0.19	0.15 to 0.34	-	0.0030	0.0030	1 (100%)	1 (100%)	-	1 (100%)

Shading indicates blank concentrations at or greater than the LRL.

Notes: BC = British Columbia; WQG = Water Quality Guidelines; CCME = Canadian Council of Ministers of the Environment; Teck = Teck Coal Limited; LRL = Laboratory Reporting Limit; No. = number; < = less than; µS/cm = microSiemens per centimetre; - = no data/not applicable; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; % = percent; NTU = Nephelometric Turbidity Units; µg/L = micrograms per litre; EC = Effect Concentration; DOC = dissolved organic carbon.

[a] The number of significant digits reported in the table is consistent with source material (e.g., BCMOECCS 2021a,b) and laboratory reports.

[b] Approved (BCMOECCS 2021a), working (BCMOECCS 2021b), and updated aluminum (BCMWLRS 2023) BC WQG for the protection of freshwater aquatic life or the long-term CCME mercury WQG (CCME 2003) for the protection of freshwater aquatic life. The BC WQG for total selenium were excluded because tissue-based benchmarks are considered more appropriate for screening selenium data.

[c] Where more than one screening value, benchmark, or updated EC was applicable, the most conservative (lowest) value was used.

[d] The LRLs for all constituents were consistently less than the applicable WQG, screening values, benchmarks, or updated EC.

[e] The total number of samples in February 2022 was n = 2 (n = 1 trip blank and n = 1 field blank). The total number of samples in September 2022 was also n = 2 (n = 1 trip blank and n = 1 field blank). Some parameters were not consistently analyzed and reported for the blank samples; differences in sample numbers are reflected in the table.

[f] Ammonia guidelines were calculated based on the temperature and pH of individual water samples.

[g] Hardness-based guidelines, benchmarks, and/or screening values were calculated based on the hardness of individual water samples.

[h] Nitrite guidelines and screening values were calculated based on chloride concentrations in individual water samples.

[i] Total aluminum guidelines were calculated based on the pH, DOC, and hardness of individual water samples (BCMWLRS 2023).

[j] Guideline for chromium VI (0.001 mg/L) was selected because this is the principal species found in surface waters.

[k] Dissolved copper guidelines were calculated based on the Biotic Ligand Model (BCMOECCS 2021a).

Table B.3: Field Blank and Trip Blank Evaluation for Water Chemistry Analyses, 2022 [a]

Constituent	Units	BC WQG/ CCME WQG [b]		Teck Screening Value/ Benchmark/ Updated Effect Concentrations [c]	Range of LRLs [d]		No. Sample Results <LRL [e]		Trip Blank <LRL [e]	
		Long-term Average	Short-term Maximum		February	September	February	September	February	September
Dissolved Metals										
Aluminum (Al)	mg/L	-	-	-	0.0010	0.0010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Antimony (Sb)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Arsenic (As)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Barium (Ba)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Beryllium (Be)	mg/L	-	-	-	0.000020	0.000020	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Bismuth (Bi)	mg/L	-	-	-	0.000050	0.000050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Boron (B)	mg/L	-	-	-	0.010	0.010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Cadmium (Cd) [g]	mg/L	0.00041 to 0.00046	0.0015 to 0.0028	0.00028 to 0.0013	0.0000050	0.0000050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Calcium (Ca)	mg/L	-	-	-	0.050	0.050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Chromium (Cr)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Cobalt (Co)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Copper (Cu) [k]	mg/L	0.00070 to 0.0016	0.0041 to 0.0099	-	0.00020	0.00020	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Iron (Fe)	mg/L	-	0.35	-	0.010	0.010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Lead (Pb)	mg/L	-	-	-	0.000050	0.000050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Lithium (Li)	mg/L	-	-	-	0.0010	0.0010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Magnesium (Mg)	mg/L	-	-	-	0.0050	0.0050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Manganese (Mn)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Mercury (Hg)	mg/L	-	-	-	0.0000050	0.0000050	1 (100%)	1 (100%)	1 (100%)	-
Molybdenum (Mo)	mg/L	-	-	-	0.000050	0.000050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Nickel (Ni)	mg/L	-	-	0.0052 to 0.0089	0.00050	0.00050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Potassium (K)	mg/L	-	-	-	0.050	0.050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Selenium (Se)	mg/L	-	-	-	0.000050	0.000050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Silicon (Si)	mg/L	-	-	-	0.050	0.050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Silver (Ag)	mg/L	-	-	-	0.000010	0.000010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Sodium (Na)	mg/L	-	-	-	0.050	0.050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Strontium (Sr)	mg/L	-	-	-	0.00020	0.00020	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Thallium (Tl)	mg/L	-	-	-	0.000010	0.000010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Tin (Sn)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Titanium (Ti)	mg/L	-	-	-	0.00030	0.00030	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Uranium (U)	mg/L	-	-	-	0.000010	0.000010	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Vanadium (V)	mg/L	-	-	-	0.00050	0.00050	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Zinc (Zn)	mg/L	-	-	-	0.0010	0.0010	1 (100%)	1 (100%)	1 (100%)	1 (100%)

Shading indicates blank concentrations at or greater than the LRL.

Notes: BC = British Columbia; WQG = Water Quality Guidelines; CCME = Canadian Council of Ministers of the Environment; Teck = Teck Coal Limited; LRL = Laboratory Reporting Limit; No. = number; < = less than; μS/cm = microSiemens per centimetre; - = no data/not applicable; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; % = percent; NTU = Nephelometric Turbidity Units; μg/L = micrograms per litre; Effect Concentration; DOC = dissolved organic carbon.

[a] The number of significant digits reported in the table is consistent with source material (e.g., BCMOECCS 2021a,b) and laboratory reports.

[b] Approved (BCMOECCS 2021a), working (BCMOECCS 2021b), and updated aluminum (BCMWLRS 2023) BC WQG for the protection of freshwater aquatic life or the long-term CCME mercury WQG (CCME 2003) for the protection of freshwater aquatic life. The BC WQG for total selenium were excluded because tissue-based benchmarks are considered more appropriate for screening selenium data.

[c] Where more than one screening value, benchmark, or updated EC was applicable, the most conservative (lowest) value was used.

[d] The LRLs for all constituents were consistently less than the applicable WQG, screening values, benchmarks, or updated EC.

[e] The total number of samples in February 2022 was n = 2 (n = 1 trip blank and n = 1 field blank). The total number of samples in September 2022 was also n = 2 (n = 1 trip blank and n = 1 field blank). Some parameters were not consistently analyzed and reported for the blank samples; differences in sample numbers are reflected in the table.

[f] Ammonia guidelines were calculated based on the temperature and pH of individual water samples.

[g] Hardness-based guidelines, benchmarks, and/or screening values were calculated based on the hardness of individual water samples.

[h] Nitrite guidelines and screening values were calculated based on chloride concentrations in individual water samples.

[i] Total aluminum guidelines were calculated based on the pH, DOC, and hardness of individual water samples (BCMWLRS 2023).

[j] Guideline for chromium VI (0.001 mg/L) was selected because this is the principal species found in surface waters.

[k] Dissolved copper guidelines were calculated based on the Biotic Ligand Model (BCMOECCS 2021a).

these differences are reflected in Appendix Table B.3. The same DQOs that were used for laboratory blanks were used for field and trip blanks (Appendix Table B.1).

Of the results that were reported for field and trip blanks, only two were greater than the LRL: nitrate (as N) in one trip blank sample from February 2022 and ammonia (as N) in one trip blank sample from September 2022 (Appendix Table B.3). The detectable nitrate concentration measured in the blank sample from February was not considered reliable, given it is within five-times the LRL (Appendix Table B.1). The reported concentration of ammonia (0.0385 mg/L as N) in the trip blank from September 2022, on the other hand, was greater than five-times the LRL. However, detectable concentrations of ammonia were not reported for the field blank or five of the nine water samples collected during the September 2022 program. Additionally, anomalous ammonia detections in trip and field blanks have occurred consistently, but infrequently, over the years (e.g., Minnow 2020). Regardless, the results for the field and trip blanks indicate that, overall, contamination of the samples in the field or during transport was unlikely.

A total of 721 method blank results were reported by ALS (see Appendix C for applicable laboratory reports) and of these, one result exceeded the LRL, but was within the less than (<) 5% uncertainty range (i.e., total vanadium in September 2022 [0.0052 mg/L versus the LRL of 0.0050 mg/L]). The LRLs for the associated batch of samples were adjusted accordingly by the laboratory. Overall, the laboratory method blank results do not indicate any issues with the data that might affect data interpretability.

B2.3 Data Precision

B2.3.1 Field Duplicate Samples

Two field duplicate samples were collected to assess field sampling precision (Appendix Table B.4): one in February and one in September 2022. Samples were collected as split samples; however, the sample aliquots in the larger "general" bottles would not be considered true splits (i.e., the smaller sample bottles would have been filled from these containers, and then these containers would have been filled directly from the sampling area).

Teck does not currently have established DQO for water quality field duplicate samples. However, by conservatively evaluating paired samples relative to laboratory DQOs (Appendix Table B.1), it can be concluded that, overall, field sampling precision and reproducibility were excellent for all water quality constituents (Appendix Table B.4). This is because the small number of relative percent difference (RPD) values greater than (>) 20% (or 4 or 10% for pH and conductivity, respectively) were associated with samples that were at or near (i.e., <10-times) the detection limit and within difference limits for paired results

Table B.4: Field Duplicate Results for Water Chemistry Analyses, 2022

Constituent	Units	RG_GHBP			RG_GHBP		
		February			September		
		28-Feb-22		RPD (%)	12-Sep-22		RPD (%)
		CG2202277			CG2212559		
Physical Tests							
Specific Conductance	µS/cm	1,600	1,610	0.62	1,540	1,530	0.65
Hardness (as $CaCO_3$)	mg/L	1,070	1,080	0.93	994	1,020	2.6
pH	pH	8.26	8.28	0.24	8.33	8.35	0.24
Total Suspended Solids	mg/L	<1.0	2.4	82	2.2	1.7	26
Total Dissolved Solids	mg/L	1,400	1,430	2.1	1,400	1,400	0
Turbidity	NTU	0.48	0.40	18	1.62	1.34	19
Anions and Nutrients							
Alkalinity, Total (as $CaCO_3$)	mg/L	299	300	0.33	246	244	0.82
Ammonia, Total (as N)	mg/L	0.0215	0.0214	0.47	0.0084	0.0080	4.9
Bromide	mg/L	<0.250	<0.250	0	<0.250	<0.250	0
Chloride	mg/L	2.1	2.03	3.4	1.85	1.71	7.9
Fluoride	mg/L	0.136	0.132	3.0	0.147	0.143	2.8
Nitrate (as N)	mg/L	4.81	4.76	1.0	4.34	4.45	2.5
Nitrite (as N)	mg/L	0.0114	0.0115	0.87	0.0102	0.0094	8.2
Total Kjeldahl Nitrogen	mg/L	0.492	0.392	23	1.67	2.10	23
Orthophosphate-Dissolved (as P)	mg/L	0.0026	0.0025	3.9	<0.0010	<0.0010	0
Total Phosphorus	mg/L	0.0036	0.0039	8.0	0.0034	0.0043	23
Sulphate (SO_4)	mg/L	776	765	1.4	780	797	2.2
Organic/Inorganic Carbon							
Total Organic Carbon	mg/L	1.84	1.92	4.3	1.7	1.62	4.8
Dissolved Organic Carbon	mg/L	1.62	1.62	0	1.86	1.68	10
Total Metals							
Aluminum (Al)	mg/L	0.0045	0.0045	0	0.0091	0.0081	12
Antimony (Sb)	mg/L	0.00039	0.00038	2.6	0.00047	0.00048	2.1
Arsenic (As)	mg/L	0.00023	0.00023	0	0.00028	0.00029	3.5
Barium (Ba)	mg/L	0.0422	0.0424	0.47	0.0422	0.0418	1.0
Beryllium (Be)	mg/L	<0.000020	<0.000020	0	<0.000020	<0.000020	0
Bismuth (Bi)	mg/L	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Boron (B)	mg/L	0.010	0.010	0	0.013	0.012	8.0
Cadmium (Cd)	mg/L	0.0000083	0.0000076	8.8	0.0000142	0.0000098	37
Calcium (Ca)	mg/L	175	180	2.8	157	156	0.64
Chromium (Cr)	mg/L	0.00014	0.00014	0	0.00016	0.00011	37
Cobalt (Co)	mg/L	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Iron (Fe)	mg/L	<0.010	<0.010	0	<0.010	<0.010	0
Lead (Pb)	mg/L	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)	mg/L	0.0158	0.0159	0.63	0.0197	0.0200	1.5
Magnesium (Mg)	mg/L	147	147	0	151	146	3.4
Manganese (Mn)	mg/L	0.00317	0.00314	1.0	0.00140	0.00137	2.2
Mercury (Hg)	mg/L	<0.00000050	<0.00000050	0	<0.0000050	<0.0000050	0
Molybdenum (Mo)	mg/L	0.00157	0.00160	1.9	0.00168	0.00168	0
Nickel (Ni)	mg/L	0.00803	0.00791	1.5	0.00862	0.00833	3.4
Potassium (K)	mg/L	2.35	2.35	0	2.45	2.38	2.9
Selenium (Se)	mg/L	0.145	0.145	0	0.149	0.15	0.67
Silicon (Si)	mg/L	3.93	3.91	0.51	3.54	3.60	1.7
Silver (Ag)	mg/L	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	3.16	3.07	2.9	2.72	2.66	2.2
Strontium (Sr)	mg/L	0.206	0.209	1.4	0.188	0.193	2.6
Thallium (Tl)	mg/L	<0.000010	<0.000010	0	0.000024	<0.000010	82
Tin (Sn)	mg/L	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)	mg/L	<0.00030	<0.00030	0	0.00036	<0.00030	18
Uranium (U)	mg/L	0.00808	0.00799	1.1	0.00864	0.00871	0.81
Vanadium (V)	mg/L	<0.00050	<0.00050	0	0.00051	<0.00050	2.0
Zinc (Zn)	mg/L	<0.0030	<0.0030	0	0.0079	<0.0030	90

Notes: The RPD was calculated using <LRL results at the LRL if one result in a duplicate pair was below the LRL. The RPD was not calculated if both results were <LRL. RPD = relative percent difference; % = percent; µS/cm = microSiemens per centimetre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; < = less than; NTU = Nephelometric Turbidity Units; µg/L = micrograms per litre; LRL = Laboratory Reporting Limit.

Table B.4: Field Duplicate Results for Water Chemistry Analyses, 2022

Constituent	Units	RG_GHBP			RG_GHBP		
		February			September		
		28-Feb-22		RPD (%)	12-Sep-22		RPD (%)
		CG2202277			CG2212559		
Dissolved Metals							
Aluminum (Al)	mg/L	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Antimony (Sb)	mg/L	0.00034	0.00034	0	0.00042	0.00046	9.1
Arsenic (As)	mg/L	0.00016	0.00017	6.1	0.00023	0.00021	9.1
Barium (Ba)	mg/L	0.0409	0.0413	1.0	0.0427	0.0423	0.94
Beryllium (Be)	mg/L	<0.000020	<0.000020	0	<0.000020	<0.000020	0
Bismuth (Bi)	mg/L	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Boron (B)	mg/L	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)	mg/L	<0.0000050	0.0000058	15	0.0000089	0.0000096	7.6
Calcium (Ca)	mg/L	188	189	0.53	141	155	9.5
Chromium (Cr)	mg/L	0.00013	<0.00010	26	<0.00010	<0.00010	0
Cobalt (Co)	mg/L	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	<0.00020	<0.00020	0	0.00042	0.00033	24
Iron (Fe)	mg/L	<0.010	<0.010	0	<0.010	<0.010	0
Lead (Pb)	mg/L	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)	mg/L	0.015	0.0149	0.67	0.0168	0.0187	11
Magnesium (Mg)	mg/L	147	148	0.68	156	154	1.3
Manganese (Mn)	mg/L	0.00194	0.00188	3.1	0.0009	0.00079	13
Mercury (Hg)	mg/L	<0.0000050	<0.0000050	0	<0.0000050	<0.0000050	0
Molybdenum (Mo)	mg/L	0.00147	0.00152	3.3	0.00146	0.00164	12
Nickel (Ni)	mg/L	0.0078	0.00778	0.26	0.00804	0.00818	1.7
Potassium (K)	mg/L	2.26	2.26	0	2.38	2.33	2.1
Selenium (Se)	mg/L	0.139	0.144	3.5	0.163	0.168	3.0
Silicon (Si)	mg/L	3.74	3.86	3.2	3.31	3.28	0.91
Silver (Ag)	mg/L	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	3.02	3.05	1.0	2.55	2.54	0.39
Strontium (Sr)	mg/L	0.213	0.214	0.47	0.171	0.191	11
Thallium (Tl)	mg/L	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Tin (Sn)	mg/L	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)	mg/L	<0.00030	<0.00030	0	<0.00030	<0.00030	0
Uranium (U)	mg/L	0.00741	0.00732	1.2	0.00732	0.00696	5.0
Vanadium (V)	mg/L	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Zinc (Zn)	mg/L	<0.0010	0.001	0	0.001	<0.0010	0

Notes: The RPD was calculated using <LRL results at the LRL if one result in a duplicate pair was below the LRL. The RPD was not calculated if both results were <LRL. RPD = relative percent difference; % = percent; µS/cm = microSiemens per centimetre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; < = less than; NTU = Nephelometric Turbidity Units; µg/L = micrograms per litre; LRL = Laboratory Reporting Limit.

(Appendix Tables B.1 and B.4).). Overall, the field sampling precision is considered acceptable for the purpose of this study.

B2.3.1 Laboratory Duplicate Samples

A total of 705 duplicate results were used to evaluate analytical precision (see Appendix C for relevant laboratory reports). For all paired samples, comparisons were within the DQO set by the analytical laboratory (Appendix Table B.1). The laboratory analytical precision can therefore be considered excellent.

B2.4 Data Accuracy

In 2022, data accuracy was evaluated based on results for 713 Laboratory Control Samples (LCS) and 625 MS samples (see Appendix C for respective laboratory reports). All LCS and MS results met the laboratory DQO (Appendix Table B.1). Overall, the LCS and MS results are considered indicative of excellent analytical precision.

B2.5 General Laboratory and Data Quality Flags

The multi-element scan for the water sample collected from Greenhills Creek Sedimentation Pond (RG_GHP) in September 2022 produced a dissolved selenium result (0.215 mg/L) that was 32% higher than the result for total selenium (0.156 mg/L; see laboratory report CG2213024 in Appendix C). The result for dissolved selenium may have been attributed to positive bias associated with signal enhancement from volatile selenium species. In response to these results, the study team requested ALS complete a Digested Dissolved Selenium analysis (E423ASe). The result of that analysis was a dissolved selenium concentration of 0.159 mg/L, which is only 2% higher than the total result. However, because the E423ASe digestion method is not fully approved or validated yet, the results generated using the standard multi-element scan (E420) were included in the 2022 GC LAEMP report.

B2.6 Data Quality Statement

Water quality data collected for this study are of acceptable quality as characterized by good to excellent detectability, negligible constituent concentrations in method blanks, excellent field and laboratory precision, and excellent laboratory accuracy. Therefore, the associated data can be used with a high level of confidence in the derivation of conclusions.

B3 SELENIUM SPECIATION

B3.1 Laboratory Reporting Limits

The analytical reports from Brooks Applied Labs for aqueous selenium speciation analyses were examined to provide an inventory of constituents for which the sample results were less than or equal to the target LRL (Appendix Table B.5; see Appendix C for laboratory reports). The LRLs for these constituents were also assessed relative to the approved (BCMOECCS 2021a) selenium BC WQG for the protection of freshwater aquatic life (i.e., 2 micrograms per litre [µg/L]; Appendix Table B.5).

Concentrations of selenate and selenite were consistently (i.e., in 100% of samples) greater than their applicable LRLs in 2022 (Appendix Table B.5). Dimethylselenoxide and methylseleninic acid were also detected in the two samples from February 2022 and 55 and 27%, respectively, of the aqueous selenium speciation samples collected in September 2022 (Appendix Table B.5). The LRLs were consistently lower than the BC WQG for total selenium (BCMOECCS 2021a). Therefore, the achieved LRLs were appropriate for this study.

B3.2 Laboratory Blanks

Four laboratory blank samples were analyzed in February 2022 and a total of 25 laboratory blank samples were analyzed in September 2022 (Appendix C). Each of the 161 individual constituent results that were produced met the laboratory's DQO (Appendix Table B.1). Therefore, laboratory blanks indicated no inadvertent sample contamination during analyses.

B3.3 Data Precision

B3.3.1 Field Duplicate Samples

Two field duplicate samples were collected to assess field sampling precision: one in February and one in September 2022 (Appendix Table B.6). The RPDs between paired results from February and September 2022 were less than or equal to (≤) 3.0 and ≤19%, respectively. Given that the field duplicates met the DQO for laboratory duplicate samples (Appendix Table B.1), field sampling precision and reproducibility are considered excellent.

B3.3.2 Laboratory Duplicate Samples

Analytical precision was evaluated by examining 10 laboratory duplicate samples for a total of 42 reported duplicate pairs (Appendix C). All comparisons of paired duplicate concentrations were within the DQO set by the analytical laboratory, except one February 2022 comparison

Table B.5: Laboratory Reporting Limit (LRL) Evaluation for Selenium Speciation Analyses, 2022

Constituent	Units	February 2022		September 2022	
		LRLs [a]	No. Sample Results <LRL	LRLs [a]	No. Sample Results <LRL
Selenium (Se)-Total	µg/L	0.165	0	0.165	0
Selenium (Se)-Dissolved	µg/L	0.165	0	0.165	0
Dimethylselenoxide-Dissolved	µg/L	0.010	0	0.010	6 (55%)
MeSe(IV) - Methylseleninic Acid (CH_3SeO_2H)-Dissolved	µg/L	0.010	0	0.010	3 (27%)
MeSe(VI) - Methaneselenonic Acid (CH_4O_3Se)-Dissolved	µg/L	0.010	2 (100%)	0.010	11 (100%)
Se(VI) - Selenate (SeO_4^{2-})-Dissolved	µg/L	0.010	0	0.010	0
Se(IV) - Selenite (SeO_3^{2-})-Dissolved	µg/L	0.010	0	0.020	0
SeCN - Selenocyanate ($SeCN^{1-}$)- Dissolved	µg/L	0.010	2 (100%)	0.010	11 (100%)
SeMe - Selenomethionine ($CH_3SeCH_2CH_2CH[NH_2]CO_2H$)-Dissolved	µg/L	0.010	2 (100%)	0.010	11 (100%)
Selenosulfate-Dissolved	µg/L	0.010	2 (100%)	0.010	11 (100%)
Unknown Selenium Species-Dissolved	µg/L	0.010	2 (100%)	0.010	11 (100%)

Notes: LRL = Laboratory Reporting Limit; No. = number; < = less than; µg/L = micrograms per litre; % = percent; BC WQG = British Columbia Water Quality Guideline.

[a] None of the LRLs exceeded the long-term selenium BC WQG for the protection of freshwater aquatic life (i.e., 2 µg/L; BCMOECCS 2021a).

Table B.6: Field Duplicate Results for Selenium Speciation Analyses, 2022

Constituent	Units	RG_GHBP February 2022 28-Feb-22 2203152		RPD (%)	RG_GHBP September 2022 12-Sep-22 2209284		RPD (%)
Selenium (Se)-Total	µg/L	134	130	3.0	124	134	7.8
Selenium (Se)-Dissolved	µg/L	130	132	1.5	127	122	4.0
Dimethylselenoxide-Dissolved	µg/L	0.040	0.040	0	0.111	0.092	19
MeSe(IV) - Methylseleninic Acid (CH_3SeO_2H)-Dissolved	µg/L	0.052	0.051	1.9	0.061	0.068	11
MeSe(VI) - Methaneselenonic Acid (CH_4O_3Se)-Dissolved	µg/L	<0.010	<0.010	0	<0.010	<0.010	0
Se(VI) - Selenate (SeO_4^{2-})-Dissolved	µg/L	132	130	1.5	137	138	0.73
Se(IV) - Selenite (SeO_3^{2-})-Dissolved	µg/L	1.33	1.32	0.75	2.84	2.91	2.4
SeCN - Selenocyanate ($SeCN^{1-}$)- Dissolved	µg/L	<0.010	<0.010	0	<0.010	<0.010	0
SeMe - Selenomethionine ($CH_3SeCH_2CH_2CH[NH_2]CO_2H$)-Dissolved	µg/L	<0.010	<0.010	0	<0.010	<0.010	0
Selenosulfate-Dissolved	µg/L	<0.010	<0.010	0	<0.010	<0.010	0
Unknown Selenium Species-Dissolved	µg/L	<0.010	<0.010	0	<0.010	<0.010	0

Notes: The RPD was calculated using <LRL results at the LRL if one result in a duplicate pair was below the LRL. The RPD was not calculated if both results were <LRL.
RPD = relative percent difference; % = percent; µg/L = micrograms per litre; < = less than; LRL = Laboratory Reporting Limit.

for selenate (RPD = 31%; RPD limit = 25%). Overall, laboratory analytical precision can be considered excellent.

The analytical laboratory also reported an estimate of precision for recoveries within 10 matrix spike duplicate (MSD) samples (Appendix C). Reported results were consistently within the DQO, which were set at a RPD ≤20% for total selenium and a RPD ≤25% for selenium species (Appendix Table B.1).

B3.4 Data Accuracy

Laboratory accuracy for selenium speciation analyses was evaluated based on 17 blank spike (BS) samples, 13 CRM samples, 10 MS samples, and 10 MSD samples. Recoveries of all BS, CRM, MS, and MSD samples from 2022 met the laboratory DQO (Appendix Table B.1). Therefore, the overall accuracy achieved by the laboratory was considered excellent.

B3.5 General Laboratory and Data Quality Flags

Selenosulphate concentrations in the two samples from February 2022 and three of the 11 samples from September 2022 were qualified as “estimated” concentrations due to the potential influence of chromatographic interference on the results. Although diluting and reanalyzing these samples could have potentially reduced the chromatographic interferences, the dilution would have elevated the LRL for selenomethionine to above the requested limit (0.010 µg/L). To date, concentrations of selenosulphate and selenomethionine in water chemistry samples collected from Greenhills and Gardine creeks have been consistently less than their respective LRLs (Minnow 2021, 2022; see also Appendix C).

B3.6 Data Quality Statement

Selenium speciation data collected for this study were characterized by good detectability, concentrations less than LRLs in all laboratory blank samples, and good field and laboratory precision (as evaluated by field and laboratory duplicate samples) and accuracy. Therefore, the associated data are considered acceptable for this study.

B4 SEDIMENT CHEMISTRY

B4.1 Laboratory Reporting Limits

The analytical reports from ALS for sediment samples collected in September 2022 (see Appendix C) were examined to provide an inventory of constituents for which the sample results were less than the LRL (Appendix Table B.7). The LRLs were assessed relative to existing British Columbia Working Sediment Quality Guidelines (BC WSQG; BCMOECCS 2021b) and the alert concentration for selenium (BCMOECCS 2021a).

”Bulk” sediments collected in September 2022 were analyzed for concentrations of metals and polycyclic aromatic hydrocarbons (PAHs) and concentrations of metals in individual sediment fractions were quantified using Sequential Extraction Analysis (SEA). Overall, none of the reported LRLs for bulk or extractable metals exceeded BC WSQG (Appendix Table B.7).

Unlike the case for metals, LRLs for PAHs occasionally exceeded BC WSQG (Appendix Table B.7). Constituents with LRLs that exceeded the lower BC WSQG (i.e., the concentrations below which adverse biological effects would not be expected to occur under most circumstances) included acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, dibenz(a,h)anthracene, fluorene, 2-methylnaphphalene, and phenanthrene. Often, elevated (relative to BC WSQG) LRLs for PAHs are attributed to high moisture content and matrix interferences that necessitated raising the detection limits (Schvets 2020, pers. Comm.). No LRLs exceeded the upper BC WSQG (i.e., the concentrations above which effects to aquatic biota may be more frequently observed) for PAHs in sediment.

Overall, the LRLs for most constituents measured in sediment samples were considered appropriate for this study, except those for acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, dibenz(a,h)anthracene, fluorene, 2-methylnaphphalene, and phenanthrene.

B4.2 Laboratory Blanks

A total of 33 laboratory method blank samples were analyzed by ALS (see Appendix C for applicable laboratory reports). Of the 568 reported method blank results, 566 met the laboratory DQO. Two method blank results for exchangeable and adsorbed barium failed to meet the laboratory DQO; however, the associated sample results less than the LRL or greater than five-times the LRL were deemed reliable by the analytical laboratory (Appendix C). Overall, the results for this study indicated no inadvertent contamination of samples within the laboratory during analysis.

Table B.7: Laboratory Reporting Limit (LRL) Evaluation for Sediment Chemistry Analyses, September 2022[a]

Constituent	Units	BC WSQG[b]		Range of LRLs	No. LRLs > Lower Guideline	No. LRLs > Upper Guideline	No. Sample Results <LRL[c]
		Lower	Upper				
Physical Tests							
% Moisture	%	-	-	0.25	-	-	0
pH (1:2)	pH units	-	-	0.10	-	-	0
Particle Size							
% Gravel (>2mm)	%	-	-	1.0	-	-	12 (55%)
% Sand (2.00mm - 1.00mm)	%	-	-	1.0	-	-	7 (32%)
% Sand (1.00mm - 0.50mm)	%	-	-	1.0	-	-	7 (32%)
% Sand (0.50mm - 0.25mm)	%	-	-	1.0	-	-	5 (23%)
% Sand (0.25mm - 0.125mm)	%	-	-	1.0	-	-	4 (18%)
% Sand (0.125mm - 0.063mm)	%	-	-	1.0	-	-	1 (4.5%)
% Silt (0.063mm - 0.0312mm)	%	-	-	1.0	-	-	0
% Silt (0.0312mm - 0.004mm)	%	-	-	1.0	-	-	0
% Clay (<4µm)	%	-	-	1.0	-	-	0
Organic/Inorganic Carbon							
Total Organic Carbon	%	-	-	0.373 to 2.56	-	-	0
Bulk Metals							
Aluminum (Al)	mg/kg	-	-	50	-	-	0
Antimony (Sb)	mg/kg	-	-	0.10	-	-	0
Arsenic (As)	mg/kg	5.9	17	0.10	0	0	0
Barium (Ba)	mg/kg	-	-	0.50	-	-	0
Beryllium (Be)	mg/kg	-	-	0.10	-	-	0
Bismuth (Bi)	mg/kg	-	-	0.20	-	-	19 (86%)
Boron (B)	mg/kg	-	-	5.0	-	-	5 (23%)
Cadmium (Cd)	mg/kg	0.6	3.5	0.020	0	0	0
Calcium (Ca)	mg/kg	-	-	50	-	-	0
Chromium (Cr)	mg/kg	37.3	90	0.50	0	0	0
Cobalt (Co)	mg/kg	-	-	0.10	-	-	0
Copper (Cu)	mg/kg	35.7	197	0.50	0	0	0
Iron (Fe)	mg/kg	21,200	43,766	50	0	0	0
Lead (Pb)	mg/kg	35	91.3	0.50	0	0	0
Lithium (Li)	mg/kg	-	-	2.0	-	-	0
Magnesium (Mg)	mg/kg	-	-	20	-	-	0
Manganese (Mn)	mg/kg	460	1,100	1.0	0	0	0
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	0	0	0
Molybdenum (Mo)	mg/kg	25	23,000	0.10	0	0	0
Nickel (Ni)	mg/kg	16	75	0.50	0	0	0
Phosphorus (P)	mg/kg	-	-	50	-	-	0
Potassium (K)	mg/kg	-	-	100	-	-	0
Selenium (Se)	mg/kg	-[d]	-[d]	0.20	-	0	0
Silver (Ag)	mg/kg	0.5	-	0.10	0	-	0
Sodium (Na)	mg/kg	-	-	50	-	-	0
Strontium (Sr)	mg/kg	-	-	0.50	-	-	0
Sulphur (S)	mg/kg	-	-	1,000	-	-	9 (41%)
Thallium (Tl)	mg/kg	-	-	0.050	-	-	0
Tin (Sn)	mg/kg	-	-	2.0	-	-	22 (100%)
Titanium (Ti)	mg/kg	-	-	1.0	-	-	0
Tungsten (W)	mg/kg	-	-	0.50	-	-	22 (100%)
Uranium (U)	mg/kg	-	-	0.050	-	-	0
Vanadium (V)	mg/kg	-	-	0.20	-	-	0
Zinc (Zn)	mg/kg	123	315	2.0	0	0	0
Zirconium (Zr)	mg/kg	-	-	1.0	-	-	7 (32%)
Exchangeable and Adsorbed Metals							
Aluminum (Al)	mg/kg	-	-	50	-	-	22 (100%)
Antimony (Sb)	mg/kg	-	-	0.10	-	-	22 (100%)
Arsenic (As)	mg/kg	5.9	17	0.050	0	0	19 (86%)
Barium (Ba)	mg/kg	-	-	0.50	-	-	0
Beryllium (Be)	mg/kg	-	-	0.20	-	-	22 (100%)
Bismuth (Bi)	mg/kg	-	-	0.20	-	-	22 (100%)
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	0	0	4 (18%)
Calcium (Ca)	mg/kg	-	-	50	-	-	0
Chromium (Cr)	mg/kg	37.3	90	0.50	0	0	22 (100%)
Cobalt (Co)	mg/kg	-	-	0.10	-	-	2 (9.1%)
Copper (Cu)	mg/kg	35.7	197	0.50	0	0	14 (64%)
Iron (Fe)	mg/kg	21,200	43,766	50	0	0	22 (100%)
Lead (Pb)	mg/kg	35	91.3	0.50	0	0	22 (100%)
Lithium (Li)	mg/kg	-	-	5.0	-	-	22 (100%)
Manganese (Mn)	mg/kg	460	1,100	1.0	0	0	0
Molybdenum (Mo)	mg/kg	25	23,000	0.50	0	0	22 (100%)
Nickel (Ni)	mg/kg	16	75	0.50	0	0	9 (41%)
Phosphorus (P)	mg/kg	-	-	50	-	-	22 (100%)
Potassium (K)	mg/kg	-	-	100	-	-	2 (9.1%)
Selenium (Se)	mg/kg	-[d]	-[d]	0.20	-	0	12 (55%)
Silver (Ag)	mg/kg	0.5	-	0.10	0	-	22 (100%)
Sodium (Na)	mg/kg	-	-	100	-	-	21 (95%)
Strontium (Sr)	mg/kg	-	-	0.50	-	-	0
Thallium (Tl)	mg/kg	-	-	0.050	-	-	22 (100%)
Tin (Sn)	mg/kg	-	-	2.0	-	-	22 (100%)
Titanium (Ti)	mg/kg	-	-	1.0	-	-	22 (100%)
Uranium (U)	mg/kg	-	-	0.050	-	-	12 (55%)
Vanadium (V)	mg/kg	-	-	0.20	-	-	22 (100%)
Zinc (Zn)	mg/kg	123	315	1.0	0	0	22 (100%)

Shading indicates an LRL greater than the lower BC WSQG.

Shading indicates an LRL greater than the both the lower and upper BC WSQG.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; LRL = Laboratory Reporting Limit; No. = number; > = greater than; < = less than; % = percent; - = no data/not applicable; mm = millimetres; µm = micrometres; mg/kg = milligrams per kilogram; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

[a] The number of significant digits reported in the table is consistent with source material (e.g., BCMOECCS 2021a,b) and laboratory reports.

[b] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[c] The total number of samples analyzed in 2022 was n = 22 (n = 21 sediment samples and n = 1 duplicate sample).

[d] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table B.7: Laboratory Reporting Limit (LRL) Evaluation for Sediment Chemistry Analyses, September 2022 [a]

Constituent	Units	BC WSQG [b]		Range of LRLs	No. LRLs > Lower Guideline	No. LRLs > Upper Guideline	No. Sample Results <LRL [c]
		Lower	Upper				
Carbonate Metals							
Aluminum (Al)	mg/kg	-	-	50	-	-	22 (100%)
Antimony (Sb)	mg/kg	-	-	0.10	-	-	22 (100%)
Arsenic (As)	mg/kg	5.9	17	0.050	0	0	9 (41%)
Barium (Ba)	mg/kg	-	-	2.0	-	-	0
Beryllium (Be)	mg/kg	-	-	0.20	-	-	22 (100%)
Bismuth (Bi)	mg/kg	-	-	0.20	-	-	22 (100%)
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	0	0	0
Calcium (Ca)	mg/kg	-	-	50	-	-	0
Chromium (Cr)	mg/kg	37.3	90	5.0	0	0	22 (100%)
Cobalt (Co)	mg/kg	-	-	0.10	-	-	0
Copper (Cu)	mg/kg	35.7	197	0.50	0	0	22 (100%)
Iron (Fe)	mg/kg	21,200	43,766	50	0	0	21 (95%)
Lead (Pb)	mg/kg	35	91.3	0.50	0	0	19 (86%)
Lithium (Li)	mg/kg	-	-	5.0	-	-	22 (100%)
Manganese (Mn)	mg/kg	460	1,100	5.0	0	0	0
Molybdenum (Mo)	mg/kg	25	23,000	0.50	0	0	22 (100%)
Nickel (Ni)	mg/kg	16	75	2.0	0	0	8 (36%)
Phosphorus (P)	mg/kg	-	-	50	-	-	22 (100%)
Selenium (Se)	mg/kg	- [d]	- [d]	0.20	-	0	14 (64%)
Silver (Ag)	mg/kg	0.5	-	0.10	0	-	22 (100%)
Strontium (Sr)	mg/kg	-	-	5.0	-	-	0
Thallium (Tl)	mg/kg	-	-	0.050	-	-	22 (100%)
Tin (Sn)	mg/kg	-	-	2.0	-	-	22 (100%)
Titanium (Ti)	mg/kg	-	-	5.0	-	-	22 (100%)
Uranium (U)	mg/kg	-	-	0.050	-	-	1 (4.5%)
Vanadium (V)	mg/kg	-	-	0.20	-	-	22 (100%)
Zinc (Zn)	mg/kg	123	315	1.0	0	0	0
Easily-reducible Metals and Iron Oxides							
Aluminum (Al)	mg/kg	-	-	50	-	-	0
Antimony (Sb)	mg/kg	-	-	0.10	-	-	20 (91%)
Arsenic (As)	mg/kg	5.9	17	0.050	0	0	0
Barium (Ba)	mg/kg	-	-	0.50	-	-	0
Beryllium (Be)	mg/kg	-	-	0.20	-	-	0
Bismuth (Bi)	mg/kg	-	-	0.20	-	-	22 (100%)
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	0	0	0
Calcium (Ca)	mg/kg	-	-	50	-	-	0
Chromium (Cr)	mg/kg	37.3	90	0.50	0	0	0
Cobalt (Co)	mg/kg	-	-	0.10	-	-	0
Copper (Cu)	mg/kg	35.7	197	0.50	0	0	7 (32%)
Iron (Fe)	mg/kg	21,200	43,766	50	0	0	0
Lead (Pb)	mg/kg	35	91.3	0.50	0	0	0
Lithium (Li)	mg/kg	-	-	5.0	-	-	22 (100%)
Manganese (Mn)	mg/kg	460	1,100	1.0	0	0	0
Molybdenum (Mo)	mg/kg	25	23,000	0.50	0	0	22 (100%)
Nickel (Ni)	mg/kg	16	75	0.50	0	0	0
Phosphorus (P)	mg/kg	-	-	50	-	-	0
Selenium (Se)	mg/kg	- [d]	- [d]	0.20	-	0	11 (50%)
Silver (Ag)	mg/kg	0.5	-	0.10	0	-	15 (68%)
Strontium (Sr)	mg/kg	-	-	0.50	-	-	0
Thallium (Tl)	mg/kg	-	-	0.050	-	-	22 (100%)
Tin (Sn)	mg/kg	-	-	2.0	-	-	22 (100%)
Titanium (Ti)	mg/kg	-	-	1.0	-	-	22 (100%)
Uranium (U)	mg/kg	-	-	0.050	-	-	0
Vanadium (V)	mg/kg	-	-	0.20	-	-	0
Zinc (Zn)	mg/kg	123	315	1.0	0	0	0
Organic-bound Metals							
Aluminum (Al)	mg/kg	-	-	50	-	-	0
Antimony (Sb)	mg/kg	-	-	0.10	-	-	22 (100%)
Arsenic (As)	mg/kg	5.9	17	0.050	0	0	0
Barium (Ba)	mg/kg	-	-	0.50	-	-	0
Beryllium (Be)	mg/kg	-	-	0.20	-	-	22 (100%)
Bismuth (Bi)	mg/kg	-	-	0.20	-	-	22 (100%)
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	0	0	1 (4.5%)
Calcium (Ca)	mg/kg	-	-	50	-	-	0
Chromium (Cr)	mg/kg	37.3	90	0.50	0	0	0
Cobalt (Co)	mg/kg	-	-	0.10	-	-	0
Copper (Cu)	mg/kg	35.7	197	0.50	0	0	0
Iron (Fe)	mg/kg	21,200	43,766	50	0	0	0
Lead (Pb)	mg/kg	35	91.3	0.50	0	0	3 (14%)
Lithium (Li)	mg/kg	-	-	5.0	-	-	22 (100%)
Manganese (Mn)	mg/kg	460	1,100	1.0	0	0	0
Molybdenum (Mo)	mg/kg	25	23,000	0.50	0	0	22 (100%)
Nickel (Ni)	mg/kg	16	75	0.50	0	0	0
Selenium (Se)	mg/kg	- [d]	- [d]	0.20	-	0	0
Silver (Ag)	mg/kg	0.5	-	0.10	0	-	22 (100%)
Strontium (Sr)	mg/kg	-	-	0.50	-	-	0
Thallium (Tl)	mg/kg	-	-	0.050	-	-	22 (100%)
Tin (Sn)	mg/kg	-	-	2.0	-	-	22 (100%)
Titanium (Ti)	mg/kg	-	-	1.0	-	-	3 (14%)
Uranium (U)	mg/kg	-	-	0.050	-	-	0
Vanadium (V)	mg/kg	-	-	0.20	-	-	0
Zinc (Zn)	mg/kg	123	315	1.0	0	0	0

Shading indicates an LRL greater than the lower BC WSQG.

Shading indicates an LRL greater than the both the lower and upper BC WSQG.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; LRL = Laboratory Reporting Limit; No. = number; > = greater than; < = less than; % = percent; - = no data/not applicable; mm = millimetres; µm = micrometres; mg/kg = milligrams per kilogram; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

[a] The number of significant digits reported in the table is consistent with source material (e.g., BCMOECCS 2021a,b) and laboratory reports.

[b] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[c] The total number of samples analyzed in 2022 was n = 22 (n = 21 sediment samples and n = 1 duplicate sample).

[d] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table B.7: Laboratory Reporting Limit (LRL) Evaluation for Sediment Chemistry Analyses, September 2022 [a]

Constituent	Units	BC WSQG [b]		Range of LRLs	No. LRLs > Lower Guideline	No. LRLs > Upper Guideline	No. Sample Results <LRL [c]
		Lower	Upper				
Residual Metals							
Aluminum (Al)	mg/kg	-	-	50	-	-	0
Antimony (Sb)	mg/kg	-	-	0.10	-	-	0
Arsenic (As)	mg/kg	5.9	17	5.0	0	0	18 (82%)
Barium (Ba)	mg/kg	-	-	2.0	-	-	0
Beryllium (Be)	mg/kg	-	-	0.20	-	-	0
Bismuth (Bi)	mg/kg	-	-	0.20	-	-	22 (100%)
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	0	0	2 (9.1%)
Calcium (Ca)	mg/kg	-	-	50	-	-	0
Chromium (Cr)	mg/kg	37.3	90	5.0	0	0	0
Cobalt (Co)	mg/kg	-	-	0.10	-	-	0
Copper (Cu)	mg/kg	35.7	197	0.50	0	0	0
Iron (Fe)	mg/kg	21,200	43,766	50	0	0	0
Lead (Pb)	mg/kg	35	91.3	0.50	0	0	0
Lithium (Li)	mg/kg	-	-	5.0	-	-	10 (45%)
Manganese (Mn)	mg/kg	460	1,100	5.0	0	0	0
Molybdenum (Mo)	mg/kg	25	23,000	0.50	0	0	1 (4.5%)
Nickel (Ni)	mg/kg	16	75	2.0	0	0	0
Selenium (Se)	mg/kg	- [d]	- [d]	0.20	-	0	0
Silver (Ag)	mg/kg	0.5	-	0.10	0	-	1 (4.5%)
Strontium (Sr)	mg/kg	-	-	5.0	-	-	0
Thallium (Tl)	mg/kg	-	-	0.050	-	-	0
Tin (Sn)	mg/kg	-	-	2.0	-	-	22 (100%)
Titanium (Ti)	mg/kg	-	-	5.0	-	-	0
Uranium (U)	mg/kg	-	-	0.050	-	-	0
Vanadium (V)	mg/kg	-	-	0.20	-	-	0
Zinc (Zn)	mg/kg	123	315	1.0	0	0	0
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	0.00671	0.0889	0.050	22 (100%)	0	1 (4.5%)
Acenaphthylene	mg/kg	0.00587	0.128	0.050	22 (100%)	0	13 (59%)
Acridine	mg/kg	-	-	0.050	-	-	1 (4.5%)
Anthracene	mg/kg	0.0469	0.245	0.050	22 (100%)	0	22 (100%)
Benz(a)anthracene	mg/kg	0.0317	0.385	0.050	22 (100%)	0	3 (14%)
Benzo(a)pyrene	mg/kg	0.0319	0.782	0.050	22 (100%)	0	7 (32%)
Benzo(b&j)fluoranthene	mg/kg	-	-	0.050	-	-	1 (4.5%)
Benzo(b+j+k)fluoranthene	mg/kg	-	-	0.075	-	-	1 (4.5%)
Benzo(g,h,i)perylene	mg/kg	0.17	3.2	0.050	0	0	3 (14%)
Benzo(k)fluoranthene	mg/kg	0.24	13.4	0.050	0	0	11 (50%)
Chrysene	mg/kg	0.0571	0.862	0.050	0	0	1 (4.5%)
Dibenz(a,h)anthracene	mg/kg	0.00622	0.135	0.050	22 (100%)	0	11 (50%)
Fluoranthene	mg/kg	0.111	2.355	0.050	0	0	3 (14%)
Fluorene	mg/kg	0.0212	0.144	0.050	22 (100%)	0	1 (4.5%)
Indeno(1,2,3-c,d)pyrene	mg/kg	0.2	3.2	0.050	0	0	13 (59%)
1-Methylnaphthalene	mg/kg	-	-	0.030	-	-	0
2-Methylnaphthalene	mg/kg	0.0202	0.201	0.030	22 (100%)	0	0
Naphthalene	mg/kg	0.0346	0.391	0.010 to 0.030	0	0	0
Phenanthrene	mg/kg	0.0419	0.515	0.050	22 (100%)	0	0
Pyrene	mg/kg	0.053	0.875	0.050	0	0	1 (4.5%)
Quinoline	mg/kg	-	-	0.050	-	-	22 (100%)

Shading indicates an LRL greater than the lower BC WSQG.

Shading indicates an LRL greater than the both the lower and upper BC WSQG.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; LRL = Laboratory Reporting Limit; No. = number; > = greater than; < = less than; % = percent; - = no data/not applicable; mm = millimetres; µm = micrometres; mg/kg = milligrams per kilogram; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

[a] The number of significant digits reported in the table is consistent with source material (e.g., BCMOECCS 2021a,b) and laboratory reports.

[b] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[c] The total number of samples analyzed in 2022 was n = 22 (n = 21 sediment samples and n = 1 duplicate sample).

[d] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

B4.3 Data Precision

B4.3.1 Field Duplicate Samples

Two pairs of field duplicate samples were collected to assess the precision of field sampling; however, only one QC sample was logged by the analytical laboratory (Appendix Table B.8). The QC samples for sediment were collected as split samples (i.e., a larger sample was homogenized and split into two duplicate sub-samples); however, some variability is expected, based on the heterogeneity of sediments, and this should be considered when interpreting the sediment chemistry results.

Teck does not currently have DQO set for sediment field duplicate samples. However, applying the DQO for laboratory duplicates (Appendix Table B.1) is considered a highly conservative estimate of field sampling precision, given that field sampling conditions and sample homogenization cannot be controlled as well as in the laboratory. Most (i.e., 77%) of paired concentrations, including all metals fractions and PAHs, were within laboratory DQO, based on the single set of field duplicates collected in 2022 (Appendix Table B.8). This is attributed to a number of sample results (particularly those for PAHs) being relatively close to (i.e., <10-times) the LRL. Regardless, the collection of replicate samples from each area is expected to average out this type of variability and support the overall results and comparisons.

B4.3.2 Laboratory Duplicate Samples

A total of 36 laboratory duplicate samples were used to evaluate laboratory precision (see Appendix C for the relevant laboratory reports). For almost all of the 596 comparisons that were reported, RPDs were within laboratory DQO (Appendix Table B.1). The first exception was a single paired result for calcium in the easily reducible metals and iron oxides fraction; the RPD between paired results was 47% and the DQO was 30%. The only other exception was a single paired result for strontium in the easily reducible metals and iron oxides fraction; the RPD between paired results was 33% and the DQO was 30%. The analytical laboratory attributed these differences to sample heterogeneity. Overall, analytical precision was deemed excellent for the sediment chemistry samples collected in September 2022.

B4.4 Data Accuracy

Data accuracy was evaluated based on the analysis of CRM, LCS, and MS. Specifically, 15 CRM samples, 36 LCS samples, and three MS samples were analyzed to produce 105, 597, and 60 individual results, respectively (see Appendix C). All CRM, LCS, and MS samples met the laboratory DQO. Overall, the accuracy achieved by the laboratory for this study can be considered excellent.

Table B.8: Field Duplicate Results for Sediment Chemistry Analyses, September 2022

Constituent	Units	RG_GAUT		
		14-Sep-22		RPD (%)
		CG2213623		
Physical Tests				
Moisture	%	26.1	38.6	39
pH (1:2)	pH units	8.26	8.35	1.1
Particle Size				
% Gravel (>2mm)	%	10.2	3.0	109
% Sand (2.00mm - 1.00mm)	%	6.1	3.6	52
% Sand (1.00mm - 0.50mm)	%	13.5	2.2	144
% Sand (0.50mm - 0.25mm)	%	13.8	4.7	98
% Sand (0.25mm - 0.125mm)	%	9.4	13.7	37
% Sand (0.125mm - 0.063mm)	%	6.9	21.9	104
% Silt (0.063mm - 0.0312mm)	%	12.8	21.7	52
% Silt (0.0312mm - 0.004mm)	%	20.6	24.2	16
% Clay (<4μm)	%	6.7	5.0	29
Organic/Inorganic Carbon				
Total Organic Carbon	%	9.4	2.6	113
Bulk Metals				
Aluminum (Al)	mg/kg	8,130	16,200	66
Antimony (Sb)	mg/kg	0.89	0.40	76
Arsenic (As)	mg/kg	6.99	7.82	11
Barium (Ba)	mg/kg	312	700	77
Beryllium (Be)	mg/kg	0.78	0.86	10
Bismuth (Bi)	mg/kg	<0.20	0.23	14
Boron	mg/kg	5.4	17.9	107
Cadmium (Cd)	mg/kg	0.918	0.844	8.4
Calcium (Ca)	mg/kg	12,000	25,500	72
Chromium (Cr)	mg/kg	11.6	19.0	48
Cobalt (Co)	mg/kg	11.1	8.11	31
Copper (Cu)	mg/kg	20.0	19.9	0.50
Iron (Fe)	mg/kg	19,500	23,500	19
Lead (Pb)	mg/kg	13.6	13.6	0
Lithium (Li)	mg/kg	12.4	25.4	69
Magnesium (Mg)	mg/kg	3,920	8,220	71
Manganese (Mn)	mg/kg	622	324	63
Mercury (Hg)	mg/kg	0.0668	0.0286	80
Molybdenum (Mo)	mg/kg	1.42	2.19	43
Nickel (Ni)	mg/kg	33.1	24.8	29
Phosphorus (P)	mg/kg	1,300	1,560	18
Potassium (K)	mg/kg	1,500	3,380	77
Selenium (Se)	mg/kg	1.22	0.67	58
Silver (Ag)	mg/kg	0.27	0.13	70
Sodium (Na)	mg/kg	56	273	132
Strontium (Sr)	mg/kg	47.8	97.7	69
Sulphur (S)	mg/kg	<1,000	<1,000	0
Thallium (Tl)	mg/kg	0.140	0.423	101
Tin (Sn)	mg/kg	<2.0	<2.0	0
Titanium (Ti)	mg/kg	10.1	20.8	69
Tungsten (W)	mg/kg	<0.50	<0.50	0
Uranium (U)	mg/kg	0.845	0.712	17
Vanadium (V)	mg/kg	26.5	31.2	16
Zinc (Zn)	mg/kg	113	101	11
Zirconium (Zr)	mg/kg	1.2	1.0	18
Exchangeable and Adsorbed Metals				
Aluminum (Al)	mg/kg	<50	<50	0
Antimony (Sb)	mg/kg	<0.10	<0.10	0
Arsenic (As)	mg/kg	<0.050	0.052	3.9
Barium (Ba)	mg/kg	46.1	224	132
Beryllium (Be)	mg/kg	<0.20	<0.20	0
Bismuth (Bi)	mg/kg	<0.20	<0.20	0
Cadmium (Cd)	mg/kg	0.173	<0.050	110
Calcium (Ca)	mg/kg	3,800	2,500	41
Chromium (Cr)	mg/kg	<0.50	<0.50	0
Cobalt (Co)	mg/kg	0.24	<0.10	82
Copper (Cu)	mg/kg	<0.50	<0.50	0
Iron (Fe)	mg/kg	<50	<50	0
Lead (Pb)	mg/kg	<0.50	<0.50	0
Lithium (Li)	mg/kg	<5.0	<5.0	0
Manganese (Mn)	mg/kg	56.7	32.3	55
Molybdenum (Mo)	mg/kg	<0.50	<0.50	0
Nickel (Ni)	mg/kg	<0.50	<0.50	0
Phosphorus (P)	mg/kg	<50	<50	0
Potassium (K)	mg/kg	130	190	38
Selenium (Se)	mg/kg	<0.20	<0.20	0
Silver (Ag)	mg/kg	<0.10	<0.10	0
Sodium (Na)	mg/kg	<100	350	111
Strontium (Sr)	mg/kg	12.6	42.4	108
Thallium (Tl)	mg/kg	<0.050	<0.050	0
Tin (Sn)	mg/kg	<2.0	<2.0	0
Titanium (Ti)	mg/kg	<1.0	<1.0	0
Uranium (U)	mg/kg	<0.050	<0.050	0
Vanadium (V)	mg/kg	<0.20	<0.20	0
Zinc (Zn)	mg/kg	<1.0	<1.0	0

Notes: The RPD was calculated using <LRL results at the LRL if one result in a duplicate pair was below the LRL. The RPD was not calculated if both results were <LRL. RPD = relative percent difference; % = percent; > = greater than; mm = millimetres; < = less than; μm = micrometres; mg/kg = milligrams per kilogram; LRL = Laboratory Reporting Limit.

Table B.8: Field Duplicate Results for Sediment Chemistry Analyses, September 2022

Constituent	Units	RG_GAUT		
		14-Sep-22		RPD (%)
		CG2213623		
Carbonate Metals				
Aluminum (Al)	mg/kg	<50	<50	0
Antimony (Sb)	mg/kg	<0.10	<0.10	0
Arsenic (As)	mg/kg	0.058	0.164	95
Barium (Ba)	mg/kg	35	123	111
Beryllium (Be)	mg/kg	<0.20	<0.20	0
Bismuth (Bi)	mg/kg	<0.20	<0.20	0
Cadmium (Cd)	mg/kg	0.19	0.245	25
Calcium (Ca)	mg/kg	3,010	13,800	128
Chromium (Cr)	mg/kg	<5.0	<5.0	0
Cobalt (Co)	mg/kg	0.71	1.42	67
Copper (Cu)	mg/kg	<0.50	<0.50	0
Iron (Fe)	mg/kg	<50	563	167
Lead (Pb)	mg/kg	<0.50	1.19	82
Lithium (Li)	mg/kg	<5.0	<5.0	0
Manganese (Mn)	mg/kg	96.6	126	26
Molybdenum (Mo)	mg/kg	<0.50	<0.50	0
Nickel (Ni)	mg/kg	<2.0	2.1	4.9
Phosphorus (P)	mg/kg	<50	<50	0
Selenium (Se)	mg/kg	<0.20	<0.20	0.0
Silver (Ag)	mg/kg	<0.10	<0.10	0
Strontium (Sr)	mg/kg	5.8	27.7	131
Thallium (Tl)	mg/kg	<0.050	<0.050	0
Tin (Sn)	mg/kg	<2.0	<2.0	0
Titanium (Ti)	mg/kg	<5.0	<5.0	0
Uranium (U)	mg/kg	0.051	0.055	7.5
Vanadium (V)	mg/kg	<0.20	<0.20	0
Zinc (Zn)	mg/kg	4.7	9.1	64
Easily-reducible Metals and Iron Oxides				
Aluminum (Al)	mg/kg	609	655	7.3
Antimony (Sb)	mg/kg	<0.10	<0.10	0
Arsenic (As)	mg/kg	0.556	0.865	43
Barium (Ba)	mg/kg	50.8	82.6	48
Beryllium (Be)	mg/kg	0.29	0.24	19
Bismuth (Bi)	mg/kg	<0.20	<0.20	0
Cadmium (Cd)	mg/kg	0.445	0.358	22
Calcium (Ca)	mg/kg	3,320	8,360	86
Chromium (Cr)	mg/kg	0.90	1.5	50
Cobalt (Co)	mg/kg	4.17	2.37	55
Copper (Cu)	mg/kg	0.65	0.90	32
Iron (Fe)	mg/kg	3,680	4,140	12
Lead (Pb)	mg/kg	3.19	4.56	35
Lithium (Li)	mg/kg	<5.0	<5.0	0
Manganese (Mn)	mg/kg	191	90.3	72
Molybdenum (Mo)	mg/kg	<0.50	<0.50	0
Nickel (Ni)	mg/kg	10.6	5.43	65
Phosphorus (P)	mg/kg	142	74	63
Selenium (Se)	mg/kg	<0.20	<0.20	0
Silver (Ag)	mg/kg	0.1	<0.10	0.0
Strontium (Sr)	mg/kg	6.63	12	58
Thallium (Tl)	mg/kg	<0.050	<0.050	0
Tin (Sn)	mg/kg	<2.0	<2.0	0
Titanium (Ti)	mg/kg	<1.0	<1.0	0
Uranium (U)	mg/kg	0.178	0.123	37
Vanadium (V)	mg/kg	2.9	2.88	0.69
Zinc (Zn)	mg/kg	26.4	24.4	7.9
Organic-bound Metals				
Aluminum (Al)	mg/kg	1,740	1,280	30
Antimony (Sb)	mg/kg	<0.10	<0.10	0
Arsenic (As)	mg/kg	0.495	0.075	147
Barium (Ba)	mg/kg	23.7	18.8	23
Beryllium (Be)	mg/kg	<0.20	<0.20	0
Bismuth (Bi)	mg/kg	<0.20	<0.20	0
Cadmium (Cd)	mg/kg	0.085	<0.050	52
Calcium (Ca)	mg/kg	1050	864	19
Chromium (Cr)	mg/kg	3.77	2.40	44
Cobalt (Co)	mg/kg	1.03	0.75	31
Copper (Cu)	mg/kg	7.32	3.82	63
Iron (Fe)	mg/kg	1,960	1,090	57
Lead (Pb)	mg/kg	0.88	0.64	32
Lithium (Li)	mg/kg	<5.0	<5.0	0
Manganese (Mn)	mg/kg	17.1	8.2	70
Molybdenum (Mo)	mg/kg	<0.50	<0.50	0
Nickel (Ni)	mg/kg	6.02	3.59	51
Selenium (Se)	mg/kg	1.01	0.36	95
Silver (Ag)	mg/kg	<0.10	<0.10	0
Strontium (Sr)	mg/kg	4.64	3.51	28
Thallium (Tl)	mg/kg	<0.050	<0.050	0
Tin (Sn)	mg/kg	<2.0	<2.0	0
Titanium (Ti)	mg/kg	2.2	<1.0	75
Uranium (U)	mg/kg	0.279	0.099	95
Vanadium (V)	mg/kg	4.45	1.53	98
Zinc (Zn)	mg/kg	9.1	5.9	43

Notes: The RPD was calculated using <LRL results at the LRL if one result in a duplicate pair was below the LRL. The RPD was not calculated if both results were <LRL. RPD = relative percent difference; % = percent; > = greater than; mm = millimetres; < = less than; µm = micrometres; mg/kg = milligrams per kilogram; LRL = Laboratory Reporting Limit.

Table B.8: Field Duplicate Results for Sediment Chemistry Analyses, September 2022

Constituent	Units	RG_GAUT		
		14-Sep-22		RPD (%)
		CG2213623		
Residual Metals				
Aluminum (Al)	mg/kg	7,710	13,700	56
Antimony (Sb)	mg/kg	0.76	0.32	81
Arsenic (As)	mg/kg	<5.00	6.6	28
Barium (Ba)	mg/kg	126	109	14
Beryllium (Be)	mg/kg	0.33	0.47	35
Bismuth (Bi)	mg/kg	<0.20	<0.20	0
Cadmium (Cd)	mg/kg	0.074	0.068	8.5
Calcium (Ca)	mg/kg	518	1,650	104
Chromium (Cr)	mg/kg	11.0	16.1	38
Cobalt (Co)	mg/kg	2.78	2.64	5.2
Copper (Cu)	mg/kg	12.6	13.4	6.2
Iron (Fe)	mg/kg	10,400	17,200	49
Lead (Pb)	mg/kg	6.99	5.13	31
Lithium (Li)	mg/kg	6.4	15.7	84
Manganese (Mn)	mg/kg	39.9	45.5	13
Molybdenum (Mo)	mg/kg	1.07	1.79	50
Nickel (Ni)	mg/kg	11.4	12.4	8.4
Selenium (Se)	mg/kg	0.35	0.24	37
Silver (Ag)	mg/kg	0.14	<0.10	33
Strontium (Sr)	mg/kg	20.8	11.3	59
Thallium (Tl)	mg/kg	0.145	0.282	64
Tin (Sn)	mg/kg	<2.0	<2.0	0
Titanium (Ti)	mg/kg	24.8	27.6	11
Uranium (U)	mg/kg	0.339	0.371	9.0
Vanadium (V)	mg/kg	28.6	29.1	1.7
Zinc (Zn)	mg/kg	59.9	57.1	4.8
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	mg/kg	0.167	<0.050	108
Acenaphthylene	mg/kg	<0.050	<0.050	0
Acridine	mg/kg	0.282	<0.050	140
Anthracene	mg/kg	<0.050	<0.050	0
Benz(a)anthracene	mg/kg	0.090	<0.050	57
Benzo(a)pyrene	mg/kg	0.060	<0.050	18
Benzo(b&j)fluoranthene	mg/kg	0.248	<0.050	133
Benzo(b+j+k)fluoranthene	mg/kg	0.248	<0.075	107
Benzo(g,h,i)perylene	mg/kg	0.094	<0.050	61
Benzo(k)fluoranthene	mg/kg	<0.050	<0.050	0
Chrysene	mg/kg	0.537	<0.050	166
Dibenz(a,h)anthracene	mg/kg	<0.050	<0.050	0
Fluoranthene	mg/kg	0.073	<0.051	37
Fluorene	mg/kg	0.395	<0.050	155
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.050	<0.050	0
1-Methylnaphthalene	mg/kg	2.38	0.031	195
2-Methylnaphthalene	mg/kg	4.65	0.046	196
Naphthalene	mg/kg	1.57	0.037	191
Phenanthrene	mg/kg	1.79	0.069	185
Pyrene	mg/kg	0.18	<0.050	113
Quinoline	mg/kg	<0.050	<0.050	0

Notes: The RPD was calculated using <LRL results at the LRL if one result in a duplicate pair was below the LRL. The RPD was not calculated if both results were <LRL. RPD = relative percent difference; % = percent; > = greater than; mm = millimetres; < = less than; µm = micrometres; mg/kg = milligrams per kilogram; LRL = Laboratory Reporting Limit.

B4.5 General Laboratory and Data Quality Flags

The analytical hold times for analysis of mercury and PAHs in bulk sediment samples from RG_GAUT on Gardine Creek and Greenhills Creek Sedimentation Pond were exceeded (see Appendix C). These samples were not located and logged immediately following receipt by the analytical laboratory.

B4.6 Data Quality Statement

Sediment quality data collected for the GC LAEMP in 2022 are of acceptable quality as characterized by good detectability, negligible constituent concentrations in method blanks, good laboratory precision, and excellent laboratory accuracy. Therefore, the associated data can be used to derive conclusions with confidence.

B5 BENTHIC INVERTEBRATE COMMUNITY

The analysis of benthic invertebrate community samples involved a concurrent assessment of data quality, including sub-sampling accuracy and precision and percent recovery of organisms. The analytical laboratories (ZEAS Inc. and Cordillera Consulting) provided laboratory data files and original QC reports for benthic invertebrate sample processing (see Appendix C).

All but one of the six benthic invertebrate community samples used to estimate sub-sampling precision met the DQO of ≤20% (i.e., estimated precision was within 22.3%; Appendix Table B.9). Organism densities (area-based samples) and individual counts (timed kick samples) were estimated for sub-sample fractions and compared to total values to estimate sub-sampling accuracy. Results for the sub-samples were within 16% of actual densities or organism counts; therefore, all sub-samples met the DQO of ≤20% for sub-sampling accuracy. Sizes of sub-sampled fractions range from 5% of a sample to a whole sample (Appendix Table B.10).

To measure the effectiveness of the sorters, 10% of samples were selected at random for re-sorting analysis by a different sorter. An average recovery rate of 96% was achieved for the six samples that were evaluated by ZEAS Inc. and the recovery rate for the single sample re-sort completed by Cordillera Consulting was 97% (Appendix Table B.11). All samples achieved the DQO for sorting efficiency (i.e., ≥90% recovery for area-based samples and ≥95%[3] for timed kick samples). Sorting efficiency (i.e., percent recovery) of benthic invertebrate samples was excellent.

Cordillera Consulting also completed blind checks on 10% of samples to assess rates of taxonomic misidentification, enumeration error, and errors due to questionable or insufficient taxonomic resolution. These checks are completed in accordance with Canadian Aquatic Biomonitoring Network (CABIN) protocols for assessing misidentification (Environment Canada 2012). The average total identification error rate, percent differences in enumeration and taxonomic disagreement, and Bray-Curtis Dissimilarity Index of checked samples were within DQO (i.e., ≤5% or 0.5 for Bray-Curtis Dissimilarity Index; Appendix Tables B.1 and B.12).

[3] Consistent with CABIN requirements (Environment Canada 2012).

Table B.9: Calculation of Benthic Invertebrate Community Sub-sampling Error, September 2022 [a]

Station	Whole Organisms	Number of Organisms in Fraction 1	Number of Organisms in Fraction 2	Number of Organisms in Fraction 3	Number of Organisms in Fraction 4	Number of Organisms in Fraction 5	Actual Density	Precision % range		Accuracy % range	
								Min	Max	Min	Max
Area-based Samples (ZEAS Inc.) [b]											
RG_GHBP-6	-	196	200	-	-	-	396	2.0	-	1.0	-
RG_GHFF-1	-	144	164	-	-	-	308	12.2	-	6.5	-
RG_GHUT-6	-	141	179	-	-	-	-	21.2	-	-	-
RG_GHP-6	-	262	276	289	337	-	1,164	4.5	22.3	0.7	15.8
RG_GHP-6	-	538	626	-	-	-	1,164	14.1	-	7.6	-
Timed Kick Samples (Cordillera Consulting)											
RG_GHDT-3	-	354	358	-	-	-	712	1.12	1.12	0.56	0.56

Highlighted values did not meet the DQO of ≤ 20%.

Notes: % = percent; min = minimum; max = maximum; - = no data/not applicable; DQO = data quality objective; ≤ = less than or equal to.

[a] The number of significant digits reported in the table is consistent with the laboratory reports.

[b] Whole large organisms were excluded from calculations.

Table B.10: Benthic Invertebrate Community Sample Fractions Sorted, September 2022

Station	Fraction Sorted [a]	Station	Fraction Sorted [a]	Station	Fraction Sorted [a]
Area-based Samples (ZEAS Inc.)					
RG_GHUT-1	1/4, 1/16 [b]	RG_GHDT-5	1/2	RG_GHBP-3	1/4
RG_GHUT-2	1/4	RG_GHDT-6	Whole	RG_GHBP-4	1/4
RG_GHUT-3	Whole	RG_GHFF-1	Whole [c]	RG_GHBP-5	1/2
RG_GHUT-4	1/2	RG_GHFF-2	Whole	RG_GHBP-6	Whole [c]
RG_GHUT-5	1/4	RG_GHFF-3	Whole	RG_GAUT-1	1/2
RG_GHUT-6	1/8 [d]	RG_GHFF-4	Whole	RG_GAUT-2	1/2
RG_GHNF-1	1/8	RG_GHFF-5	Whole	RG_GAUT-3	1/2
RG_GHNF-2	1/4	RG_GHFF-6	1/4	RG_GAUT-4	1/2
RG_GHNF-3	Whole	RG_GHP-1	1/4	RG_GAUT-5	Whole
RG_GHNF-4	1/16	RG_GHP-2	1/8	RG_GAUT-6	1/2
RG_GHNF-5	1/16	RG_GHP-3	1/2	RG_GANF-1	1/2
RG_GHNF-6	1/16	RG_GHP-4	1/4	RG_GANF-2	1/2
RG_GHDT-1	1/4	RG_GHP-5	Whole	RG_GANF-3	1/2
RG_GHDT-2	1/2	RG_GHP-6	Whole [c,e]	RG_GANF-4	1/2
RG_GHDT-3	Whole	RG_GHBP-1	1/2	RG_GANF-5	1/2
RG_GHDT-4	Whole	RG_GHBP-2	1/2	RG_GANF-6	Whole
Timed Kick Samples (Cordillera Consulting)					
RG_GHNF-1	1/5	RG_GHNF-5	1/20	RG_GHDT-3	Whole [c]
RG_GHNF-3	Whole	RG_GHDT-1	Whole	RG_GHDT-5	Whole

Note: µm = micrometre.

[a] Mesh sizes were 400 µm for all stations/samples except RG_GHP-1 through RG_GHP-6. These samples were collected from Greenhills Creek Sedimentation Pond and were sieved through a 500 µm mesh.

[b] Algae portion of sample sorted to 1/16; remaining sample sorted to 1/4.

[c] Two halves sorted for subsampling error calculations.

[d] Two sixteenths sorted for subsampling error calculations.

[e] Four quarters sorted for subsampling error calculations.

Table B.11: Percent Recovery of Benthic Invertebrates, September 2022

Station	Number of Organisms Recovered (initial sort)	Number of Organisms in Re-sort	Percent Recovery
Area-based Samples (ZEAS Inc.)			
RG_GANF-6	183	190	96%
RG_GHBP-6	378	396	96%
RG_GHDT-1	81	84	96%
RG_GHDT-5	135	145	93%
RG_GHNF-5	215	230	94%
RG_GHP-6	1,158	1,164	99%
		Average % Recovery	96%
Timed Kick Samples (Cordillera Consulting)			
QC Sample 1	322	331	97%

Highlighted values did not meet the DQO of ≥90% (ZEAS Inc.) or ≥95% (Cordillera Consulting).

Notes: % = percent; DQO = data quality objective; ≥ = greater than or equal to.

Table B.12: Calculation of Benthic Invertebrate Community Taxonomic Error, September 2022 [a]

Station	Taxa Identified	Error Rate (%)	Percent Difference in Enumeration (%)	Percent Taxonomic Disagreement (%)	Bray-Curtis Dissimilarity Index
Timed Kick Samples (Cordillera Consulting)					
RG_GHNF-3	346	0.00	0.28985507	0.57803468	0.00289855

Highlighted values did not meet the DQO of ≤5% or 0.05 for the Bray-Curtis Dissimilarity Index.

Notes: % = percent; DQO = data quality objective; ≤ = less than or equal to.

[a] The number of significant digits reported in the table is consistent with the laboratory report.

B6 BENTHIC INVERTEBRATE TISSUE CHEMISTRY

B6.1 Laboratory Reporting Limits

Benthic invertebrate tissue chemistry samples collected in February and September 2022 were analyzed by TrichAnalytics Inc. (Trich). The analytical reports (Appendix C) were examined to provide an inventory of constituents for which the sample results were less than the LRL. Additionally, LRLs for selenium were assessed relative to the 4 milligram per kilogram dry weight (mg/kg dw) guideline for British Columbia (BCMOECCS 2021a) and the most conservative (i.e., lowest) EVWQP benchmark (i.e., the 11 µg/g dw EVWQP Level 1 Benchmark for dietary effects to juvenile fish; Golder 2014).

All constituents except arsenic were detected in all samples collected in February and September 2022 (Appendix Table B.13). Specifically, arsenic was not detected in two (i.e., 7.1%) of the 28 benthic invertebrate tissue chemistry samples from September 2022. The LRLs for selenium were consistently less than the ENV/BCMOECCS guideline and the lowest EVWQP Level 1 Benchmark (Appendix Table B.13). Therefore, the achieved LRLs were considered appropriate for the study.

B6.2 Data Precision

Laboratory duplicate samples and recoveries of CRM (i.e., DORM-4, NIST-1566b, and NIST-2976) were used to assess laboratory precision (Appendix Table B.1; Appendix C). One and four laboratory duplicate samples were prepared and analyzed with the benthic invertebrate tissue chemistry samples collected in February and September 2022, respectively (Appendix C). All laboratory duplicate results met the DQO set by the analytical laboratory (Appendix Table B.1). The DQO for estimating precision of recoveries of CRM was set at a relative standard deviation (RSD) of ≤20%. Results were within the DQO (Appendix C). Therefore, laboratory precision for the benthic invertebrate tissue chemistry analyses completed by Trich are considered excellent and are of acceptable quality for this study.

B6.1 Data Accuracy

Data accuracy for the benthic invertebrate tissue chemistry samples was evaluated based on recoveries of CRM from four laboratory samples (i.e., one for February and three for September 2022; Appendix C). Each of the reported results for the four CRM samples met the DQO (Appendix Table B.1; see also Appendix C). Therefore, the accuracy achieved by analytical laboratory was considered excellent.

Table B.13: **Laboratory Reporting Limit Evaluation for Benthic Invertebrate Tissue Chemistry Analyses, 2022**

Constituent	Units	LRLs [a,b]		No. Sample Results <LRL[c]	
		February	September	February	September
Aluminum (Al)	mg/kg dw	0.022	0.063 to 0.087	0	0
Antimony (Sb)	mg/kg dw	0.047	0.003 to 0.004	0	0
Arsenic (As)	mg/kg dw	0.366	0.398 to 0.431	0	2 (7.1%)
Barium (Ba)	mg/kg dw	0.001	0.001	0	0
Boron (B)	mg/kg dw	0.060	0.060 to 0.107	0	0
Cadmium (Cd)	mg/kg dw	0.048	0.068 to 0.070	0	0
Calcium (Ca)	mg/kg dw	14	3.1 to 6.1	0	0
Chromium (Cr)	mg/kg dw	0.376	0.061 to 0.064	0	0
Cobalt (Co)	mg/kg dw	0.004	0.014 to 0.019	0	0
Copper (Cu)	mg/kg dw	0.004	0.018 to 0.029	0	0
Iron (Fe)	mg/kg dw	0.454	0.795 to 0.801	0	0
Lead (Pb)	mg/kg dw	0.002	0.001	0	0
Lithium (Li)	mg/kg dw	0.002	0.019 to 0.022	0	0
Magnesium (Mg)	mg/kg dw	0.015	0.062 to 0.078	0	0
Manganese (Mn)	mg/kg dw	0.009	0.008	0	0
Mercury (Hg)	mg/kg dw	0.023	0.022 to 0.027	0	0
Molybdenum (Mo)	mg/kg dw	0.001	0.001	0	0
Nickel (Ni)	mg/kg dw	0.038	0.001 to 0.052	0	0
Phosphorus (P)	mg/kg dw	39	60 to 88	0	0
Potassium (K)	mg/kg dw	1.2	2.4 to 2.8	0	0
Selenium (Se)	mg/kg dw	0.431	0.375 to 0.579	0	0
Silver (Ag)	mg/kg dw	0.001	0.001	0	0
Sodium (Na)	mg/kg dw	1.1	4.6 to 5.7	0	0
Strontium (Sr)	mg/kg dw	0.001	0.001	0	0
Thallium (Tl)	mg/kg dw	0.001	0.001	0	0
Tin (Sn)	mg/kg dw	0.018	0.020 to 0.022	0	0
Titanium (Ti)	mg/kg dw	0.125	0.001	0	0
Uranium (U)	mg/kg dw	0.001	0.001	0	0
Vanadium (V)	mg/kg dw	0.028	0.028 to 0.036	0	0
Zinc (Zn)	mg/kg dw	0.353	0.216 to 0.230	0	0

Shading indicates an LRL for selenium that is greater than the lowest applicable EVWQP Level 1 Benchmark (i.e., 11 µg/g dw) for dietary effects to juvenile fish (Golder 2014).

Shading indicates an LRL greater than the BCMOECCS interim selenium guideline for invertebrate tissue (4 µg/g dw; BCMOECCS 2021a).

Notes: LRL = Laboratory Reporting Limit; < = less than; mg/kg dw = milligrams per kilogram dry weight; % = percent; EVWQP = Elk Valley Water Quality Plan; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

[a] The number of significant digits reported in the table is consistent with laboratory reports.

[b] The LRLs for selenium were compared to the BCMOECCS interim guideline and EVWQP Level 1 Benchmark for dietary effects to juvenile fish (i.e., the most conservative benchmark); LRLs were consistently below guidelines/benchmarks. No other constituents had guidelines or EVWQP benchmarks for concentrations in benthic invertebrate tissues.

[c] Total n = 4 samples in February 2022 and total n = 28 samples in September 2022.

B6.2 Data Quality Statement

Benthic invertebrate tissue chemistry data collected for this study are of acceptable quality as characterized by excellent detectability, laboratory precision, and laboratory accuracy. Therefore, the associated data can be used with a high level of confidence in the derivation of conclusions.

B7 OVERALL DATA QUALITY STATEMENT

Overall, the quality of the data collected in support of the 2022 GC LAEMP is considered acceptable for derivation of conclusions related to the study questions described in the main report.

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APPENDIX C
WESTSLOPE CUTTHROAT TROUT

REPORT

Greenhills Creek 2022 Fish Population Monitoring

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23586694-001-R-Rev0

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The individuals listed below contributed to the preparation of this report.

Name	Title	Organization	Role
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Suggested Citation: WSP Canada Inc. and Poisson Consulting Ltd. 2023. Greenhills Creek 2022 Fish Population Monitoring. Report prepared for Teck Coal Ltd., Sparwood, BC. 40 pages.

Executive Summary

Greenhills Operations (GHO) is a steel-making coal mine operated by Teck Coal Limited (Teck) in the Fording River watershed in southeast British Columbia. Greenhills Creek is a tributary of the upper Fording River that is located in and adjacent to the southern portion of GHO. The Greenhills Creek sedimentation pond divides this tributary into two sections. Downstream of the pond, water flows down a spillway, through a decant channel, and through a culvert with a duckbill outlet into lower Greenhills Creek, which flows a further 0.58 km to the upper Fording River. Upper Greenhills Creek extends approximately 5 km upstream of the sedimentation pond and has a 2 km-long tributary called Gardine Creek.

The only fish species present in the Greenhills Creek watershed is Westslope Cutthroat Trout (WCT; *Oncorhynchus clarkii lewisi*). Lower Greenhills Creek is accessible to the population of WCT in the upper Fording River up to the fish barrier at the duckbill culvert. WCT in upper Greenhills Creek and Gardine Creek were originally part of the population in the upper Fording River but were isolated by the construction of the sedimentation pond in the early 1980s.

Monitoring of WCT in Greenhills Creek occurs as part of Teck's WCT monitoring program in the upper Fording River and other Teck monitoring programs such as the Greenhills Creek Local Aquatic Effects Assessment and Monitoring Program (LAEMP; formerly Greenhills and Gardine Creek Aquatic Effects Monitoring Program – GGCAMP). In 2022, data collection included spawning (redd) surveys, backpack electrofishing surveys to estimate juvenile densities, and night-time dip-net surveys to collect information about the size of age-0 WCT. WCT data collected in Greenhills Creek were analyzed as part of the overall population monitoring program for the upper Fording River. The objective of this report is to describe the 2022 fish population monitoring results specific to the Greenhills Creek watershed.

During the 2022 spawning surveys, redds were observed in lower and upper Greenhills Creek and Gardine Creek but the estimated total number of unique nests was low (*n*=9). Estimated densities of juvenile (age-1 and age-2+ less than 200 mm fork length) WCT were greater in lower Greenhills Creek and Gardine Creek than in upper Greenhills Creek. The inconsistent number and location of sites sampled each year made it difficult to assess temporal trends but the electrofishing data did not suggest any substantial changes or sustained trends in the density of age-1 or age-2+ WCT in upper Greenhills Creek, Gardine Creek, or lower Greenhills Creek.

The model-estimated mean length of age-0 WCT was larger in lower Greenhills Creek (64 mm) than all other monitored tributaries and portions of the upper Fording River watershed (23 to 53 mm). Age-0 WCT were not captured upstream of the sedimentation pond but age-1 WCT in upper Greenhills Creek were estimated to be smaller (50 to 89 mm) than those captured in lower Greenhills Creek (75 to 114 mm) based on visual examination of the data. The larger size of age-0 and age-1 WCT in lower Greenhills Creek, when compared to other monitored portions of the upper Fording River watershed, was attributed to higher water temperatures downstream of the Greenhills Creek sedimentation pond, as the number of degree-days during the growing season appears to be greater than nearly all other monitored portions of the upper Fording River watershed.

The length-at-age of age-2 and older WCT and the length-at-maturity are uncertain for WCT in Greenhills Creek and the upper Fording River population. These uncertainties currently limit or bias estimation of vital rates, which are egg deposition (spawning), growth, and survival. Monitoring methods that could help reduce uncertainties in population metrics and vital rates include: 1) scale ageing; 2) continued PIT-tagging to improve understanding of growth, movement, and survival; and, 3) recording the estimated size of spawners observed during spawning surveys to inform length-at-maturity.

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FIGURES

1.0 INTRODUCTION

Greenhills Operations (GHO) is a steel-making coal mine operated by Teck Coal Limited (Teck) in the Fording River watershed in the Elk Valley in southeast British Columbia. Greenhills Creek is a tributary of the upper Fording River that is located in and adjacent to the southern portion of GHO (Figure 1). Lower Greenhills Creek is the 0.6 km[1] section of the tributary between its confluence with upper Fording River and the culvert and spillway at the downstream end of the Greenhills Creek sedimentation pond. Upper Greenhills Creek is defined as the portion of the tributary upstream of the sedimentation pond.

The only fish species present in upper and lower Greenhills Creek is Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*), which is listed as a species of Special Concern provincially (Government of BC 2023) and under the federal Species-At-Risk Act (COSEWIC 2016). Lower Greenhills Creek is accessible to the population of Westslope Cutthroat Trout (WCT) in the upper Fording River, which is an isolated population upstream of Josephine Falls, a natural barrier to upstream fish movement. WCT are also present in the Greenhills Creek sedimentation pond and in upper Greenhills Creek and can move between these two habitats. Infrastructure at the outlet of the sedimentation pond includes a spillway that discharges water into a stilling basin (a 2 m deep concrete-walled portion of channel designed to dissipate energy; Minnow 2021). Downstream of the stilling basin, water flows through a culvert with a duckbill outlet that is intended to prevent upstream movement of WCT from lower Greenhills Creek (AJM 2022). Upper Greenhills Creek provides approximately 5 km of habitat for WCT upstream of the sedimentation pond (Cloutier et al. 2023) and Gardine Creek, a tributary of upper Greenhills Creek, provides an additional approximately 2 km of habitat (KNRC 2007). WCT in lower Greenhills Creek are considered part of the upper Fording River population whereas WCT upstream of the culvert/spillway barrier are considered an isolated population.

Monitoring of the upper Fording River WCT population has occurred in most years since 2012 (Cope 2020; Thorley et al. 2022a). A variety of sampling methods are used to collect data in the upper Fording River and in fish-bearing tributaries (Thorley et al. 2022b). In 2022, WCT data collection included sites in lower and upper Greenhills Creek and in Gardine Creek. Fish population data from the Greenhills Creek watershed are analyzed and included as part of the overall population monitoring program for the upper Fording River (Thorley et al. 2023b) but are not specifically highlighted or summarized in that program's annual report. The objective of this report is to describe the 2022 fish population monitoring results specific to the Greenhills Creek watershed. Where data from previous years are available, trends in the fish population over time are assessed.

A conceptual framework to guide monitoring and improve understanding of Teck's actions (i.e., mining-related activities as well as habitat compensation) on fish and fish habitat is currently in development (Thorley et al. in preparation). The framework describes the potential pathways of effect from actions to fish habitat, which can influence the vital rates of fish populations (growth, survival, reproduction, and movement), which in turn affect changes in the abundance of fish over time (i.e., the population dynamics). The framework includes 10 guiding questions regarding the biology of fish populations (Table 1). Information collected to answer these questions can be used to understand population characteristics, estimate vital rates, and provide inputs for modelling of population dynamics in the future. This report summarizes the 2022 fish population monitoring results in the Greenhills Creek watershed in terms of the 10 guiding questions.

[1] The stream network and river kilometres used in this report are based on Teck's GIS stream network

Table 1: Questions about the fish population that were used to frame the 2022 monitoring results.

Population Characteristics: Questions about the fish population that are relatively constant across years
1) What is the geographic range of the fish population?
2) What is the genetic diversity and effective genetic population size?
3) What are the life history strategies within the fish population?
4) What is the timing of life history events?
5) What are the sizes of the key life stages?
Vital Rates and Associated Endpoints: Questions about the fish population that can vary by year
6) What is the growth rate of key life stages?
7) What is the spatial distribution of key life stages?
8) What is the abundance of key life stages?
9) What is the total number of eggs deposited?
10) What is the survival of key life stages?

Note: Questions are from Teck's Fish Framework (Thorley et al., in preparation) and are described in Golder et al. (2022)

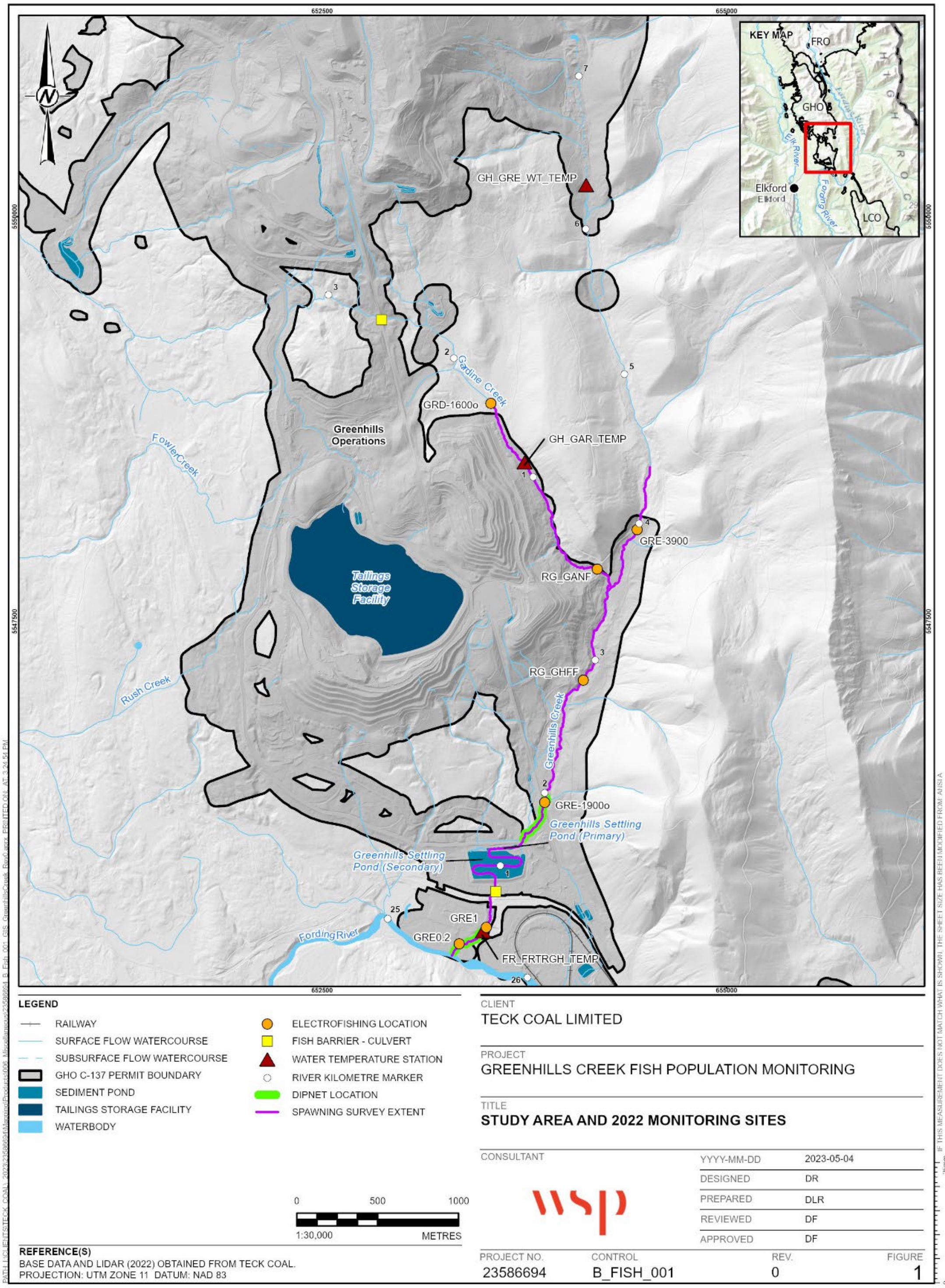

Figure 1: Map of study area and locations of fish population monitoring sites sampled in 2022.

2.0 METHODS

2.1 Overview

Data collection and analysis followed the study design for the 2022 upper Fording River WCT monitoring program (Thorley et al. 2022b). Alignment with the WCT population monitoring standards and protocols in 2021 and 2022 allows for comparability with other Teck Coal regional fish monitoring programs. Data were collected as part of the upper Fording River WCT program and other Teck monitoring programs such as the Greenhills Creek Local Aquatic Effects Assessment and Monitoring Program (LAEMP; formerly Greenhills and Gardine Creek Aquatic Effects Monitoring Program – GGCAMP). Data collection in the Greenhills Creek watershed in 2022 included a spawning survey, backpack electrofishing, a night-time dip-net survey, and snorkeling observations near infrastructure downstream of the sedimentation pond (Table 2). Spawning surveys were used to estimate the total number of nests and assess the timing and locations of spawning. Backpack electrofishing was used to estimate the densities of juvenile fish including age-1 and age-2+ life stages. The age-2+ life stage refers to fish from age-2 (i.e., third year of life) until they reach the adult body form, which was assumed to be at a fork length of 200 mm. Night-time dip-net surveys were used to target age-0 fish.

Downstream snorkel surveys are used to enumerate adult WCT in the upper Fording River and selected larger tributaries (Thorley et al. 2022b). Greenhills Creek is not typically included in these downstream snorkel survey because of its shallow depth; however, one exception was that in 2022, the plunge pool at the outlet of the duckbill culvert in lower Greenhills Creek was snorkeled during the survey. In addition, visual observations and counts of WCT in the duckbill plunge pool and in the stilling basin and decant channel between the culvert and spillway were conducted as part of effectiveness monitoring. A summary of snorkeling and visual observations in these areas is included in this report.

Results in this report focus on the 2022 monitoring year, but data from previous study years were included where possible to assess recent trends over time. Historic data will continue to be incorporated into the standardized database and will be included in future analyses when possible.

Table 2: Summary of fish monitoring methods used in Greenhills Creek in 2022.

Method	Type of Data and Life Stage Targeted	Location
Spawning (redd) survey	Number of redds/nests, and timing and location of spawning by mature adults	▪ 0.6 km of lower Greenhills Creek ▪ 2.8 km of upper Greenhills Creek ▪ 1.6 km of Gardine Creek
Backpack electrofishing survey	Abundance of juvenile fish (age-1 and age 2+)	▪ Three small, closed locations (GRE1 [RG_GHBP]*, RG_GHFF, and RG_GANFF) ▪ Three large, open sites (GRE0.2 [GH_GH2]*, GRE-1900o, and GRD-1600o [RG_GAUT]*) ▪ One closed site from a fish salvage (GRE-3900)

Method	Type of Data and Life Stage Targeted	Location
Night-time dip-net survey	Size of age-0 fish near the end of the growing season	■ Lower and upper Greenhills Creek
Snorkeling and visual observations	Number of juvenile, subadult, and adult fish	■ Plunge pool at the outlet of the duckbill culvert (during effectiveness monitoring of the duckbill and during the upper Fording River WCT snorkel survey) ■ Stilling basin and decant channel between culvert and spillway from sedimentation pond (during effectiveness monitoring)

* Site names in brackets refer to the corresponding site name from the LAEMP or GGCAMP at the same location

2.2 Spawning (Redd) Survey

Redds are disturbances in the gravel due to spawning activity. Redds may contain multiple nests where fish deposit eggs. Spawning surveys are conducted to count the number of nests and the data are used to estimate the total number of nests, as well as the timing and spatial distribution of spawning. In 2022, spawning surveys were conducted approximately weekly in the Greenhills Creek watershed between early June and early August. Areas surveyed were the entire 0.6 km of lower Greenhills Creek, the 2.8 km of upper Greenhills Creek upstream of the sedimentation pond (from river kilometre 1.3 to 3.1), and 1.6 km of Gardine Creek. Spawning survey data from 2021 are also included in this report.

Spawning surveys followed Teck's standard protocol for monitoring spawning near Teck sites (Smit et al. 2022). Spawning surveys were conducted by a crew of two observers walking in an upstream direction with one observer on each bank. All suitable spawning gravels were visually inspected for spawning-related disturbances. A single nest or aggregation of nests was considered a redd. Each nest was classified as "definitive", which are nests with a distinct pit upstream of a loose mound of clean pebbles and gravels, or "potential", which includes test digs by females to evaluate the substrate, or older nests that are no longer distinct. For each redd, the time, spatial coordinates, number of potential and definitive nests within the redd, and the number of adult fish associated with the redd were recorded. Data recorded regarding sampling effort and conditions included the following:

- date and time of the start and end of the survey
- GPS coordinates of the start and end location of the survey
- water temperature and turbidity at the start and end location of the survey
- estimated length of stream that could not be sampled

2.3 Backpack Electrofishing Survey

Backpack electrofishing is the primary method used to monitor the abundance of juvenile fish (age-1 and age2+). Two types of electrofishing surveys were conducted: removal-depletion at small, closed sites, and mark-recapture at large, open sites. Removal-depletion at small, closed sites was used in previous years between 2013 and 2021 during the LAEMP/GGCAMP program. Mark-recapture at large, open sites began in 2021 to address potential bias and limitations of the previous method. Small, closed sites were index sites that were sampled in consecutive years whereas the locations of large, open sites were randomly selected each year using a stratified approach. For both types of electrofishing, a single electrofishing pass was conducted at all sites, with additional passes conducted at a subset of sites to allow estimates of capture efficiency and therefore absolute abundance. Capture efficiency was estimated using removal-depletion for small, closed sites and mark-recapture methods for large, open sites. The combination of two electrofishing methods used in 2021 and 2022 allows comparison to previous years of data that used only small, closed sites, while reducing bias by sampling a greater portion of the study area with large, open sites.

In 2022, backpack electrofishing was conducted in Greenhills Creek watershed on 24 August and 1 and 2 September (Table 3). Methods for the two types of electrofishing followed Teck's protocol (Thorley et al. 2022c) and are summarized below. In the analysis, backpack electrofishing data from 2013 to 2022 were used.

Table 3: Summary of electrofishing sites sampled in 2022.

Stream	Site Name	LAEMP / GGCAMP Site Name	Location (km[a])	Date Sampled	Site Type	Number of Passes	Site Length (m)	Average Site Width (m)
Lower Greenhills	GRE0.2	GH_GH2	0.120	24 August	Open	1	293	1.5
Lower Greenhills	GRE1	RG_GHBP	0.315	2 September	Closed	1	100	1.0
Lower Greenhills	GRE1	RG_GHBP	0.315	2 September	Closed	1	24	2.0
Lower Greenhills	GRE1	RG_GHBP	0.315	2 September	Closed	1	38	3.0
Upper Greenhills	GRE-1900o	n/a	1.930	1 September	Open	2	295	2.9
Upper Greenhills	RG_GHFF	RG_GHFF	2.845	1 September	Closed	2	40	3.0
Upper Greenhills	RG_GHFF	RG_GHFF	2.845	2 September	Closed	2	35	3.0
Upper Greenhills	RG_GHFF	RG_GHFF	2.845	2 September	Closed	2	45	3.0
Upper Greenhills	GRE-3900[b]	n/a	3.955	22 August	Closed	1	25	3.0
Gardine	RG_GANF	RG_GANF	0.190	1 September	Closed	2	50	2.0
Gardine	RG_GANF	RG_GANF	0.190	1 September	Closed	2	60	2.0
Gardine	RG_GANF	RG_GANF	0.190	1 September	Closed	2	50	2.0
Gardine	GRD-1600o	RG_GAUT	1.585	1 September	Open	2	292	0.7

a. km refers to the distance upstream from the tributary mouth.

b. Site GRE-3900 was a fish salvage site that was not part of the small, closed sites from the upper Fording River WCT population monitoring program. Data from the first electrofishing pass from this salvage site were used in this report.

2.3.1 Removal-Depletion at Small Closed Sites

Three small, closed sites were sampled in 2022. The sites sampled were GRE1 in lower Greenhills Creek, GHFF in upper Greenhills Creek, and RG_GANFF in Gardine Creek. At each of the three sites, three single mesohabitat units (pool, riffle, glide, or cascade) of approximately 10 to 35 m in length (approximately 100 m^2 in wetted area) were sampled. Mesohabitats were isolated (closed) using stop nets at the upstream and downstream boundaries. Within each mesohabitat, all habitat was sampled by a crew of three, including one operator, one active netter with a dip-net, and a second, passive netter using a pole seine. Each electrofishing pass started at the downstream net and moved upstream in a systematic bank to bank sweep.

For the overall upper Fording River WCT monitoring program, the approach was to conduct an initial single electrofishing pass at all the mesohabitats (three per site), an additional second pass at a randomly selected subset of sites, and a third pass at a randomly selected subset of sites. In the Greenhills Creek watershed, one pass was conducted at GRE1 and two passes were conducted at RG_GANFF and RG_GHFF.

Captured fish were held in a dark-coloured bucket with fresh aerated stream water until all electrofishing passes and fish processing were complete. Fish were released in slow velocity habitat in their capture site. The total number of fish observed but not captured was also recorded for each pass.

In addition to the small, closed sites described above, data from a fish salvage at site GRE-3900 were used in the analyses. Only data from the first electrofishing pass of the salvage were used. As the site was isolated using block nets, the site was considered a closed site, but only one 25 m by 3 m area was fished and not three mesohabitats like in the closed sites for population monitoring.

2.3.2 Mark-Recapture at Large Open Sites

Electrofishing of large, open sites was used to increase the proportion of the accessible habitat sampled by electrofishing. The method consisted of a single open (without stop nets) pass at long (approximately 300 m) sites. Sites were selected using stratified random sampling. To ensure all tributaries and segments of interest were sampled, the following strata were used:

- Lower Greenhills Creek (known as Reach 1)
- Upper Greenhills Creek (reaches 3 and 4 combined)
- Gardine Creek

One large open site from each of these strata was randomly selected in 2022. The selected sites were the following:

- GRE-100o in lower Greenhills Creek, located 0.1 km from the confluence with the upper Fording River, which was in a similar location as GRE0.2, which was sampled in previous years
- GRE-1900o in upper Greenhills Creek, located 1.9 km upstream from the confluence with the upper Fording River
- GRD-1600o in Gardine Creek, located 1.6 km from its confluence with upper Greenhills Creek

During electrofishing passes, three crew members (one operator, one active netter with a dip-net, and one passive netter with a pole seine) sampled in an upstream direction starting at the downstream end of the site. The fourth and fifth crew members processed captured fish while the rest of the crew electrofished and recorded data, including the start and end locations and times, and the locations and times of all captured fish. This method of processing while sampling and recording individual fish locations has several advantages, including the following:

- It provides data regarding the fine-scale distribution of fish in each section
- Fish can be released close to (within approximately 5 m of) their capture location, which may reduce stress and the chance of displacement of fish

In addition to captured fish, the total number of fish observed but not captured was recorded. Fish processing and data collection was the same as for small, closed sites, as described in the section below.

At a subset of randomly selected sites in the upper Fording River watershed, a second pass was conducted on the following day to allow estimation of capture efficiency from data from recaptured fish (Section 2.7.7). In the Greenhills Creek watershed, one pass was conducted at GRE0.2 (GRE-100o) and two passes were conducted at GRE-1900o and GRD-1600o.

2.3.3 Fish Processing

Fish processing followed the protocol (Thorley et al. 2022c) and the 2022 study design (Thorley et al. 2022b). All captured fish were measured for fork length to the nearest 1 mm, weighed to the nearest 0.1 g, scanned for a Passive Integrated Transponder (PIT) tag (if larger than 99 mm), and photographed. A PIT tag was inserted into all uninjured fish greater than or equal to 100 mm. Fish were inspected for any deformities, erosion, lesions, or tumours (DELT) and the information was recorded using the DELT categories and scale from Ings and Weech (2020), which is consistent with the methods in the study design for the 2021 to 2023 Regional Aquatics Effects Monitoring Program. Processed fish were allowed to recover before being released as close to their capture location as possible, preferably near cover and in slow moving water.

2.4 Night-Time Dip-Net Survey

Due to their small size and patchy distribution, age-0 WCT are rarely caught during fall backpack electrofishing surveys. The size of age-0 WCT has been linked to overwintering survival, particularly in cold, headwater streams (Coleman and Fausch 2007a, 2007b). Age-0 fish in the stream margins were captured using hand nets during the dip-net surveys to gather information on the size of age-0 WCT near the end of the growing season. Age-1 fish in stream margins were not the main target but were occasionally captured. In addition to information about size-at-age, the surveys provided limited information on the spatial distribution of age-0 and age-1 fish (occupancy but not relative density).

The dip-net survey was conducted in lower Greenhills Creek on October 13, 2022 (Figure 1). The location and estimated body length were recorded for all observed WCT. Fish approximately 100 mm or less were captured using a hand net where possible and were measured and photographed before being released at their location of capture. A subset of five fry were weighed to the nearest 0.01 g.

The measured lengths of captured age-0 fish and the estimated lengths of observed age-0 fish were used in the length-at-age analyses (Section 2.7.4). The relationship between water temperature and the size of age-0 WCT will be presented in a separate report (Brooks et al. in preparation).

2.5 Snorkeling and Visual Observations

Downstream snorkel surveys were used to enumerate adult WCT in the upper Fording River and selected larger tributaries from 2012 to 2022. Historically, snorkel surveys were not conducted in Greenhills Creek, but in 2022 the plunge pool at the outlet of the duckbill culvert was assessed while conducting the downstream snorkel survey for the upper Fording River WCT monitoring program. Data from the plunge pool were not included in the analysis of downstream snorkel data for the analysis in the upper Fording River WCT monitoring program but are included in this report.

Effectiveness monitoring of the duckbill culvert fish barrier was conducted on 16 occasions between October 2020, when the duckbill culvert outlet was installed, and September 2022 (AJM 2022). Objectives of effectiveness monitoring were to assess the following: 1) fish presence/absence within or adjacent to GHO infrastructure; 2) habitat conditions in Greenhills Creek at the duckbill outlet; and 3) general condition and functionality of the duckbill. Data included in this report are the counts of WCT from snorkeling and stream-side visual observations in the plunge pool of the duckbill culvert outlet and in the Greenhills sedimentation pond decant channel, stilling basin, and a naturalized section of stream located between the spillway and culvert.

Although the plunge pool appears to provide habitat for a substantial number of WCT (AJM 2022), this area has not typically been sampled as part of the upper Fording River population monitoring program. Therefore, counts of WCT from the downstream snorkel survey and effectiveness monitoring were included in this report as an indicator of fish abundance in this portion of Greenhills Creek.

2.6 Water Temperature

Water temperature data from three stations were used in this report (Figure 1), including one station in lower Greenhills Creek (FR_FRTRGH), one station in upper Greenhills Creek (GH_GAR), and one station in Gardine Creek (GH_GAR). Water temperature data were summarized to support the interpretation of fish population data, as water temperature is known to influence vital rates (e.g., growth and survival) of WCT in the upper Fording River watershed (Evaluation of Cause Team 2021). Water temperature data were used to calculate the growing season degree-days (GSDD) as described in Brooks et al. (2022). As in Coleman and Fausch (2007a), the start of the growing season was defined as "*the beginning of the first week that average stream temperatures exceeded and remained above 5°C for the season*" and the end of the growing season was defined as "*the last day of the first week that average stream temperature dropped below 4°C*". GSDD was calculated as the sum of daily average temperatures during the growing season.

Water temperature data were not available for the entire growing season at any of the three stations. At the station in lower Greenhills Creek (FR_FRTRGH), only the last few days of the growing season were missing and the missing data were estimated using linear extrapolation based on the relationship between local air temperature[2] and available water temperature data at this station. For the other two stations, data from a significant portion of the growing season were missing so GSDD was not estimated. Because GSDD could not be estimated at two of three stations, the mean water temperature during August was used as an additional metric to compare growing conditions between areas of the Greenhills Creek watershed.

2.7 Data Analysis

Data compilation and analysis were completed as part of the upper Fording River WCT monitoring program by Poisson Consulting Ltd. Methods are summarized here and additional details are provided in the online analytic appendix (Thorley et al. 2023a). All monitoring summarized for Greenhills Creek is in alignment with the WCT population monitoring program in 2021 and 2022 and Teck's regional fish monitoring standards and protocols to allow for comparability between locations.

2.7.1 Data Preparation

The historical (pre-2020) fish population data were provided to Poisson Consulting Ltd. by Teck Coal Ltd. as an assortment of Excel spreadsheets and shape files. The 2020 and 2021 field data were provided by Lotic Environmental Ltd. as Excel spreadsheets, gpx files, and kmz files, and by Ecofish Research Ltd. as Excel spreadsheets. The 2022 data were provided by Teck Coal Ltd. as geodatabase files from Teck's internal fish database. A spatial layer of the stream network was also provided by Teck as a geodatabase. All available years of data were extracted and cleaned (i.e., checked for errors and corrected if possible) and tidied (i.e., manipulated into a consistent format) before being stored in a purpose-built SQLite database using R version 4.2.2 (R Core Team 2022).

2.7.2 Statistical Analysis

Model parameters were estimated using Bayesian methods. The estimates were produced using JAGS (Plummer 2003) and STAN (Carpenter et al. 2017; Thorley et al. 2022b). For additional information on Bayesian estimation, the reader is referred to McElreath (2020). Unless stated otherwise, the Bayesian analyses used weakly informative normal and half-normal prior distributions (Gelman et al. 2017). The posterior distributions were estimated from 1,500 Markov Chain Monte Carlo (MCMC) samples thinned from the second halves of three chains (Kery and Schaub 2011). Model convergence was confirmed by ensuring that the potential scale reduction factor, $\hat{R}$, was ≤ 1.05 (Kery and Schaub 2011) and the effective sample size (Brooks et al. 2011), ESS, was ≥ 150 for each of the monitored parameters (Kery and Schaub 2011).

[2] Daily, local air temperatures were obtained from https://daymet.ornl.gov/

The parameters are summarised in terms of the point estimate, lower and upper 95% compatibility limits (CLs) (Rafi and Greenland 2020) and the surprisal s-value (Greenland 2019). The estimate is the median (i.e., 50th percentile) of the MCMC samples while the 95% CLs are the 2.5th and 97.5th percentiles. The range between the upper and lower CL is referred to as the compatibility interval (CI).

The results are displayed graphically by plotting the modeled relationships between an explanatory variable and the response variable with the remaining variables held constant. In general, continuous and discrete fixed variables are held constant at their mean and first level values, respectively, while random variables are held constant at their average values (expected values of the underlying hyperdistributions) (Kery and Schaub 2011).

The analyses were implemented using R version 4.2.2 (R Core Team 2022) and the mbr family of packages.

For the purposes of data analysis, the term subpopulation refers to a subgroup of the WCT population in the upper Fording River (Thorley et al. 2023b). Subgroups are defined for different sections of streams. The sections were chosen to identify groups of fish that can be treated as having similar growth, survival, reproduction and/or movement for modeling purposes based on the current understanding of habitat (physical, chemical, and biological). As such, the subpopulation reflect life stage(s) and vital rate(s) under consideration as well as the presence of fish barriers and available data. For Greenhills Creek, upper Greenhills Creek and Gardine Creek were considered a single subpopulation and lower Greenhills Creek was a subpopulation.

2.7.3 Spawning (Redd) Survey

2.7.3.1 Redd Fading

In 2021, a subset of redds in the upper Fording River watershed were flagged and their visibility in subsequent surveys that year was recorded. These data were used to estimate the number of days until 50% of redds/nests had become invisible based on an exponential model. The time period when redds/nests remained visible was subsequently used to estimate the total expected nest count in a particular area each year (Section 2.7.3.2).

The key assumption of the redd fading model is the following:

- The daily probability of fading is constant.

2.7.3.2 Nest Count

To estimate the total number of unique nests in each year and stream segment, the nest counts were analyzed using a hierarchical Bayesian Area-Under-the-Curve (AUC) model (Hilborn et al. 1999; Su et al. 2001).

Key assumptions of this nest count model include the following:

- Nest count varies randomly by segment within stream within year.
- Spawning activity (i.e., the timing of spawning) is normally distributed.
- Nests are visible for approximately 19 days.
- The variation around the expected nest count is normally distributed.

2.7.4 Length-at-Age

The lengths of age-0 fish in the upper Fording River watershed were analyzed using a generalized linear mixed effects model. The analysis used all age-0 fish captured by electrofishing and night-time dip-net surveys.

Key assumptions of the length-at-age model include the following:

- Fork length varies by day of the year of capture.
- Fork length varies randomly by subpopulation and year.
- The residual variation in the fork lengths is as described by student's t distribution truncated at 18 mm.
- The standard deviation of the normal component of the residual variation varies by observation vs capture.

Preliminary analysis indicated that observation vs capture was not an informative predictor of fork length.

2.7.5 Body Condition

For fish captured by electrofishing, the length and weight data for individuals between 90 and 169 mm were analyzed using a weight-length model (He et al. 2008). The model was based on the allometric relationship, $\mathrm{W} = \alpha \mathrm{L}^{\beta}$, where W is the weight (mass), α is the coefficient, β is the exponent, and L is the fork length. The relationship was transformed using the natural logarithm to linearize the relationship, resulting in the equation: $\log(W) = \log(a) + b \times \log(L)$.

Key assumptions of the condition model include the following:

- α can vary randomly by year, subpopulation and subpopulation within year.
- The residual variation in weight is log-normally distributed.

Preliminary analysis indicated that day of the year was not an informative predictor of α .

Results of the body condition analysis were plotted in terms of the percent change in the predicted body weight of a 100 mm fish relative to a typical subpopulation in typical year.

2.7.6 Length Frequency

Length frequency histograms were used to visualize the size structure of WCT captured by electrofishing and to help identify length cutoffs between life stages. Length cutoffs were identified visually from the histograms using professional judgement. It was assumed that age-0, age-1, and age-2+ could be identified by non-overlapping length distributions in the histograms. All fish greater than or equal to 200 mm in fork length were considered a single life stage grouping consisting of both subadult and adult fish. All fish greater than the maximum length of age-1 fish and less than 200 mm were considered age-2+.

Data from 2013 to 2022 were used in the analysis. For plotting purposes, data were grouped for the period before (2013 to 2017) and after (2019 to 2022) the large decrease in the abundance of subadult and adult WCT that occurred in the upper Fording River between 2017 and 2019 (Evaluation of Cause Team 2021).

2.7.7 Density

The electrofishing data were analyzed using a hierarchical Bayesian removal model (Wyatt 2002). The model estimated capture efficiency using removal-depletion data from the subset of small, closed sites that received more than one electrofishing pass. Capture efficiency was used in the model to estimate the absolute density of fish at each site. Density was estimated separately for the age-1 and age-2+ life stages. Densities were calculated per unit of stream length (lineal density) instead of per unit of area (areal density). Lineal density is preferred over areal density because fish are typically concentrated in specific parts of the stream cross-section rather than evenly distributed throughout the area, which makes fish densities better described by length rather than area. Additionally, area-based densities will fluctuate with stream discharge, whereas lineal based densities do not.

For the purpose of estimating changes in density over time, the subpopulations were assigned to one of three groupings: mainstem, tributary, and below-pond tributary (lower Greenhills, Lake Mountain, Fish Ponds, and lower Henretta creeks). This was done to allow overall comparisons of mainstem and tributary habitats and to allow temporal trends to differ between the three subpopulation groupings.

Key assumptions of the density model include the following:

- Lineal density varies by subpopulation grouping.
- Lineal density varies randomly by year, subpopulation, location, and subpopulation grouping within year.
- The number of fish at each site in each year is described by an over-dispersed Poisson distribution.
- The capture efficiency varies with the electrofishing effort, subpopulation grouping and method.
- The catch on each pass is binomially distributed.

3.0 RESULTS

3.1 Spawning (Redd) Survey

In 2022, 11 definitive nests were observed, of which 5 were in lower Greenhills Creek, 5 were in upper Greenhills Creek, and 1 was in Gardine Creek (Table 4). In 2021, 47 nests were observed in lower Greenhills Creek, while only 2 were observed in upper Greenhills Creek and none were observed in Gardine Creek. Few definitive nests were observed in 2020 with 3 counted in upper Greenhills Creek and 2 counted in lower Greenhills Creek. In the three years combined, the spatial distribution of definitive nests showed that spawning occurred throughout lower Greenhills Creek and was limited to a short section of upper Greenhills Creek, 2.4 to 3.0 km upstream of the stream's confluence with the upper Fording River (Figure 2). The single definitive nest observed in Gardine Creek was located approximately 200 m upstream from the confluence with upper Greenhills Creek.

Based on the redd fading model using data from the upper Fording River, 50% of redds/nests would no longer be visible after 18.8 days (CI: 14.4–24.8 days).

Table 4: The total number of definitive nests counted across all surveys by year and stream.

Year	Lower Greenhills Creek	Upper Greenhills Creek	Gardine Creek
2020	2	3	-
2021	47	2	0
2022	5	5	1

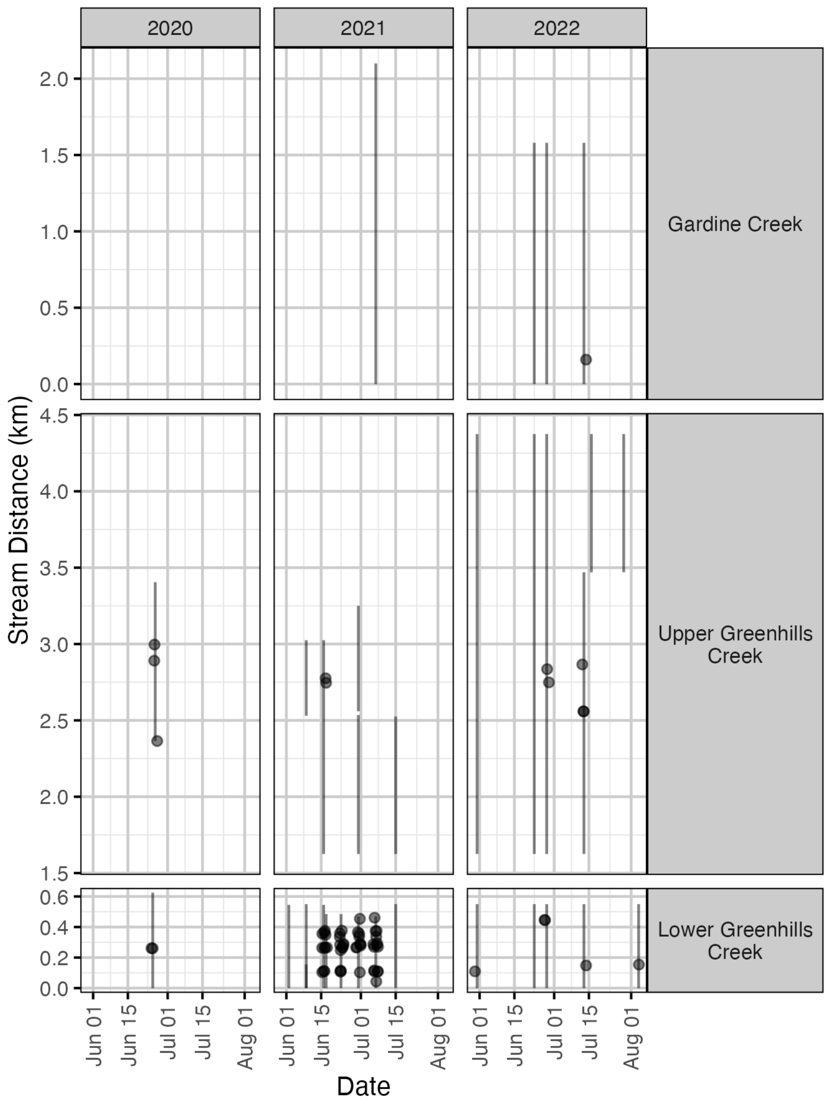

Figure 2: Definitive nests in Greenhills and Gardine Creek by stream distance, date, and year. Visits are indicated by vertical lines. Points are partially transparent and jittered to better convey information on density.

Because of the single survey date and different methods used in 2020, only data from 2021 and 2022 were used to assess the timing of spawning and to estimate the total count of unique nests. The timing of spawning was similar between subpopulations and years (2021 and 2022), with most nests observed between mid-June and mid-July. Spawning continued later in many of the tributaries, including Greenhills Creek, when compared to the upper Fording River (Figure 3). Based on the AUC model (Figure 3), the estimated expected total count of unique nests in lower Greenhills Creek was 8 in 2022 and 20 in 2021 (Figure 4). The estimated total count of unique nests in lower Greenhills Creek was similar to the estimate for LCO Dry Creek and Porter Creek but lower than the estimate for Chauncey Creek and Fish Pond Creek. In upper Greenhills Creek and Gardine Creek, there were not enough nest data to estimate the total expected unique nest count using the AUC model.

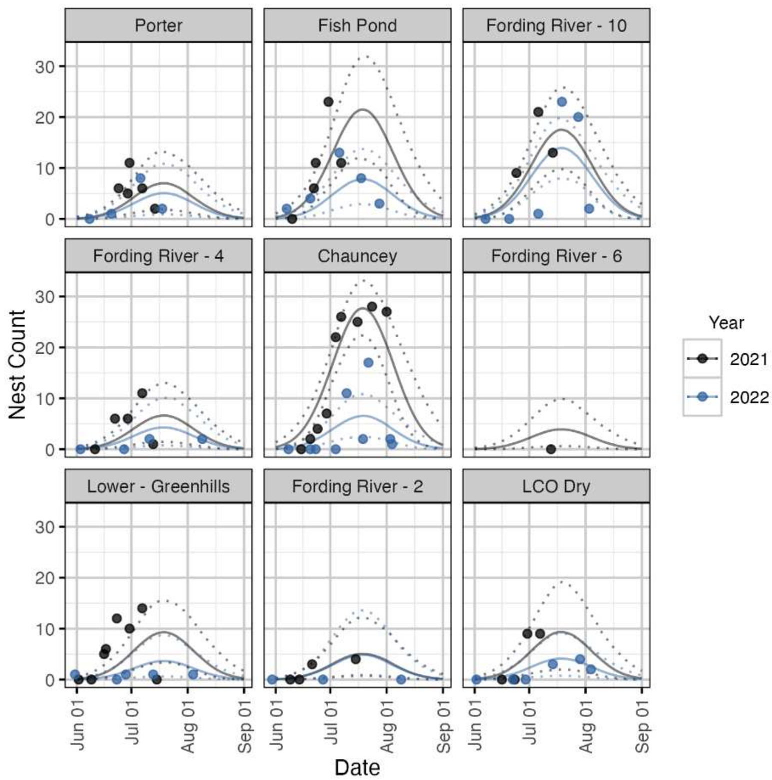

Figure 3: Daily nest counts by date, year, stream, and stream segment. Solid lines show the predicted counts from the AUC model with 95% CIs (dotted lines). Upper Greenhills and Gardine creeks were not included in the AUC model because of insufficient data.

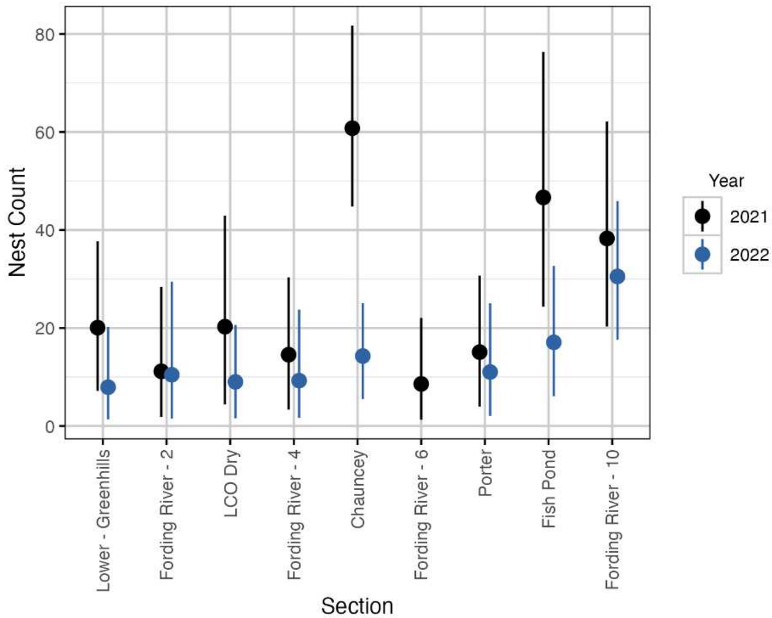

Figure 4: The estimated total unique nest count (with 95% CIs) by stream and year.

3.2 Body Condition

Weight-length relationships were similar among subpopulations in the upper Fording River watershed (Figure 5). Based on these relationships, the predicted weight of a 100 mm WCT was used to estimate the percent difference in body condition between subpopulations in a typical year (Figure 6). The estimated body condition of WCT in upper and lower Greenhills Creek was within the range of values from other areas in the upper Fording River watershed. The estimated body condition of WCT in lower Greenhills Creek (-1%, CI: -5% to 2%) was less than than in upper Greenhills Creek and Gardine Creek (1%, CI: - 2% to 6%) but the difference was small (i.e., 2%) and highly uncertain. As the expected size of a 100 mm WCT is approximately 10 g (Figure 5), a 2% increase would represent an increase from 10 to 10.2 g.

The estimated body condition by year in upper Greenhills Creek and Gardine Creek decreased from 9% in 2017 to -6% in 2021, followed by an increase to 5% in 2022 (Figure 7). A similar trend was observed in lower Greenhills Creek with a decrease from 3% in 2017 to -6% in 2020, followed by an increase to -2% in 2021 and 1% in 2022.

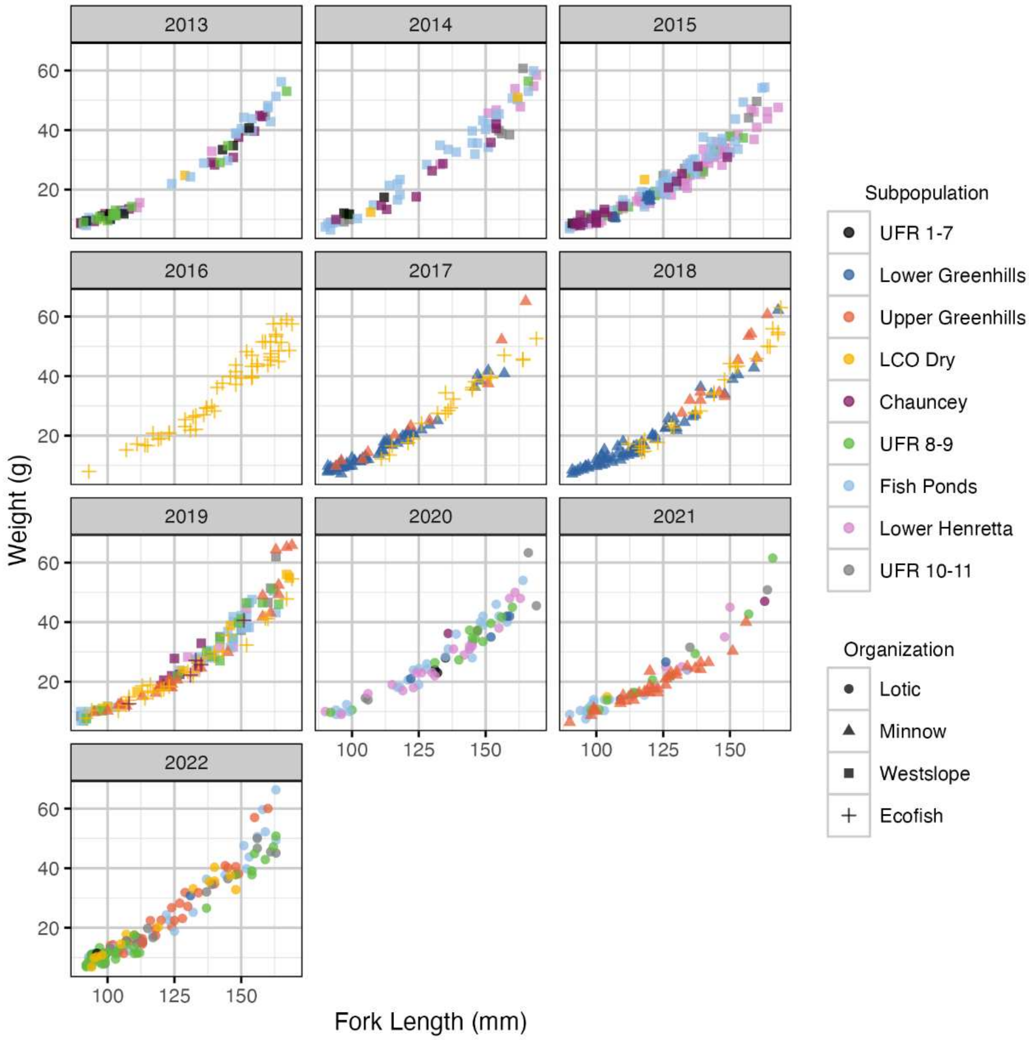

Figure 5: Weight by fork length of Westslope Cutthroat Trout by subpopulation (panel), year (point colour), and organization that collected the data (point shape). Subpopulations are different locations within the upper Fording River (UFR) watershed. The panel for upper Greenhills Creek also includes data from Gardine Creek.

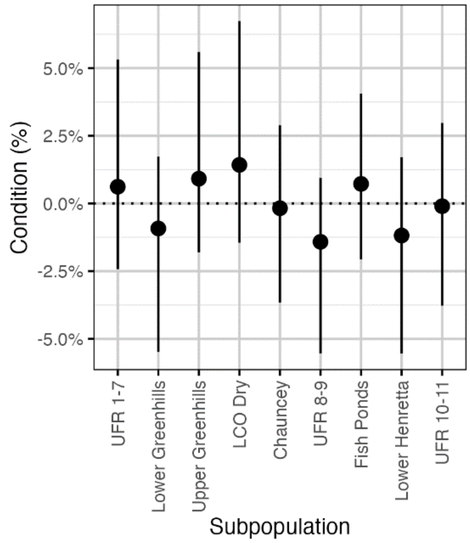

Figure 6: Body condition, shown as the percent change in the body weight of a 100 mm fish in a typical year relative to a typical stream by subpopulation (with 95% CIs). Subpopulations are different locations within the upper Fording River (UFR) watershed.

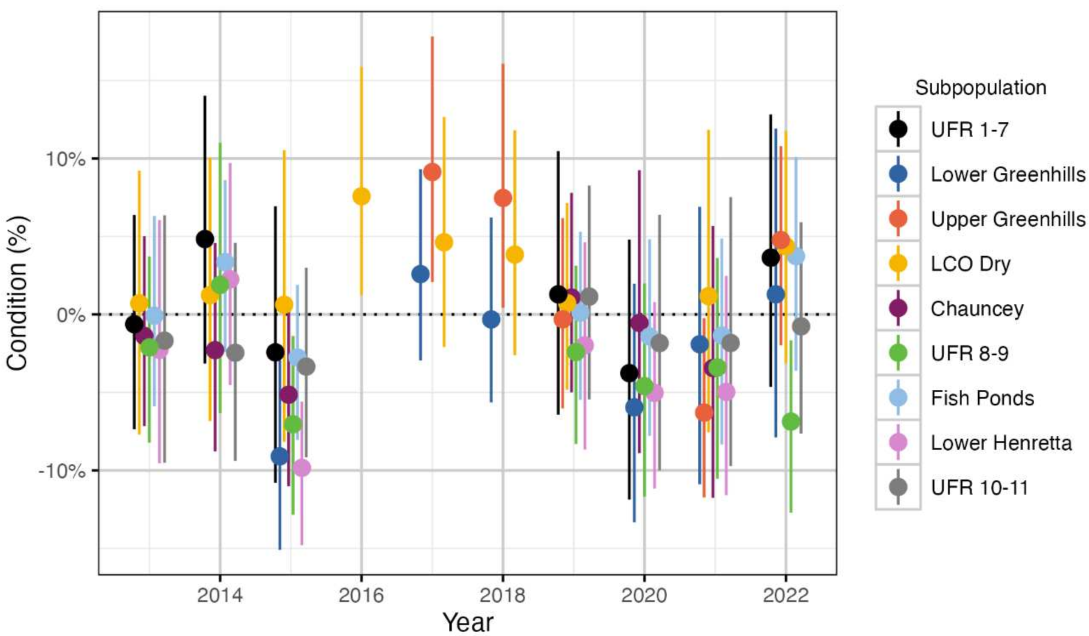

Figure 7: Body condition, shown as the percent change in the body weight of a 100 mm fish relative to a typical stream in a typical year by year and subpopulation (with 95% CIs). Subpopulations are different locations within the upper Fording River (UFR) watershed.

3.3 Length Frequency

Size structure of the catch and length-at-age cutoffs for WCT differed between upper and lower Greenhills Creek. In lower Greenhills Creek, age-0 WCT were less than 75 mm, and age-1 WCT ranged from 75 to 114 mm (Figure 8; Table 5). Age-0 and age-1 fish were larger in lower Greenhills Creek than most other subpopulations.

In upper Greenhills Creek and Gardine Creek, it was assumed that the first mode in the length frequency histogram represented age-1 WCT (50 to 89 mm) and that age-0 WCT were not captured. This suggests that age-1 WCT were smaller in upper Greenhills Creek and Gardine Creek than most other subpopulations in the upper Fording River and its tributaries, with the exceptions of LCO Dry Creek and Chauncey Creek, which the data suggest had similar sized age-1 WCT (Figure 8).

Length frequency data did not suggest a difference in length-at-age between the periods before and after the population decline that occurred between 2017 and 2019 (Figure 8).

Table 5: Length cutoffs for life stages of WCT in Greenhills Creek.

Section	Life Stage	Fork Length
Lower Greenhills Creek	Age-0	< 75 mm
Lower Greenhills Creek	Age-1	75–114 mm
Lower Greenhills Creek	Age-2+	114–199 mm
Lower Greenhills Creek	Subadult and adult	≥ 200 mm
Upper Greenhills Creek and Gardine Creek	Age-0	< 50 mm
Upper Greenhills Creek and Gardine Creek	Age-1	50–89 mm
Upper Greenhills Creek and Gardine Creek	Age-2+	90–199 mm
Upper Greenhills Creek and Gardine Creek	Subadult and adult	≥ 200 mm

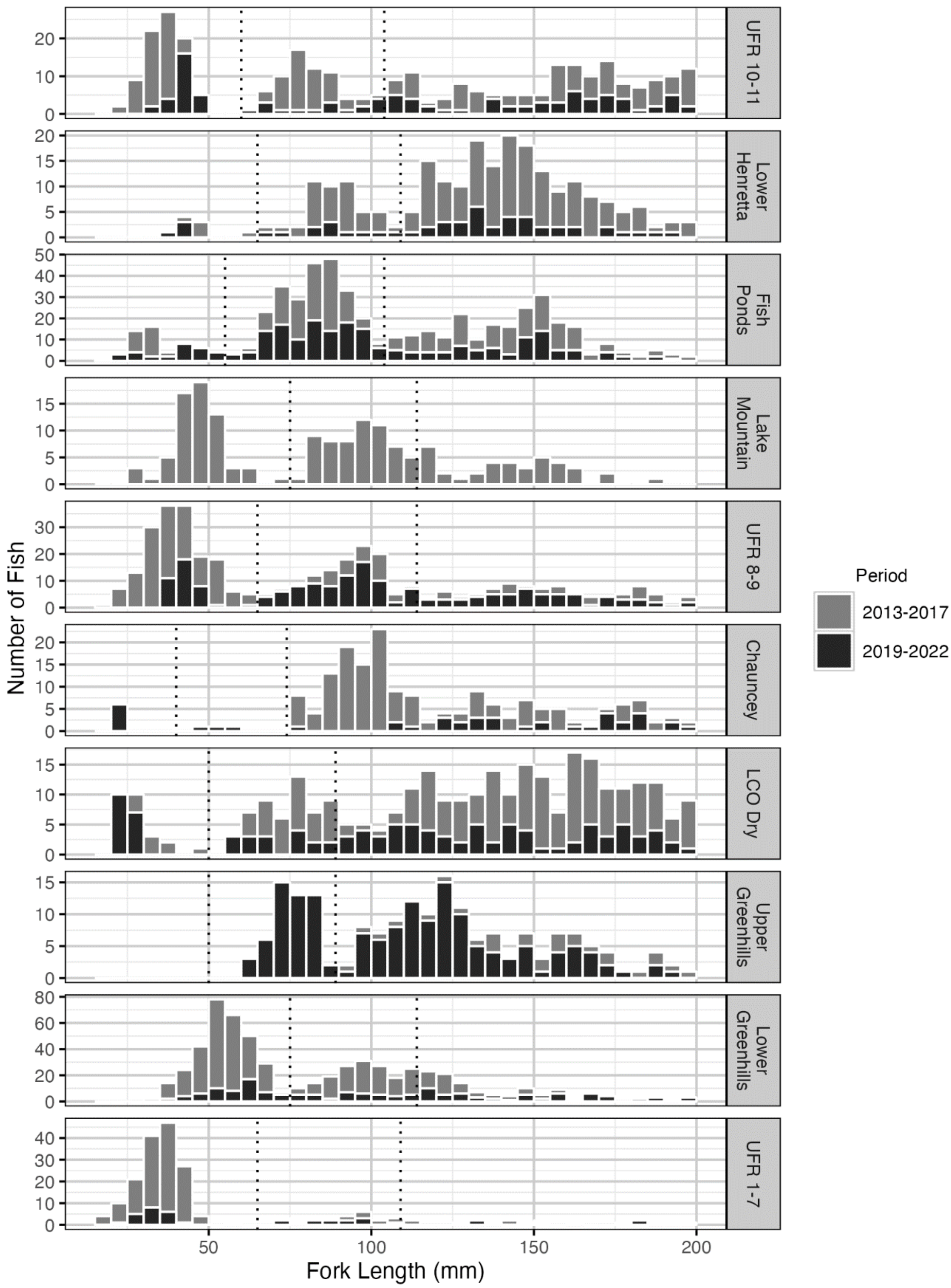

Figure 8: Number of fish captured by electrofishing by fork length, subpopulation, and period. Colour of bars represents the period before or after the decrease in counts of WCT during snorkel surveys that occurred between 2017 and 2019. The vertical dotted lines indicate the age-1 life stage cutoffs.

3.4 Length-At-Age

The estimated length of age-0 fish was greater in lower Greenhills Creek (64 mm, CI: 56–74 mm) than all other subpopulations of the upper Fording River watershed. In other subpopulations, estimated mean length ranged from 23 to 53 mm. Age-0 WCT were not captured in upper Greenhills Creek or Gardine Creek during electrofishing or the night-time dip-net survey.

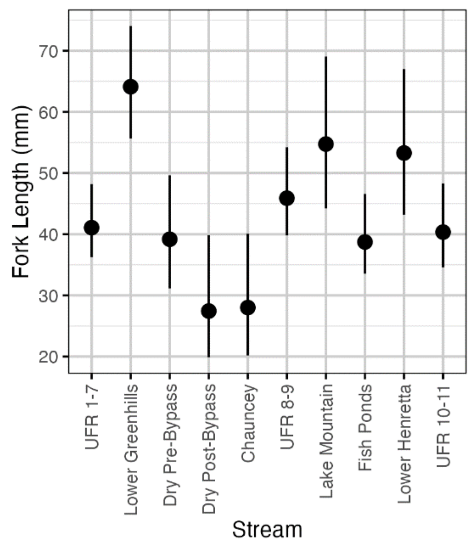

Figure 9: Estimated fork length of age-0 Westslope Cutthroat Trout on 01 October in a typical year by subpopulation within the upper Fording River watershed (with 95% CIs).

3.5 Density

The number of fish captured during the first electrofishing pass by site and year was used to assess general trends in catch over time (Figure 10). In the Greenhills Creek watershed, WCT were captured on the first pass at 5 of 7 sites in 2022. At sites in the Greenhills Creek watershed that were sampled in multiple years (GRE1, RG_GHFF, and RG_GANF), catches from 2022 were comparable to most previous years. Although the number of sites was small and not consistent across years, the data do not suggest any substantial or sustained change in density over time in Gardine Creek, upper Greenhills Creek, or lower Greenhills Creek.

During all years, age-1 WCT were rarely captured in sites in upper Greenhills Creek but were more common in Gardine Creek and lower Greenhills Creek (Figure 10). Age-2+ WCT were captured in all three of these sections (upper Greenhills, lower Greenhills, and Gardine creeks) in all years sampled. Although capture densities were lower in lower Greenhills Creek than in upper Greenhills and Gardine creeks in 2022 (Figure 10), these capture densities do not include WCT in the plunge pool of the duckbill culvert flowing into lower Greenhills Creek (Figure 1), where snorkeling and visual surveys indicated a substantial number of WCT were observed between mid-August and early September (Table 8).

Information from removal-depletion surveys was used to estimate capture efficiency, which allowed estimates of absolute density and abundance by life stage (age-1 and age-2+; Figure 11). Estimated densities by subpopulation for a typical year showed greater densities in lower Greenhills Creek than upper Greenhill Creek (including Gardine Creek; Figure 11). Estimated density by subpopulation groupings (Figure 12) indicated that the greatest densities were in tributaries that were downstream of ponds (age-1: 67 fish/100 m; age-2: 50 fish/100 m), followed by mainstem subpopulations in the upper Fording River (age-1: 17 fish/100 m; age-2: 16 fish/100 m), and the lowest densities were in tributaries without or upstream of ponds (age-1: 2 fish/100 m; age-2: 8 fish/100 m).

Estimated densities of age-1 WCT by site for a typical year were greater in lower Greenhills Creek (6–15 fish/100 m) and Gardine Creek (4–9 fish/100 m) than in upper Greenhills Creek (0.7–5 fish/100 m; Figure 13). The same trend was observed for age-2+ WCT with greater densities in lower Greenhills Creek (7–11 fish/100 m) and Gardine Creek (4–24 fish/100 m) than in upper Greenhills Creek (1–10 fish/100 m; Figure 14).

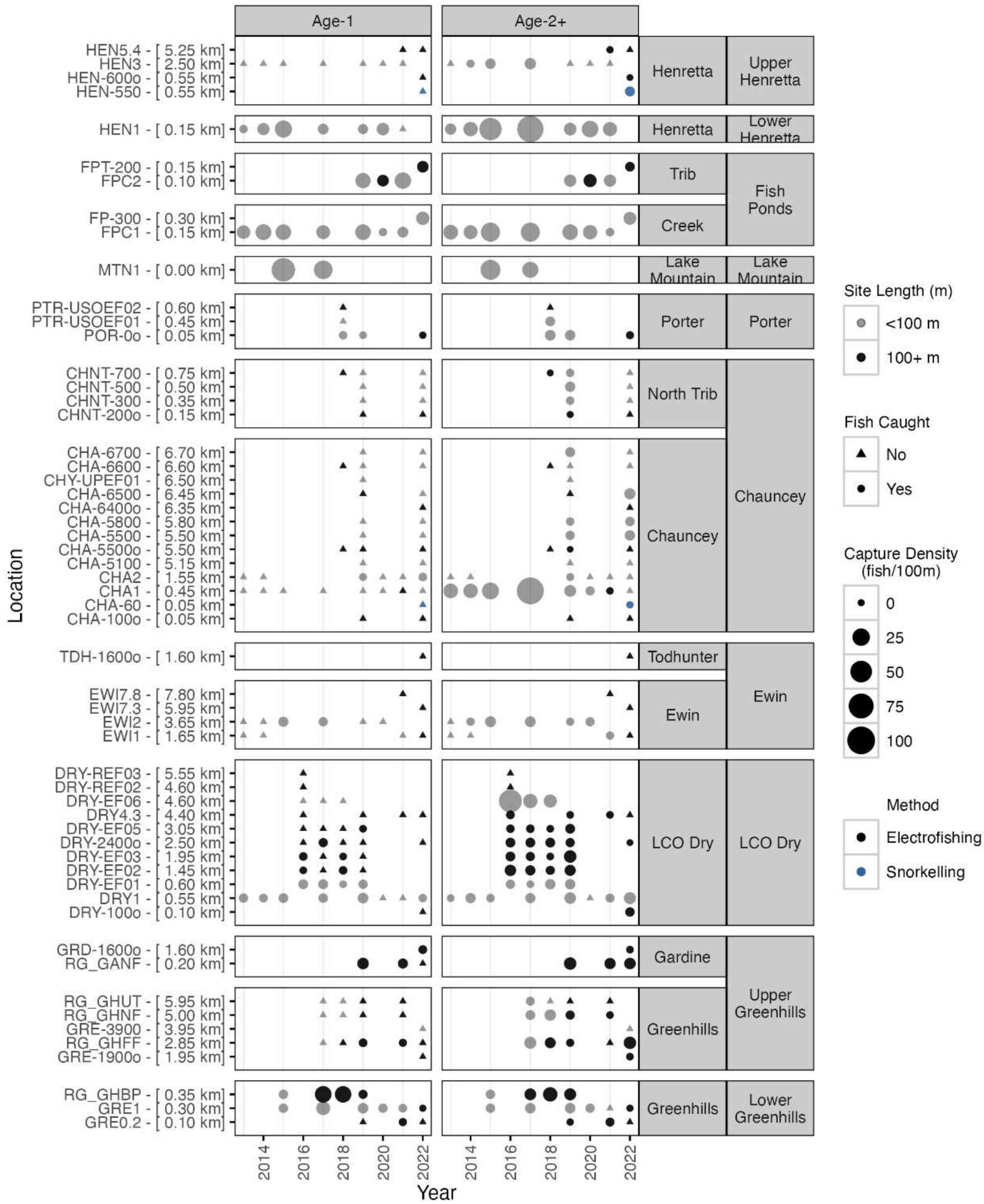

Figure 10: Electrofishing capture density on the first pass by year, location, and life stage. Densities from upstream snorkeling surveys targeting juvenile fish from Thorley et al. (2023b) are also shown. All locations shown are tributaries of the upper Fording River.

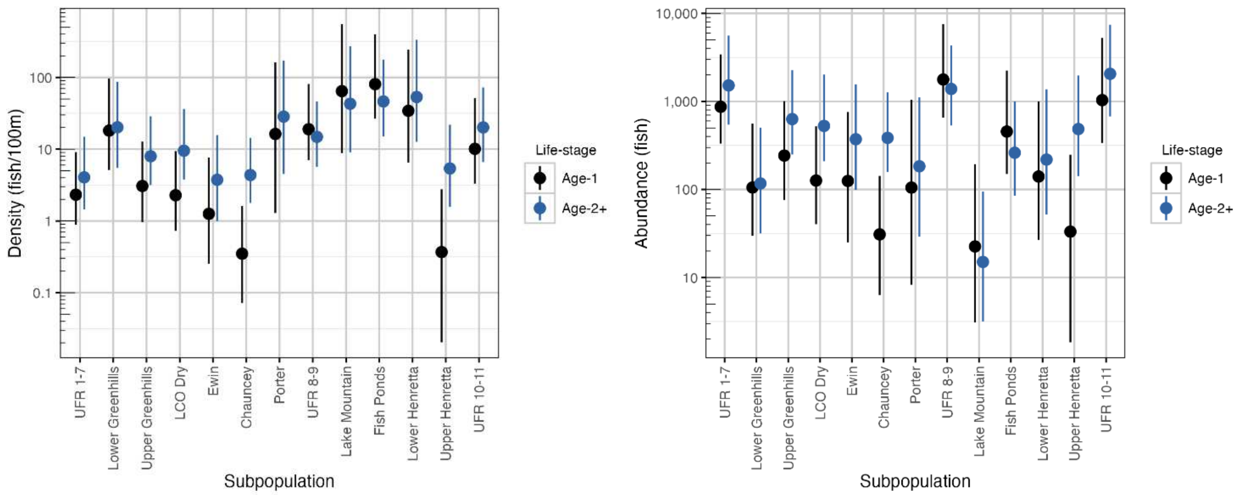

Figure 11: Estimated lineal densities (left panel) and abundances (right panel) by subpopulation and life stage in a typical year (with 95% CIs). Values are plotted on a logarithmic scale.

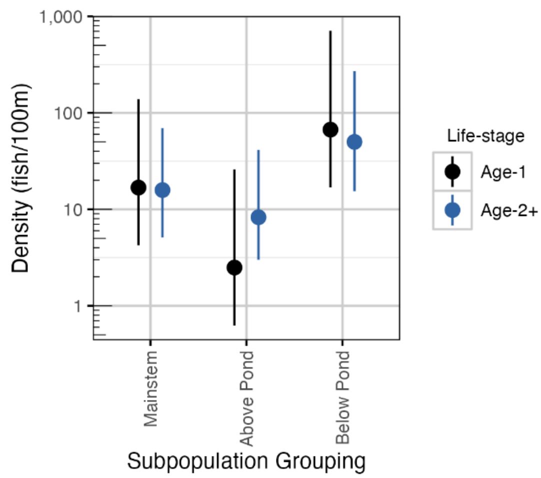

Figure 12: Estimated lineal density by subpopulation grouping and life stage in a typical year (with 95% CIs). Values are plotted on a logarithmic scale.

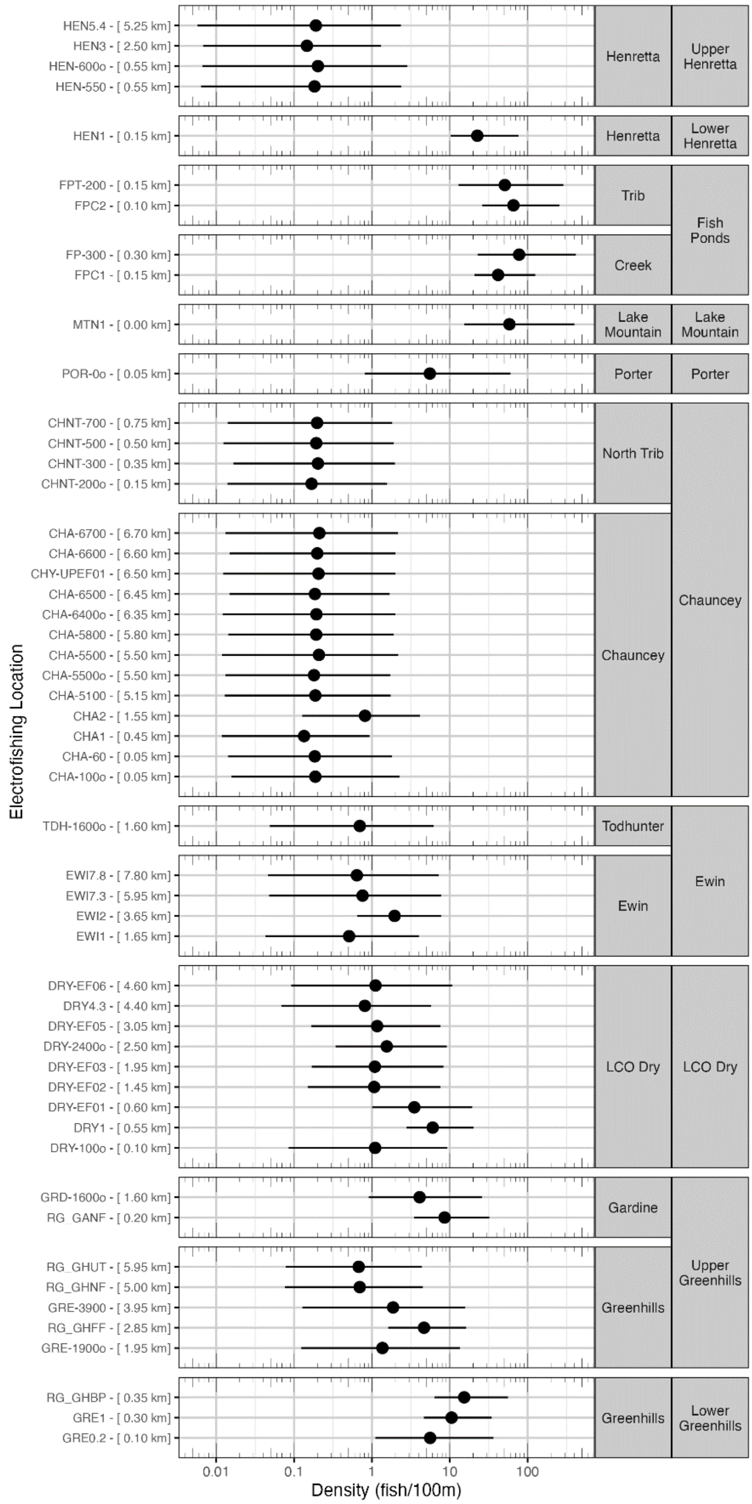

Figure 13: Estimated age-1 lineal density in a typical year by location and subpopulation (with 95% CIs), based on all years of available data. The densities are plotted on a logarithmic scale. Locations shown are tributaries or sections of the upper Fording River (UFR).

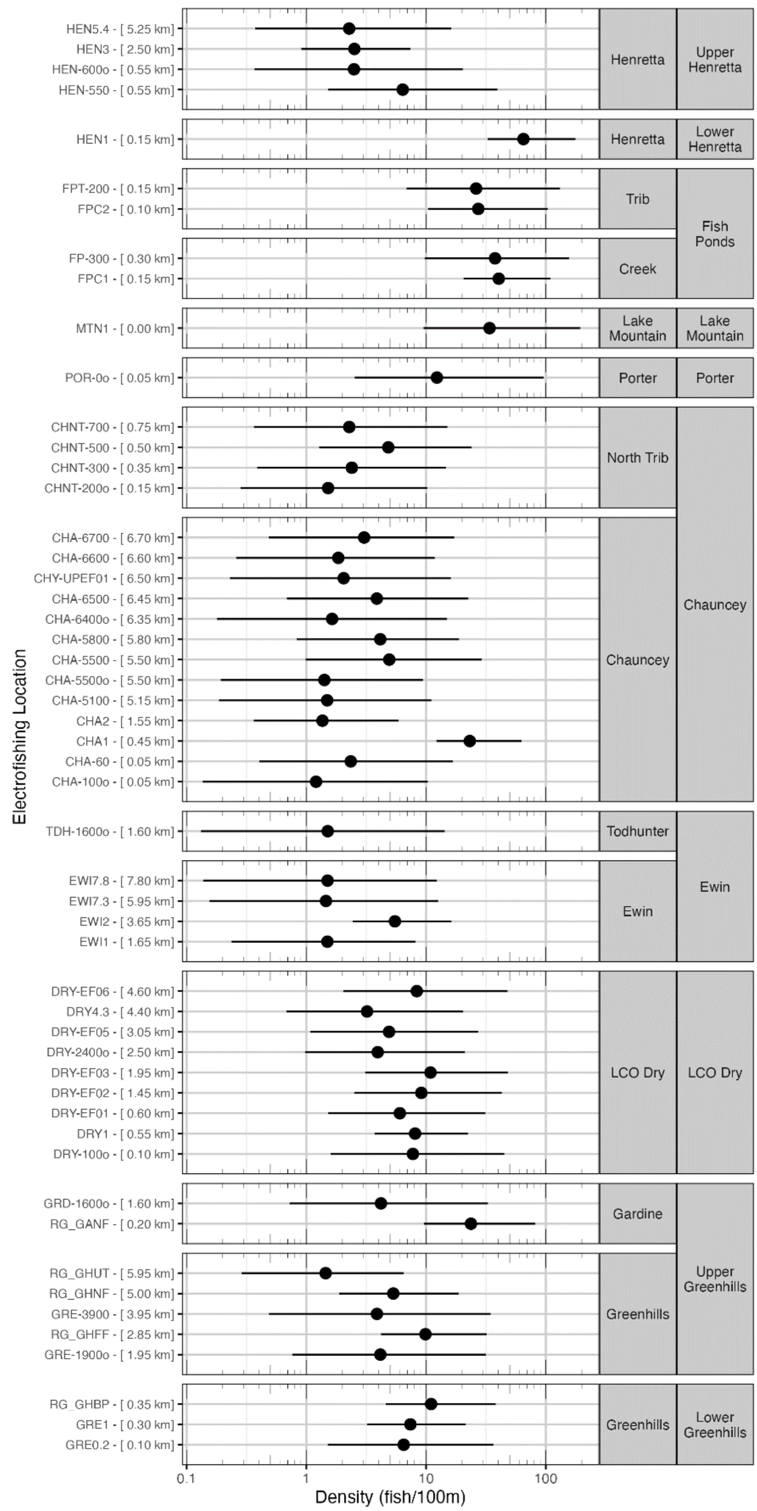

Figure 14: Estimated age-2+ lineal density in a typical year by location and subpopulation (with 95% CIs), based on all years of available data. The densities are plotted on a logarithmic scale. Locations shown are tributaries or sections of the upper Fording River (UFR).

3.6 Night-Time Dip-Net Survey

The night-time dip-net surveys targeted age-0 WCT and were conducted in lower and upper Greenhills Creek on 13 October 2022 (Table 6). In lower Greenhills Creek, three age-0 WCT were captured and no other age-0 WCT were observed. Lengths from captured fish were used in the analysis of length-at-age (Section 3.4). These data also demonstrate that lower Greenhills Creek provides rearing habitat for age-0 WCT. Age-0 WCT were not captured or observed in upper Greenhills Creek.

Table 6: Date, location, and catch of age-0 WCT during the night-time dip-net survey in Greenhills Creek.

Date	Location		Number of Age-0	
	Start of Site (km[a])	End of Site (km[a])	Observed	Captured
13 October 2022	25	300	0	3
13 October 2022	1640	1970	0	0

[a.] km refers to the distance upstream from the confluence of Greenhills Creek with the upper Fording River.

3.7 Snorkeling and Visual Observations

During the downstream snorkel survey on 31 August 2022, a total of 26 WCT were observed in the plunge pool at the outlet of the duckbill culvert in lower Greenhills Creek (Table 7). Based on the estimated fork lengths of these fish, and the age-1 length cutoffs for lower Greenhills Creek shown in Table 5, two of the WCT were age-0, 14 were age-1, and 10 were age-2+; subadults or adults (≥200 mm) were not recorded.

During effectiveness monitoring of the duckbill culvert barrier between October 2020 and September 2022, the number of WCT observed in the plunge pool ranged from 0 to 128 individuals (Table 8). WCT were not observed in the plunge pool during early spring of 2021 (late March to late May) or 2022 (late April to late May) but were present at all other times of year when monitoring occurred. The greatest abundance was observed on 16 August 2022 when 128 WCT were counted. WCT were rarely observed in the decant channel and stilling basin with counts ranging from 1 to 4 individuals, and WCT were not observed at these locations on many occasions.

Table 7: Number of Westslope Cutthroat Trout by fork length observed during snorkel surveys of the plunge pool at the duckbill culvert outlet in lower Greenhills Creek on 31 August 2022 as part of the downstream snorkel survey for the upper Fording River WCT monitoring program.

Fork Length	Life Stage	Number of Fish
45–49 mm	Age-0	1
50–54 mm	Age-0	1
85–89 mm	Age-1	2
90–94 mm	Age-1	2
95–99 mm	Age-1	2
100–104 mm	Age-1	5
105–109 mm	Age-1	3
125–129 mm	Age-2+	1
135–139 mm	Age-2+	1
140–144 mm	Age-2+	4
145–149 mm	Age-2+	1
170–174 mm	Age-2+	1
180–184 mm	Age-2+	2
	Total	**26**

Table 8: Number of fish observed during snorkeling and visual observation surveys conducted during effectiveness monitoring of the duckbill culvert fish barrier as presented in AJM (2022).

Date	Number of Fish Observed	
	Stilling Basin/Decant Channel	Plunge Pool
15 October 2020	0	14
10 December 2020	0	6
24 March 2021	0	0
4 May 2021	0	0
31 May 2021	0	0
30 June 2021	0	26
7, 13, 20 July 2021	0	$\geq$28[a]
11 August 2021	1	46
19 August 2021	0	30
27 August 2021	0	43
22 September 2021	2	35
12 October 2021	1	40
12 November 2021	0	53
19 April 2022	0	0
17 May 2022	0	0
6 June 2022	0	4
20 July 2022	2	32
4 August 2022	1[b]	72
16 August 2022	4	128
7 September 2022	3	67

[a] observations of at least 28 fish were made on 7, 13, or 20 July 2021.
[b] unconfirmed whether a single fish was observed on three separate occasions or if three unique fish were encountered.

3.8 Water Temperature

At the site in lower Greenhills Creek situated 300 m upstream of the confluence with the upper Fording River, 2,143 GSDD were accumulated in 2022. Compared to data collected in 2021 in the upper Fording River watershed, the value of GSDD in lower Greenhills Creek (2,143 GSDD) was substantially higher than any of the tributaries (typically less than 1,000 GSDD) and greater than nearly all sites in the upper Fording River, which ranged from 1,300 to 2,089 GSDD (Brooks et al. 2022). The estimate of GSDD in lower Greenhills Creek was used to help interpret results regarding growth and length-at-age of WCT (Sections 4.1.5 and 4.2.1). Estimates of GSDD from throughout the upper Fording River watershed will be used to model relationships with the size of age-0 WCT in future analyses (Brooks et al., in preparation).

Because water temperature data were missing for a substantial portion of the growing season at the stations in upper Greenhills Creek and Gardine Creek, mean temperature in August was calculated for all three stations to compare temperature across the watershed. Mean water temperature in August (Table 9) was highest in lower Greenhills Creek, lowest in upper Greenhills Creek, and intermediate in Gardine Creek.

Table 9: Summary of water temperature in Greenhills Creek watershed in 2022.

Location	Station	Mean temperature in August	Growing Season Degree-Days
Lower Greenhills Creek	FR_FRTRGH	17.0°C	2143
Upper Greenhills Creek	GH_GRE_WT	5.1°C	n/a
Gardine Creek	GH_GAR	10.9°C*	n/a

* At station GH_GAR, data were missing for the first 3 days of August.

4.0 DISCUSSION

Results from the population monitoring program were used, along with supporting information from other reports, to address 10 guiding questions about the fish population (Sections 4.1 and 4.2). Integration of the results with other related monitoring programs is discussed in Section 4.3.

4.1 Population Characteristics

Questions about population characteristics are addressed to provide context for understanding the dynamics of the population. These characteristics are not expected to change frequently, though the state of knowledge should be updated as additional data are collected or if there are alterations to habitat or connectivity, such as the installation or removal of barriers.

4.1.1 What is the geographic range of the fish population?

Lower Greenhills Creek, from the plunge pool at the duckbill culvert outlet downstream to the upper Fording River, provides 0.6 km of habitat for WCT and this habitat is accessible to the population in the upper Fording River. The duckbill culvert outlet is considered a complete barrier that prevents the upstream movement of WCT (AJM 2022). Between the spillway from the Greenhills Creek sedimentation pond and the culvert, WCT have occasionally been observed in the stilling basin and decant channel (AJM 2022). These fish had likely moved downstream from the sedimentation pond and were subsequently captured and moved into the upper Fording River during fish salvage efforts (AJM 2022).

The Greenhills Creek sedimentation pond is approximately 150 m long and 400 m wide and provides habitat for WCT (Minnow 2018, 2019).

Upstream of the sedimentation pond, upper Greenhills Creek provides 4.9 km of habitat. The upper extent of fish habitat is where the headwaters emerge from the East Spoil Run Out (Cloutier et al. 2023). There are no impassable barriers in upper Greenhills Creek (Cloutier et al. 2023).

Gardine Creek provides habitat between its confluence with upper Greenhills Creek and an impassable barrier located 1.8 km upstream of its confluence (KNRC 2007).

4.1.2 What is the genetic diversity and effective genetic population size?

WCT in lower Greenhills Creek are part of the inter-breeding population in the upper Fording River watershed upstream of Josephine Falls. This population is genetically pure with no evidence of introgression from Rainbow Trout (*Oncorhynchus mykiss*; Rubidge and Taylor 2005; Carscadden and Rogers 2011). Estimates of the heterozygosity (H_E) have been used to assess the genetic diversity of WCT populations in BC and suggested that the diversity of WCT samples collected in 1998 (H_E=0.37) and 2000 (H_E=0.54) from the upper Fording River was close to the provincial average (H_E=0.56; Taylor et al. 2003).

The effective population size is the number of individuals in an idealized population, where genetic drift is the only factor in operation, that results in the same amount of genetic drift as the observed population (Wang et al. 2016). The effective population size is important because it determines the rate of change (loss) in H_E (i.e., diversity) of a population caused by genetic drift, which is the random sampling of genetic variants in a finite population (Charlesworth 2009). Therefore, the effective population size has implications for the diversity and long-term viability of a population. The 50/500 rule is a widely accepted rule-of-thumb for minimum effective population sizes (Harmon and Braude 2010) although a recent recommendation was that effective population of sizes of 100/1000 are more appropriate (Frankham et al. 2014). The 50/500 rule states that an effective population size of 50 is required to avoid inbreeding depression in the short-term while an effective population size of 500 is required to maintain evolutionary potential in the long term. In salmonid populations the effective population size is often assumed to be one-fifth the adult population size (Allendorf et al. 1997; Hastings et al. 2008) which puts the short and long-term minimum target adult population sizes at 250 and 2,500 individuals, respectively. The estimated population size of subadults and adults combined (≥200 mm) in the upper Fording River (excluding upper Greenhills and Gardine creeks) was greater than 2,500 in 2012 to 2014 and 2017, decreased to 330 in 2019, and increased to approximately 2,000 in 2022 (Thorley et al. 2023b). Given the increasing population trend, genetic diversity in the upper Fording River population does not appear to be a concern in the short term (Thorley et al. 2023b).

WCT in upper Greenhills Creek and Gardine Creek are an isolated population since the construction of the spillway in the early 1980s that prevents upstream fish movements. Although the genetic diversity has not been tested, because the population originated from the upper Fording River, the spillway/culvert are impassable, and no other fish species are present, it is assumed that the WCT population in upper Greenhills Creek remains genetically pure. Since isolation, the genetic diversity of this population is expected to have decreased over time due to genetic drift. The current level of genetic diversity of WCT in upper Greenhills Creek is unknown.

There is uncertainty in the adult population size in the upper Greenhills Creek watershed but the small amount of habitat and available data suggest that the population is small. The estimates of abundance of age-1 (50 to 89 mm) and age-2+ (90 to 199 mm) WCT were 248 and 715 fish, respectively, which was based on the entire length of habitat upstream of the barrier, including the sedimentation pond, upper Greenhills Creek, and Gardine Creek. These estimates are for immature fish, not an estimate of adult fish that is required to estimate effective population size. However, the estimates of age-1 and age-2+ fish suggest a relatively small population. A population estimate from mark-recapture data collected in the Greenhills sedimentation pond in July and October of 2017 was 514 individuals with a 95% confidence interval of 310 to 1,499 individuals; however, the life stages represented in that estimate were not provided (Minnow 2018). The number of definitive nests counted in 2021 (*n*=2) and 2022 (*n*=6) also suggests a small population size of adults in upper Greenhills Creek and Gardine Creek. Although the adult population size in the upper Greenhills Creek watershed is unknown, available abundance data suggest that it is less than the long-term value based on the 50/500 rule (2,500 individuals) and may or may not be greater than the short-term value based on the 50/500 rule (250 individuals) for isolated populations, as described above.

4.1.3 What are the life history strategies within the fish population?

Life history strategies of WCT in the upper Fording River include fluvial residents that remain year-round within the same stream, fluvial migrants that reside mostly in the upper Fording River but migrate into tributaries to spawn, and adfluvial migrants that live in lake or ponds for part of the year but migrate into stream habitats to spawn (Cope et al. 2016; Thorley et al. 2023b). Based on a telemetry study by Cope et al. (2016) in the upper Fording River watershed, approximately 40% of tracked fish were fluvial migrants, 50% were fluvial residents that showed little annual movement, and 10% were adfluvial migrants residing in Henretta Lake. Fluvial migrants had an average home range of approximately 18 km and residents had a home range of approximately 5 km.

In lower Greenhills Creek, resident and migratory life history types are assumed to be present. In the isolated population upstream of the spillway, life history types could include fluvial residents and adfluvial migrants that spend most of the year in the sedimentation pond. Fish that move downstream of the sedimentation pond over the spillway would be permanently lost from the population in upper Greenhills Creek.

4.1.4 What is the timing of life history events?

The timing of spawning in upper and lower Greenhills Creek is primarily between mid-June and mid-July (Figure 2), which is within the range of the timing for the population in the upper Fording River (Figure 3). Cope et al. (2016) documented adult fish migrating to spawning areas in the upper Fording River watershed, including Greenhills Creek, in April and May. In a typical year, spawning commenced by 15 May and continued to about 15 July (Cope et al. 2016). Cope et al. (2016) observed that spawning activity started once mean daily water temperatures were 5°C and daily maximums exceeded 7°C.

Emergence of hatchery-reared WCT occurs after the eggs have accumulated 575 to 600 degree-days (Thorley et al. 2023b) which is consistent with Coleman and Fausch's (2007a) estimate of 570 to 600 Accumulated Thermal Units (ATUs) for Colorado Cutthroat Trout (*Oncorhynchus clarkii pleuriticus*). Based on Cope et al. (2016), emergence and summer rearing begin in mid-July and last until the end of September.

Migration toward overwintering areas begins in September and lasts until mid-October, while the overwintering period itself starts in mid-October and lasts to the end of March (Cope et al. 2016).

4.1.5 What are the sizes of the life stages?

The length of age-0 WCT was larger in lower Greenhills Creek (64 mm, CI: 58–69 mm) than all other monitored tributaries and portions of the upper Fording River watershed (23 to 53 mm), based on estimates for a typical year (Figure 9). The length of age-0 WCT in upper Greenhills in unknown because this life stage has not been captured there since at least 2013, based on the data reviewed.

Age-1 WCT ranged from 75 to 114 mm in lower Greenhills Creek, which was greater than the size of this age class in most other tributaries and portions of the upper Fording River, based on data from 2013 to 2022. In upper Greenhills Creek (including Gardine Creek), age-1 WCT were smaller (50 to 89 mm) than most other tributaries and portions of the upper Fording River, with the exceptions of LCO Dry Creek and Chauncey Creek, which had similar sized age-1 WCT.

The size distributions of age-2 and older WCT overlapped and age data from scale samples are not currently available. Therefore, other life stages, the age-2+ (< 200 mm) and subadults and adults (≥200 mm) groupings, were assigned based on the 200 mm threshold suggested by Cope et al. (2016). Observations of spawning behaviour (paired up fish, or fish near redds) by WCT between 150 and 200 mm in LCO Dry Creek (Faulkner et al. 2020) suggest that the 200 mm cutoff may not be an appropriate minimum size for mature adults in headwater tributaries in the study area.

The length distribution of all age classes from age-2 and older, and the length-at-maturity are uncertain, especially in smaller tributaries of the upper Fording River.

The larger size of age-0 WCT in lower Greenhills Creek did not appear to be due to earlier spawning, as the majority of spawning occurred between mid-June and mid-July, which was similar to the timing of most other subpopulations in the upper Fording River watershed (Thorley et al. 2023b). The large size of age-0 WCT was likely related to the warm water temperature downstream of the sedimentation pond, as the number of GSDD was greater in lower Greenhills Creek than all other areas where GSDD was calculated in the upper Fording River watershed (Section 3.8)

4.2 Vital Rates and Associated Endpoints

4.2.1 What is the growth rate of key life stages?

Using combined length-at-age and growth increment data, Cope et al. (2016), estimated a growth rate parameter (k) for WCT in the upper Fording River of 0.15 (95% CI of 0.11 to 0.20), which is comparable to other WCT in headwater streams in the Canadian Rocky Mountains (range 0.13 to 0.20; Janowicz et al. 2018). In the mainstem of the upper Fording River, WCT were estimated to reach the minimum size of the subadults and adult category (≥200 mm) beginning at age-3 or age-4, and the smallest length-at-maturity was 200 mm for males and 233 mm for females (Cope et al. 2016). However, the growth rate likely varies substantially by stream and individual due to the diversity of temperature regimes and life history strategies. Evidence for variable growth rates includes the variation in size of age-0 fish in different tributaries (Figure 9). The large size of age-0 and age-1 WCT in lower Greenhills Creek suggests more rapid growth of early stages than in other parts of the upper Fording River watershed, which was likely related to warm water temperatures. Annual growth of WCT (size range: 129 to 346 mm) in upper Greenhills Creek and the sedimentation pond, based on three fish tagged in 2017 and recaptured in 2018, ranged from 31 to 91 mm per year (Minnow 2019).

4.2.2 What is the spatial distribution of key life stages?

Age-0 WCT are likely present in upper and lower Greenhills Creek and in Gardine Creek. Age-0 WCT were captured in lower Greenhills Creek but not in upper Greenhills Creek or Gardine Creek between 2013 and 2022 (Figure 8). Although age-0 WCT have not been captured upstream of the sedimentation pond, as age-1 WCT are present and it is an isolated population, age-0 fish must have been present in prior years and survived to age-1. A previous study in upper Greenhills Creek (Minnow 2018) reported the capture of age-0 WCT but based on their lengths (94 to 106 mm), and the length-at-age cutoffs used in this report (Figure 8), these fish were likely age-1 or age-2.

Age-1 and age-2+ WCT are present throughout the Greenhills Creek watershed.

The distribution of subadults and adults (≥200 mm) is not known because backpack electrofishing does not target these life stages and downstream snorkel surveys are not conducted in Greenhills Creek (except in the stilling basin and decant channel as part of effectiveness monitoring or fish salvages). However, redd surveys demonstrate that spawning activity by adults occurs in lower and upper Greenhills Creek and in Gardine Creek.

WCT captured in the Greenhills Creek sedimention pond ranged in length from 120 to 382 mm (Minnow 2018), suggesting age-2 to adult life stages are present in the pond; younger age classes could also be present but were not captured using the sampling methods used (hoop-nets and gill-nets).

4.2.3 What is the abundance of key life stages?

The abundance of age-0 fish is unknown because abundance estimates are not possible using the selected monitoring methods.

The estimated total abundance of age-1 WCT in a typical year was 119 individuals (CI: 33–624 individuals) in lower Greenhills Creek and 248 individuals (CI: 75–1107 individuals) in upper Greenhills Creek including Gardine Creek (Figure 11). The estimated total abundance of age-2+ WCT (from age-2 up to 200 mm) in a typical year was 161 individuals (CI: 38–804 individuals) in lower Greenhills Creek and 715 individuals (CI: 248–3104 individuals) in upper Greenhills Creek. Although densities of both life stages were lower in upper Greenhills Creek than lower Greenhills Creek, the more extensive habitat in upper Greenhills Creek resulted in a greater total abundance estimate. The low number of sites sampled in different years make it difficult to assess temporal trends, but the data do not suggest any substantial or sustained change in density over time in Gardine Creek, upper Greenhills Creek, or lower Greenhills Creek.

The abundance of the subadult and adult (≥200 mm) WCT is unknown because this life stage is not currently targeted by the capture methods used in the Greenhills Creek watershed.

4.2.4 What is the total number of eggs deposited?

Total egg deposition can be estimated using the estimated abundance of mature adults, the length-distribution of adults, and assumptions about the length-fecundity relationship, the sex ratio, and the probability of spawning. As estimates of the abundance and length distribution of mature adults in upper Greenhills Creek are not available, the number of eggs deposited is unknown. An alternative way to estimate egg deposition would be based on the estimated number of redds, and assumptions about the observer efficiency and the average number of eggs per redd. Based on the low number of redds observed in upper Greenhills Creek (including Gardine Creek) in 2022 (n=6), the spawning survey may not be detecting all of the nests and therefore nest counts were not used for an approximate estimate of egg deposition. Based on these recent spawning survey data, the nest counts are not currently considered a robust indicator of total spawner abundance but do provide information on the timing and spatial distribution of spawning.

WCT in lower Greenhills Creek are part of the upper Fording River population. For this population, egg deposition was estimated using the estimated abundance and lengths of subadult and adult fish, along with assumptions of a 1:1 sex ratio and a 50% probability of spawning each year. The total egg deposition for the upper Fording River population was estimated to have peaked at approximately 970,000 eggs in 2017 before decreasing to approximately 60,000 eggs in 2019, and increasing to approximately 430,000 eggs by 2022 (Thorley et al. 2023b). These authors considered the estimates of egg deposition to be likely overestimates, because the estimates of the number subadult and adult fish included immature and mature fish.

4.2.5 What is the survival of key life stages?

Survival from the egg stage to age-1 was estimated for the upper Fording River population using estimates of the number of eggs deposited and age-1 abundance. The estimated egg to age-1 survival rate ranged from a minimum of 0.5% in the 2012 spawning year to a maximum of 3.2% in 2019 and was 0.8% in the 2021 spawning year, which is the most recent year for which age-1 abundance estimates are available (Thorley et al. 2023b). These estimates are likely underestimates of survival because of the overestimation of egg deposition due to inclusion of immature fish in the abundance estimate of subadult and adults (Thorley et al. 2023b). In comparison, the egg to age-1 survival rate required for population replacement (i.e., when each adult produces one offspring) that was calculated based on life history parameters (Ma and Thompson 2021) was 2.0% (Thorley et al. 2023b). These estimates of egg to age-1 survival in the upper Fording River are also considered applicable to WCT in lower Greenhills Creek.

The annual survival rate of radio tagged subadult and adult WCT in the UFR was 67% (Cope et al. 2016), which is assumed to also apply to lower Greenhills Creek.

In upper Greenhills Creek, egg to age-1 survival cannot be estimated because adult abundance and therefore egg deposition is unknown. It is uncertain whether survival of eggs, juveniles, and adults in upper Greenhills Creek differ from survival rates estimated in the upper Fording River.

4.3 Integration with Other Monitoring Programs

Results from this monitoring program will also be used by the Greenhills Creek Local Aquatic Effects Monitoring Program (LAEMP; formerly GGCAMP). Results concerning aquatic habitat conditions from the Greenhills Creek LAEMP will also be used in future years to help interpret possible causes of observed trends in fish populations in the Greenhills Creek watershed. The Greenhills Creek LAEMP was initially designed to monitor the effects of anti-scalant addition that was intended to prevent further calcite deposition and concretion, but the program was recently modified to also consider the effects of other influences and mitigation activities in the watershed (Minnow 2022). Study questions in the Greenhills Creek LAEMP are the following:

1. *What is the current status of aquatic health in Greenhills and Gardine creeks, as evidenced by physical, chemical, and biological conditions?*
2. *Have physical, chemical, and/or biological conditions indicative of aquatic health in Greenhills and Gardine creeks changed over time and are the changes expected based on the activities and projects occurring in the watershed?*

3. *Can observed changes be linked to antiscalant addition in lower Greenhills Creek; activities to support relocation of the antiscalant addition facility to Upper Greenhills Creek; or initiation of antiscalant addition on Upper Greenhills Creek starting in October 2022?*

For all three study questions, WCT are included as part of the assessment of aquatic health and biological conditions. The Greenhills Creek LAEMP's general questions related to fish are the following:

1. *Do estimates of WCT abundance, densities, biomass, or health endpoints differ among areas?*
2. *Have endpoints changed at the monitoring areas over time and are these changes unexpected based on the activities and projects occurring in the watershed, including the addition of antiscalant to lower Greenhills Creek?*

Estimated densities from this report can be used to address sub-question #1. The estimated density of age-2+ WCT was greater in lower Greenhills Creek (8–12 fish/100 m) and Gardine Creek (4–26 fish/100 m) than in upper Greenhills Creek (1–10 fish/100 m; Figure 14). Age-1 WCT were present in Gardine Creek and lower Greenhills Creek but were not captured in upper Greenhills Creek during most sample years (Figure 10). Snorkel surveys consistently reported large numbers of juvenile fish (age-1 and age-2+) in the plunge pool of the culvert outlet into lower Greenhills Creek. Regarding sub-question #2, the relatively low number of sites sampled makes it difficult to assess temporal trends. However, the available electrofishing data did not suggest any substantial changes or sustained trends in the density of age-1 or age-2+ WCT in upper Greenhills Creek, Gardine Creek, or lower Greenhills Creek between 2015 and 2022. In addition to the Greenhills Creek LAEMP, a summary of aquatic monitoring data from the upper Fording River watershed upstream of Josephine Falls (Teck's management unit #1), including fish population results from lower and upper Greenhills Creek, will be included as part of the upcoming Regional Aquatic Effects Monitoring Program's 2020 to 2022 interpretive report.

5.0 SUMMARY AND CONCLUSIONS

Although lower Greenhills Creek is a short (0.58 km) section of tributary, it appears to provide spawning habitat for adults and rearing habitat for juveniles. The exceptionally large size of age-0 WCT was attributed to warm water temperature, as indicated by GSDD, that is likely due to warming in the sedimentation pond upstream. WCT in lower Greenhills Creek are part of the upper Fording River population that decreased substantially (approximately 90%) between 2017 and 2019, but increased consecutively each year from 2020 to 2022, suggesting that the population is recovering (Thorley et al. 2023b). Most vital rates, such as survival, growth, and reproduction (egg deposition), are at least partially understood for the upper Fording River WCT population (Section 4.2; Thorley et al. 2023b). Length-at-age and length-at-maturity are important uncertainties, as the inability to separate subadults and adults likely biases estimates of egg deposition and survival and therefore limits understanding of the resulting population dynamics.

The upper Greenhills Creek watershed provides approximately 7 km of habitat to an isolated population of WCT in upper Greenhills Creek, Gardine Creek, and the Greenhills Creek sedimentation pond. The number of definitive nests observed during spawning surveys in 2021 and 2022 was low (≤6 nests per year), but densities of age-1 WCT were similar to other tributaries that were not below ponds (Figure 13), which indicates that successful spawning and recruitment is occurring. Estimated densities of age-1 and age-2+ (<200 mm) WCT did not suggest any temporal trends between 2013 and 2022, although the number of sites sampled was low and not consistent across years. The catch data do not suggest a decline in juvenile WCT abundance in upper Greenhills Creek between 2017 and 2019, as was observed for subadults and adults (but not juveniles) in the upper Fording River.

The length distributions of age-2 and older age classes, and the length-at-maturity in upper Greenhills Creek are uncertain and may differ in this isolated headwater population compared to the upper Fording River.
The abundance of adults and survival between different life stages cannot be estimated using available data.
The genetic diversity and effective population size in upper Greenhills Creek are uncertain but are likely both substantially lower than for the upper Fording River population from which the fish have been isolated for over 40 years.

6.0 CLOSURE

We trust that this report meets your current requirements. If you have any further questions, please do not hesitate to contact us.

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https://golderassociates.sharepoint.com/sites/169917/project files/5 technical work/greenhills/report/final/23586694-001-r-rev0-gho greenhills creek 2022 fish population monitoring 08may_23.docx

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APPENDIX D

RAW LABORATORY REPORTS

ALS - WATER CHEMISTRY

CERTIFICATE OF ANALYSIS

Work Order	: **CG2202277**	Page	: 1 of 7
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Ave Sparwood BC Canada	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 01-Mar-2022 09:21
PO	: VPO00748510	Date Analysis Commenced	: 01-Mar-2022
C-O-C number	: February GGCAMP 2022	Issue Date	: 11-Mar-2022 17:45
Sampler	: ----		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Elke Tabora		Inorganics, Calgary, Alberta
Erin Sanchez		Inorganics, Calgary, Alberta
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Monica Ko	Lab Assistant	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Sample Comments

Sample	*Client Id*	*Comment*
CG2202277-004	RG_TRIP_WS_GGCAMP_2022-02-28_NP	004 - hg vial submitted
CG2202277-004	RG_TRIP_WS_GGCAMP_2022-02-28_NP	Sample 4: Water sample for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

Qualifiers

Qualifier	*Description*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
RRV	*Reported result verified by repeat analysis.*

TKNI	*TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_FBLANK_WS_GGCAMP_2022-02-28_NP	RG_GHBP_WS_GGCAMP_2022-02-28_NP	RG_RIVER_WS_GGCAMP_2022-02-28_NP	RG_TRIP_WS_GGCAMP_2022-02-28_NP	----
				Client sampling date / time	28-Feb-2022 10:00	28-Feb-2022 10:00	28-Feb-2022 10:00	28-Feb-2022 10:00	----
					CG2202277-001	CG2202277-002	CG2202277-003	CG2202277-004	--------
					Result	Result	Result	Result	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	<2.0	<2.0	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	299	300	<1.0	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	<1.0	365	366	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	<1.0	299	300	<1.0	----
conductivity	----	E100	2.0	μS/cm	<2.0	1600	1610	<2.0	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	<0.50	1070	1080	<0.50	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	511	472	416	507	----
pH	----	E108	0.10	pH units	5.23	8.26	8.28	5.09	----
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	1400	1430	<10	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	<1.0	<1.0	2.4	<1.0	----
turbidity	----	E121	0.10	NTU	<0.10	0.48	0.40	<0.10	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	0.0215	0.0214	<0.0050	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.250 DLDS	<0.250 DLDS	<0.050	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	<0.10	2.10	2.03	<0.10	----
fluoride	16984-48-8	E235.F	0.020	mg/L	<0.020	0.136	0.132	<0.020	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	<0.050	0.492	0.392 TKNI	<0.050	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	<0.0050	4.81	4.76	0.0081 RRV	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	0.0114	0.0115	<0.0010	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	0.0026	0.0025	<0.0010	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	<0.0020	0.0036	0.0039	<0.0020	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	<0.30	776	765	<0.30	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	1.62	1.62	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	1.84	1.92	<0.50	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

				Client sample ID	RG_FBLANK_WS_GGCAMP_2022-02-28_NP	RG_GHBP_WS_GGCAMP_2022-02-28_NP	RG_RIVER_WS_GGCAMP_2022-02-28_NP	RG_TRIP_WS_GGCAMP_2022-02-28_NP	----
				Client sampling date / time	28-Feb-2022 10:00	28-Feb-2022 10:00	28-Feb-2022 10:00	28-Feb-2022 10:00	----
Analyte	CAS Number	Method	LOR	Unit	CG2202277-001	CG2202277-002	CG2202277-003	CG2202277-004	--------
					Result	Result	Result	Result	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	<0.10	22.5	22.3	<0.10	----
cation sum	----	EC101	0.10	meq/L	<0.10	21.7	21.8	<0.10	----
ion balance (cations/anions)	----	EC101	0.010	%	100	96.4	97.8	100 RRV	----
ion balance (APHA)	----	EC101	0.010	%	<0.010	1.81	1.13	<0.010	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	<0.0030	0.0045	0.0045	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	0.00039	0.00038	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	<0.00010	0.00023	0.00023	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	<0.00010	0.0422	0.0424	----	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	<0.020	<0.020	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	<0.000050	----	----
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	0.010	0.010	----	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	<0.0050	0.0083	0.0076	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	<0.050	175	180	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	<0.00010	0.00014	0.00014	----	----
cobalt, total	7440-48-4	E420	0.10	µg/L	<0.10	<0.10	<0.10	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	<0.00050	----	----
iron, total	7439-89-6	E420	0.010	mg/L	<0.010	<0.010	<0.010	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	<0.000050	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	0.0158	0.0159	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	<0.0050	147	147	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	<0.00010	0.00317	0.00314	----	----
mercury, total	7439-97-6	E508-L	0.00050	µg/L	<0.00050	<0.00050	<0.00050	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	<0.000050	0.00157	0.00160	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	0.00803	0.00791	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	<0.050	2.35	2.35	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	<0.050	145	145	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	<0.10	3.93	3.91	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	----	----
sodium, total	7440-23-5	E420	0.050	mg/L	<0.050	3.16	3.07	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_FBLANK_WS_GGCAMP_2022-02-28_NP	RG_GHBP_WS_GGCAMP_2022-02-28_NP	RG_RIVER_WS_GGCAMP_2022-02-28_NP	RG_TRIP_WS_GGCAMP_2022-02-28_NP	----
Client sampling date / time					28-Feb-2022 10:00	28-Feb-2022 10:00	28-Feb-2022 10:00	28-Feb-2022 10:00	----
					CG2202277-001	CG2202277-002	CG2202277-003	CG2202277-004	--------
					Result	Result	Result	Result	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	<0.00020	0.206	0.209	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	<0.50	260	262	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	----	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	<0.00030	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	<0.000010	0.00808	0.00799	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	<0.00050	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	<0.0030	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	0.00034	0.00034	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	<0.00010	0.00016	0.00017	<0.00010	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	<0.00010	0.0409	0.0413	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.020	<0.020	<0.020	<0.020	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	<0.0050	<0.0050	0.0058	<0.0050	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	<0.050	188	189	<0.050	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	0.00013	<0.00010	<0.00010	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	----	----	----	<0.10	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	0.0150	0.0149	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	<0.0050	147	148	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	<0.00010	0.00194	0.00188	<0.00010	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	<0.000050	0.00147	0.00152	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	0.00780	0.00778	<0.00050	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	RG_FBLANK_WS_GGCAMP_2022-02-28_NP	RG_GHBP_WS_GGCAMP_2022-02-28_NP	RG_RIVER_WS_GGCAMP_2022-02-28_NP	RG_TRIP_WS_GGCAMP_2022-02-28_NP	----
				Client sampling date / time	28-Feb-2022 10:00	28-Feb-2022 10:00	28-Feb-2022 10:00	28-Feb-2022 10:00	----
Analyte	CAS Number	Method	LOR	Unit	CG2202277-001	CG2202277-002	CG2202277-003	CG2202277-004	--------
					Result	Result	Result	Result	----
Dissolved Metals									
potassium, dissolved	7440-09-7	E421	0.050	mg/L	<0.050	2.26	2.26	<0.050	----
selenium, dissolved	7782-49-2	E421	0.050	µg/L	<0.050	139	144	<0.050	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	<0.050	3.74	3.86	<0.050	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	<0.050	3.02	3.05	<0.050	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	<0.00020	0.213	0.214	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	<0.50	250	252	<0.50	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	<0.00030	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	<0.000010	0.00741	0.00732	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	0.0010	<0.0010	----
dissolved mercury filtration location	----	EP509	-	-	Field	Field	Field	Field	----
dissolved metals filtration location	----	EP421	-	-	Field	Field	Field	Field	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2202277**	Page	: 1 of 21
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Ave Sparwood BC Canada	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 01-Mar-2022 09:21
PO	: VPO00748510	Issue Date	: 11-Mar-2022 17:46
C-O-C number	: February GGCAMP 2022		
Sampler	: ----		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
			Preparation Date	*Holding Times Rec*	*Holding Times Actual*	*Eval*	*Analysis Date*	*Holding Times Rec*	*Holding Times Actual*	*Eval*
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E298	28-Feb-2022	01-Mar-2022	28 days	1 days	✓	01-Mar-2022	27 days	0 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_GHBP_WS_GGCAMP_2022-02-28_NP	E298	28-Feb-2022	01-Mar-2022	28 days	1 days	✓	01-Mar-2022	27 days	0 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_RIVER_WS_GGCAMP_2022-02-28_NP	E298	28-Feb-2022	01-Mar-2022	28 days	1 days	✓	01-Mar-2022	27 days	0 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_TRIP_WS_GGCAMP_2022-02-28_NP	E298	28-Feb-2022	01-Mar-2022	28 days	1 days	✓	01-Mar-2022	27 days	0 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E235.Br-L	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GHBP_WS_GGCAMP_2022-02-28_NP	E235.Br-L	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_RIVER_WS_GGCAMP_2022-02-28_NP	E235.Br-L	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_TRIP_WS_GGCAMP_2022-02-28_NP	E235.Br-L	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E235.Cl-L	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GHBP_WS_GGCAMP_2022-02-28_NP	E235.Cl-L	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_RIVER_WS_GGCAMP_2022-02-28_NP	E235.Cl-L	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_TRIP_WS_GGCAMP_2022-02-28_NP	E235.Cl-L	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)										
HDPE RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E378-U	28-Feb-2022	----	----	----		02-Mar-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)										
HDPE RG_GHBP_WS_GGCAMP_2022-02-28_NP	E378-U	28-Feb-2022	----	----	----		02-Mar-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)										
HDPE RG_RIVER_WS_GGCAMP_2022-02-28_NP	E378-U	28-Feb-2022	----	----	----		02-Mar-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)										
HDPE RG_TRIP_WS_GGCAMP_2022-02-28_NP	E378-U	28-Feb-2022	----	----	----		02-Mar-2022	3 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E235.F	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GHBP_WS_GGCAMP_2022-02-28_NP	E235.F	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_RIVER_WS_GGCAMP_2022-02-28_NP	E235.F	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_TRIP_WS_GGCAMP_2022-02-28_NP	E235.F	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E235.NO3-L	28-Feb-2022	----	----	----		01-Mar-2022	3 days	1 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GHBP_WS_GGCAMP_2022-02-28_NP	E235.NO3-L	28-Feb-2022	----	----	----		01-Mar-2022	3 days	1 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_RIVER_WS_GGCAMP_2022-02-28_NP	E235.NO3-L	28-Feb-2022	----	----	----		01-Mar-2022	3 days	1 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_TRIP_WS_GGCAMP_2022-02-28_NP	E235.NO3-L	28-Feb-2022	----	----	----		01-Mar-2022	3 days	1 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E235.NO2-L	28-Feb-2022	----	----	----		01-Mar-2022	3 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GHBP_WS_GGCAMP_2022-02-28_NP	E235.NO2-L	28-Feb-2022	----	----	----		01-Mar-2022	3 days	1 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_RIVER_WS_GGCAMP_2022-02-28_NP	E235.NO2-L	28-Feb-2022	----	----	----		01-Mar-2022	3 days	1 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_TRIP_WS_GGCAMP_2022-02-28_NP	E235.NO2-L	28-Feb-2022	----	----	----		01-Mar-2022	3 days	1 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E235.SO4	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GHBP_WS_GGCAMP_2022-02-28_NP	E235.SO4	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_RIVER_WS_GGCAMP_2022-02-28_NP	E235.SO4	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_TRIP_WS_GGCAMP_2022-02-28_NP	E235.SO4	28-Feb-2022	----	----	----		01-Mar-2022	28 days	1 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E318	28-Feb-2022	08-Mar-2022	28 days	9 days	✓	09-Mar-2022	19 days	1 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_GHBP_WS_GGCAMP_2022-02-28_NP	E318	28-Feb-2022	08-Mar-2022	28 days	9 days	✓	09-Mar-2022	19 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_RIVER_WS_GGCAMP_2022-02-28_NP	E318	28-Feb-2022	08-Mar-2022	28 days	9 days	✓	09-Mar-2022	19 days	1 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_TRIP_WS_GGCAMP_2022-02-28_NP	E318	28-Feb-2022	09-Mar-2022	28 days	9 days	✓	10-Mar-2022	19 days	1 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E372-U	28-Feb-2022	02-Mar-2022	28 days	2 days	✓	02-Mar-2022	26 days	0 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) RG_GHBP_WS_GGCAMP_2022-02-28_NP	E372-U	28-Feb-2022	02-Mar-2022	28 days	2 days	✓	02-Mar-2022	26 days	0 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) RG_RIVER_WS_GGCAMP_2022-02-28_NP	E372-U	28-Feb-2022	02-Mar-2022	28 days	2 days	✓	02-Mar-2022	26 days	0 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) RG_TRIP_WS_GGCAMP_2022-02-28_NP	E372-U	28-Feb-2022	02-Mar-2022	28 days	2 days	✓	02-Mar-2022	26 days	0 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E421.Cr-L	28-Feb-2022	06-Mar-2022	180 days	6 days	✓	07-Mar-2022	174 days	1 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) RG_GHBP_WS_GGCAMP_2022-02-28_NP	E421.Cr-L	28-Feb-2022	06-Mar-2022	180 days	6 days	✓	07-Mar-2022	174 days	1 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) RG_RIVER_WS_GGCAMP_2022-02-28_NP	E421.Cr-L	28-Feb-2022	06-Mar-2022	180 days	6 days	✓	07-Mar-2022	174 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) RG_TRIP_WS_GGCAMP_2022-02-28_NP	E421.Cr-L	28-Feb-2022	06-Mar-2022	180 days	6 days	✓	07-Mar-2022	174 days	1 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E509	28-Feb-2022	08-Mar-2022	28 days	8 days	✓	08-Mar-2022	20 days	0 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GHBP_WS_GGCAMP_2022-02-28_NP	E509	28-Feb-2022	08-Mar-2022	28 days	8 days	✓	08-Mar-2022	20 days	0 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_RIVER_WS_GGCAMP_2022-02-28_NP	E509	28-Feb-2022	08-Mar-2022	28 days	8 days	✓	08-Mar-2022	20 days	0 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
HDPE dissolved (nitric acid) RG_TRIP_WS_GGCAMP_2022-02-28_NP	E509	28-Feb-2022	08-Mar-2022	28 days	8 days	✓	08-Mar-2022	20 days	0 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E421	28-Feb-2022	06-Mar-2022	180 days	6 days	✓	07-Mar-2022	174 days	1 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) RG_GHBP_WS_GGCAMP_2022-02-28_NP	E421	28-Feb-2022	06-Mar-2022	180 days	6 days	✓	07-Mar-2022	174 days	1 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) RG_RIVER_WS_GGCAMP_2022-02-28_NP	E421	28-Feb-2022	06-Mar-2022	180 days	6 days	✓	07-Mar-2022	174 days	1 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) RG_TRIP_WS_GGCAMP_2022-02-28_NP	E421	28-Feb-2022	06-Mar-2022	180 days	6 days	✓	07-Mar-2022	174 days	1 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E358-L	28-Feb-2022	01-Mar-2022	28 days	1 days	✓	02-Mar-2022	27 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GHBP_WS_GGCAMP_2022-02-28_NP	E358-L	28-Feb-2022	01-Mar-2022	28 days	1 days	✓	02-Mar-2022	27 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_RIVER_WS_GGCAMP_2022-02-28_NP	E358-L	28-Feb-2022	01-Mar-2022	28 days	1 days	✓	02-Mar-2022	27 days	1 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E355-L	28-Feb-2022	01-Mar-2022	28 days	1 days	✓	02-Mar-2022	27 days	1 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GHBP_WS_GGCAMP_2022-02-28_NP	E355-L	28-Feb-2022	01-Mar-2022	28 days	1 days	✓	02-Mar-2022	27 days	1 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_RIVER_WS_GGCAMP_2022-02-28_NP	E355-L	28-Feb-2022	01-Mar-2022	28 days	1 days	✓	02-Mar-2022	27 days	1 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_TRIP_WS_GGCAMP_2022-02-28_NP	E355-L	28-Feb-2022	01-Mar-2022	28 days	1 days	✓	02-Mar-2022	27 days	1 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E283	28-Feb-2022	----	----	----		02-Mar-2022	14 days	2 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_GHBP_WS_GGCAMP_2022-02-28_NP	E283	28-Feb-2022	----	----	----		02-Mar-2022	14 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Acidity by Titration										
HDPE RG_RIVER_WS_GGCAMP_2022-02-28_NP	E283	28-Feb-2022	----	----	----		02-Mar-2022	14 days	2 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_TRIP_WS_GGCAMP_2022-02-28_NP	E283	28-Feb-2022	----	----	----		02-Mar-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E290	28-Feb-2022	----	----	----		02-Mar-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_GHBP_WS_GGCAMP_2022-02-28_NP	E290	28-Feb-2022	----	----	----		02-Mar-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_RIVER_WS_GGCAMP_2022-02-28_NP	E290	28-Feb-2022	----	----	----		02-Mar-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_TRIP_WS_GGCAMP_2022-02-28_NP	E290	28-Feb-2022	----	----	----		02-Mar-2022	14 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E100	28-Feb-2022	----	----	----		02-Mar-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_GHBP_WS_GGCAMP_2022-02-28_NP	E100	28-Feb-2022	----	----	----		02-Mar-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_RIVER_WS_GGCAMP_2022-02-28_NP	E100	28-Feb-2022	----	----	----		02-Mar-2022	28 days	2 days	✓

Matrix: **Water**

Evaluation: ✘ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Physical Tests : Conductivity in Water										
HDPE RG_TRIP_WS_GGCAMP_2022-02-28_NP	E100	28-Feb-2022	----	----	----		02-Mar-2022	28 days	2 days	✓
Physical Tests : ORP by Electrode										
HDPE RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E125	28-Feb-2022	----	----	----		08-Mar-2022	0 hrs	193 hrs	✘ EHTR-FM
Physical Tests : ORP by Electrode										
HDPE RG_GHBP_WS_GGCAMP_2022-02-28_NP	E125	28-Feb-2022	----	----	----		08-Mar-2022	0 hrs	193 hrs	✘ EHTR-FM
Physical Tests : ORP by Electrode										
HDPE RG_RIVER_WS_GGCAMP_2022-02-28_NP	E125	28-Feb-2022	----	----	----		08-Mar-2022	0 hrs	193 hrs	✘ EHTR-FM
Physical Tests : ORP by Electrode										
HDPE RG_TRIP_WS_GGCAMP_2022-02-28_NP	E125	28-Feb-2022	----	----	----		08-Mar-2022	0 hrs	193 hrs	✘ EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E108	28-Feb-2022	----	----	----		02-Mar-2022	0 hrs	49 hrs	✘ EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GHBP_WS_GGCAMP_2022-02-28_NP	E108	28-Feb-2022	----	----	----		02-Mar-2022	0 hrs	49 hrs	✘ EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_RIVER_WS_GGCAMP_2022-02-28_NP	E108	28-Feb-2022	----	----	----		02-Mar-2022	0 hrs	49 hrs	✘ EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_TRIP_WS_GGCAMP_2022-02-28_NP	E108	28-Feb-2022	----	----	----		02-Mar-2022	0 hrs	49 hrs	✘ EHTR-FM

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Physical Tests : TDS by Gravimetry										
HDPE										
RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E162	28-Feb-2022	----	----	----		05-Mar-2022	7 days	5 days	✓
Physical Tests : TDS by Gravimetry										
HDPE										
RG_GHBP_WS_GGCAMP_2022-02-28_NP	E162	28-Feb-2022	----	----	----		05-Mar-2022	7 days	5 days	✓
Physical Tests : TDS by Gravimetry										
HDPE										
RG_RIVER_WS_GGCAMP_2022-02-28_NP	E162	28-Feb-2022	----	----	----		05-Mar-2022	7 days	5 days	✓
Physical Tests : TDS by Gravimetry										
HDPE										
RG_TRIP_WS_GGCAMP_2022-02-28_NP	E162	28-Feb-2022	----	----	----		05-Mar-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE										
RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E160-L	28-Feb-2022	----	----	----		05-Mar-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE										
RG_GHBP_WS_GGCAMP_2022-02-28_NP	E160-L	28-Feb-2022	----	----	----		05-Mar-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE										
RG_RIVER_WS_GGCAMP_2022-02-28_NP	E160-L	28-Feb-2022	----	----	----		05-Mar-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE										
RG_TRIP_WS_GGCAMP_2022-02-28_NP	E160-L	28-Feb-2022	----	----	----		05-Mar-2022	7 days	5 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E121	28-Feb-2022	----	----	----		02-Mar-2022	3 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Physical Tests : Turbidity by Nephelometry										
HDPE										
RG_GHBP_WS_GGCAMP_2022-02-28_NP	E121	28-Feb-2022	----	----	----		02-Mar-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
RG_RIVER_WS_GGCAMP_2022-02-28_NP	E121	28-Feb-2022	----	----	----		02-Mar-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
RG_TRIP_WS_GGCAMP_2022-02-28_NP	E121	28-Feb-2022	----	----	----		02-Mar-2022	3 days	2 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid)										
RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E420.Cr-L	28-Feb-2022	----	----	----		07-Mar-2022	180 days	7 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid)										
RG_GHBP_WS_GGCAMP_2022-02-28_NP	E420.Cr-L	28-Feb-2022	----	----	----		07-Mar-2022	180 days	7 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid)										
RG_RIVER_WS_GGCAMP_2022-02-28_NP	E420.Cr-L	28-Feb-2022	----	----	----		07-Mar-2022	180 days	7 days	✓
Total Metals : Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)										
Pre-cleaned amber glass - total (lab preserved)										
RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E508-L	28-Feb-2022	----	----	----		05-Mar-2022	28 days	5 days	✓
Total Metals : Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)										
Pre-cleaned amber glass - total (lab preserved)										
RG_GHBP_WS_GGCAMP_2022-02-28_NP	E508-L	28-Feb-2022	----	----	----		05-Mar-2022	28 days	5 days	✓
Total Metals : Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)										
Pre-cleaned amber glass - total (lab preserved)										
RG_RIVER_WS_GGCAMP_2022-02-28_NP	E508-L	28-Feb-2022	----	----	----		05-Mar-2022	28 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) RG_FBLANK_WS_GGCAMP_2022-02-28_NP	E420	28-Feb-2022	----	----	----		07-Mar-2022	180 days	7 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) RG_GHBP_WS_GGCAMP_2022-02-28_NP	E420	28-Feb-2022	----	----	----		07-Mar-2022	180 days	7 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) RG_RIVER_WS_GGCAMP_2022-02-28_NP	E420	28-Feb-2022	----	----	----		07-Mar-2022	180 days	7 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	421378	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	421515	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	420943	1	15	6.6	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	420811	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	420812	1	16	6.2	5.0	✓
Conductivity in Water	E100	421514	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	425389	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	426361	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	425390	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	421012	1	12	8.3	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	421302	1	15	6.6	5.0	✓
Fluoride in Water by IC	E235.F	420809	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	420813	1	16	6.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	420814	1	16	6.2	5.0	✓
ORP by Electrode	E125	426060	1	20	5.0	5.0	✓
pH by Meter	E108	421513	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	420810	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	421874	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	425329	1	20	5.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	427209	2	40	5.0	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	425020	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	425330	2	20	10.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	421013	1	13	7.6	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	420883	1	17	5.8	5.0	✓
Turbidity by Nephelometry	E121	421432	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	421378	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	421515	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	420943	1	15	6.6	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	420811	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	420812	1	16	6.2	5.0	✓
Conductivity in Water	E100	421514	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	425389	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	426361	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	425390	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	421012	1	12	8.3	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	421302	1	15	6.6	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Fluoride in Water by IC	E235.F	420809	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	420813	1	16	6.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	420814	1	16	6.2	5.0	✓
ORP by Electrode	E125	426060	1	20	5.0	5.0	✓
pH by Meter	E108	421513	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	420810	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	421874	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	425329	1	20	5.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	427209	2	40	5.0	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	425020	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	425330	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	421013	1	13	7.6	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	420883	1	17	5.8	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	421870	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	421432	1	20	5.0	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	421378	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	421515	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	420943	1	15	6.6	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	420811	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	420812	1	16	6.2	5.0	✓
Conductivity in Water	E100	421514	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	425389	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	426361	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	425390	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	421012	1	12	8.3	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	421302	1	15	6.6	5.0	✓
Fluoride in Water by IC	E235.F	420809	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	420813	1	16	6.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	420814	1	16	6.2	5.0	✓
Sulfate in Water by IC	E235.SO4	420810	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	421874	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	425329	1	20	5.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	427209	2	40	5.0	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	425020	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	425330	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	421013	1	13	7.6	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	420883	1	17	5.8	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	421870	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	421432	1	20	5.0	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	420943	1	15	6.6	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	420811	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	420812	1	16	6.2	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	425389	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	426361	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	425390	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	421012	1	12	8.3	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	421302	1	15	6.6	5.0	✓
Fluoride in Water by IC	E235.F	420809	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	420813	1	16	6.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	420814	1	16	6.2	5.0	✓
Sulfate in Water by IC	E235.SO4	420810	1	16	6.2	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	425329	1	20	5.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	427209	2	40	5.0	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	425020	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	425330	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	421013	1	13	7.6	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	420883	1	17	5.8	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	J. Environ. Monit., 2005, 7, 37-42 (mod)	Ammonia in water is analyzed by flow-injection analysis with fluorescence detection after reaction with orthophthaldialdehyde (OPA).
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Vancouver - Environmental	Water	APHA 4500-Norg D (mod)	Total Kjeldahl Nitrogen is determined using block digestion followed by flow-injection analysis with fluorescence detection.
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Vancouver - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L Vancouver - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAFS.
Dissolved Mercury in Water by CVAAS	E509 Vancouver - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Vancouver - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested using block digestion with Copper Sulfate Digestion Reagent.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Mercury Water Filtration	EP509 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **CG2202277**	Page	: 1 of 18
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Ave Sparwood BC Canada	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 01-Mar-2022 09:21
PO	: VPO00748510	Date Analysis Commenced	: 01-Mar-2022
C-O-C number	: February GGCAMP 2022	Issue Date	: 11-Mar-2022 17:45
Sampler	: ----		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Elke Tabora		Inorganics, Calgary, Alberta
Erin Sanchez		Inorganics, Calgary, Alberta
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Monica Ko	Lab Assistant	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percentage Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test specific).

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 421378)											
CG2202276-002	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	37.4	36.1	3.70%	20%	----
Physical Tests (QC Lot: 421432)											
CG2202272-001	Anonymous	turbidity	----	E121	0.10	NTU	<0.10	<0.10	0	Diff <2x LOR	----
Physical Tests (QC Lot: 421513)											
CG2202271-001	Anonymous	pH	----	E108	0.10	pH units	7.96	7.97	0.126%	4%	----
Physical Tests (QC Lot: 421514)											
CG2202271-001	Anonymous	conductivity	----	E100	2.0	µS/cm	2790	2790	0.00%	10%	----
Physical Tests (QC Lot: 421515)											
CG2202271-001	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	441	440	0.136%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	441	440	0.136%	20%	----
Physical Tests (QC Lot: 421874)											
CG2202275-008	Anonymous	solids, total dissolved [TDS]	----	E162	40	mg/L	1630	1700	4.21%	20%	----
Physical Tests (QC Lot: 426060)											
CG2202275-001	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	462	460	0.564%	15%	----
Anions and Nutrients (QC Lot: 420809)											
CG2201584-005	Anonymous	fluoride	16984-48-8	E235.F	0.100	mg/L	0.146	0.145	0.0002	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 420810)											
CG2201584-005	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	1.50	mg/L	407	403	1.06%	20%	----
Anions and Nutrients (QC Lot: 420811)											
CG2201584-005	Anonymous	bromide	24959-67-9	E235.Br-L	0.250	mg/L	<0.250	<0.250	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 420812)											
CG2201584-005	Anonymous	chloride	16887-00-6	E235.Cl-L	0.50	mg/L	11.9	11.6	2.96%	20%	----
Anions and Nutrients (QC Lot: 420813)											
CG2201584-005	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0250	mg/L	21.0	20.7	1.16%	20%	----
Anions and Nutrients (QC Lot: 420814)											
CG2201584-005	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 420883)											
CG2202276-002	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0039	0.0039	0.00002	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 420943)											

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Anions and Nutrients (QC Lot: 420943) - continued											
CG2202276-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 421302)											
CG2202276-002	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0036	0.0040	0.0004	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 427209)											
CG2202264-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.326	0.322	0.004	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 427393)											
CG2202277-004	RG_TRIP_WS_GGCAMP_ 2022-02-28_NP	Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 421012)											
CG2202277-001	RG_FBLANK_WS_GGCA MP_2022-02-28_NP	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 421013)											
CG2202277-001	RG_FBLANK_WS_GGCA MP_2022-02-28_NP	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Total Metals (QC Lot: 425020)											
CG2201847-001	Anonymous	mercury, total	7439-97-6	E508-L	0.50	ng/L	<0.50	<0.50	0	Diff <2x LOR	----
Total Metals (QC Lot: 425329)											
CG2202276-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
Total Metals (QC Lot: 425330)											
CG2202276-001	Anonymous	copper, total	7440-50-8	E420	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		nickel, total	7440-02-0	E420	0.00100	mg/L	0.0392	0.0402	2.38%	20%	----
CG2202276-001	Anonymous	aluminum, total	7429-90-5	E420	0.0060	mg/L	<0.0060	<0.0060	0	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00020	mg/L	0.00045	0.00044	0.000006	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00020	mg/L	0.0549	0.0562	2.33%	20%	----
		beryllium, total	7440-41-7	E420	0.040	mg/L	<0.040 µg/L	<0.000040	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.020	mg/L	0.031	0.031	0.00006	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0100	mg/L	0.786 µg/L	0.000798	1.54%	20%	----
		calcium, total	7440-70-2	E420	0.100	mg/L	408	411	0.630%	20%	----
		cobalt, total	7440-48-4	E420	0.20	mg/L	<0.20 µg/L	<0.00020	0	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0020	mg/L	0.215	0.208	3.29%	20%	----
		magnesium, total	7439-95-4	E420	0.0100	mg/L	198	201	1.49%	20%	----
		manganese, total	7439-96-5	E420	0.00020	mg/L	0.00038	<0.00020	0.00018	Diff <2x LOR	----
		molybdenum, total	7439-98-7	E420	0.000100	mg/L	0.00144	0.00136	5.41%	20%	----

Sub-Matrix: **Water**

Laboratory Duplicate (DUP) Report

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Total Metals (QC Lot: 425330) - continued											
CG2202276-001	Anonymous	potassium, total	7440-09-7	E420	0.100	mg/L	5.68	5.76	1.53%	20%	----
		selenium, total	7782-49-2	E420	0.100	mg/L	388 µg/L	0.403	3.96%	20%	----
		silicon, total	7440-21-3	E420	0.20	mg/L	2.16	2.19	1.61%	20%	----
		silver, total	7440-22-4	E420	0.000020	mg/L	0.000034	0.000022	0.000012	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.100	mg/L	9.38	9.57	1.98%	20%	----
		strontium, total	7440-24-6	E420	0.00040	mg/L	0.367	0.367	0.0424%	20%	----
		sulfur, total	7704-34-9	E420	1.00	mg/L	337	337	0.0954%	20%	----
		thallium, total	7440-28-0	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00060	mg/L	<0.00060	<0.00060	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000020	mg/L	0.0164	0.0168	2.40%	20%	----
		vanadium, total	7440-62-2	E420	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0060	mg/L	0.0148	0.0155	0.0007	Diff <2x LOR	----
Dissolved Metals (QC Lot: 425389)											
CG2202276-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 425390)											
CG2202276-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0020	mg/L	0.0062	0.0053	0.0010	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00020	mg/L	0.00044	0.00042	0.00002	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00020	mg/L	0.0618	0.0634	2.48%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.040	mg/L	<0.040 µg/L	<0.000040	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.020	mg/L	0.031	0.030	0.001	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0100	mg/L	0.824 µg/L	0.000792	3.95%	20%	----
		calcium, dissolved	7440-70-2	E421	0.100	mg/L	444	450	1.33%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.20	mg/L	<0.20 µg/L	<0.00020	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00040	mg/L	<0.00040	<0.00040	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0020	mg/L	0.217	0.221	1.82%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0100	mg/L	200	205	2.19%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00020	mg/L	0.00039	0.00042	0.00002	Diff <2x LOR	----
		molybdenum, dissolved	7439-98-7	E421	0.000100	mg/L	0.00150	0.00153	2.32%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00100	mg/L	0.0356	0.0367	2.86%	20%	----
		potassium, dissolved	7440-09-7	E421	0.100	mg/L	5.34	5.52	3.32%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Dissolved Metals (QC Lot: 425390) - continued											
CG2202276-001	Anonymous	selenium, dissolved	7782-49-2	E421	0.100	mg/L	415 µg/L	0.419	1.05%	20%	----
		silicon, dissolved	7440-21-3	E421	0.100	mg/L	2.21	2.30	4.10%	20%	----
		silver, dissolved	7440-22-4	E421	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.100	mg/L	9.70	9.89	1.98%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00040	mg/L	0.389	0.390	0.351%	20%	----
		sulfur, dissolved	7704-34-9	E421	1.00	mg/L	364	370	1.62%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000020	mg/L	0.000021	<0.000020	0.000001	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00060	mg/L	<0.00060	<0.00060	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000020	mg/L	0.0164	0.0166	1.06%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0020	mg/L	0.0168	0.0175	0.0006	Diff <2x LOR	----
Dissolved Metals (QC Lot: 426361)											
CG2202216-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 421378)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 421432)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 421514)						
conductivity	----	E100	1	µS/cm	1.3	----
Physical Tests (QCLot: 421515)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 421870)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 421874)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 420809)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 420810)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 420811)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 420812)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 420813)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 420814)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 420883)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 420943)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 421302)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 427209)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 427209) - continued						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 427393)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Organic / Inorganic Carbon (QCLot: 421012)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 421013)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 425020)						
mercury, total	7439-97-6	E508-L	0.5	ng/L	<0.50	----
Total Metals (QCLot: 425329)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 425330)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 425330) - continued						
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Dissolved Metals (QCLot: 425389)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 425390)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 425390) - continued						
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Dissolved Metals (QCLot: 426361)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 421378)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	106	85.0	115	----
Physical Tests (QCLot: 421432)									
turbidity	----	E121	0.1	NTU	200 NTU	94.6	85.0	115	----
Physical Tests (QCLot: 421513)									
pH	----	E108	----	pH units	7 pH units	100	98.6	101	----
Physical Tests (QCLot: 421514)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	101	90.0	110	----
Physical Tests (QCLot: 421515)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	103	85.0	115	----
Physical Tests (QCLot: 421870)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	102	85.0	115	----
Physical Tests (QCLot: 421874)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	91.6	85.0	115	----
Physical Tests (QCLot: 426060)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	101	95.4	104	----
Anions and Nutrients (QCLot: 420809)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	93.3	90.0	110	----
Anions and Nutrients (QCLot: 420810)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 420811)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	100	85.0	115	----
Anions and Nutrients (QCLot: 420812)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	98.3	90.0	110	----
Anions and Nutrients (QCLot: 420813)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	99.5	90.0	110	----
Anions and Nutrients (QCLot: 420814)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 420883)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	8.02 mg/L	100	80.0	120	----
Anions and Nutrients (QCLot: 420943)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	96.5	85.0	115	----
Anions and Nutrients (QCLot: 421302)									

Sub-Matrix: **Water**

Laboratory Control Sample (LCS) Report

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Anions and Nutrients (QCLot: 421302) - continued									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.02 mg/L	93.8	80.0	120	----
Anions and Nutrients (QCLot: 427209)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	96.2	75.0	125	----
Anions and Nutrients (QCLot: 427393)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	97.9	75.0	125	----
Organic / Inorganic Carbon (QCLot: 421012)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	104	80.0	120	----
Organic / Inorganic Carbon (QCLot: 421013)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	111	80.0	120	----
Total Metals (QCLot: 425020)									
mercury, total	7439-97-6	E508-L	0.5	ng/L	5 ng/L	104	80.0	120	----
Total Metals (QCLot: 425329)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	95.8	80.0	120	----
Total Metals (QCLot: 425330)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	93.2	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	104	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	96.3	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	99.6	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	97.6	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	97.9	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	96.7	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	94.9	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	99.8	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	96.0	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	95.6	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	98.3	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	95.9	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	102	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	95.5	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	97.8	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	103	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	96.4	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	102	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	92.4	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	97.7	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 425330) - continued									
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	92.6	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	97.0	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	95.1	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	109	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	100	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	95.7	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	99.5	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	95.8	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	95.4	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	98.3	80.0	120	----
Dissolved Metals (QCLot: 425389)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
Dissolved Metals (QCLot: 425390)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	109	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	108	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	101	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	108	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	98.8	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	102	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	102	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	102	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	100	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	92.8	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	104	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	105	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	103	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	104	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	100	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	102	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	103	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	102	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	94.2	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	104	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Dissolved Metals (QCLot: 425390) - continued									
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	102	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	91.0	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	106	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	98.1	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	101	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	103	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	103	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	88.8	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	100	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 420809)										
CG2202277-001	RG_FBLANK_WS_GGCAMP_2022-02-28_NP	fluoride	16984-48-8	E235.F	0.871 mg/L	1 mg/L	87.1	75.0	125	----
Anions and Nutrients (QCLot: 420810)										
CG2202277-001	RG_FBLANK_WS_GGCAMP_2022-02-28_NP	sulfate (as SO4)	14808-79-8	E235.SO4	95.8 mg/L	100 mg/L	95.8	75.0	125	----
Anions and Nutrients (QCLot: 420811)										
CG2202277-001	RG_FBLANK_WS_GGCAMP_2022-02-28_NP	bromide	24959-67-9	E235.Br-L	0.488 mg/L	0.5 mg/L	97.7	75.0	125	----
Anions and Nutrients (QCLot: 420812)										
CG2202277-001	RG_FBLANK_WS_GGCAMP_2022-02-28_NP	chloride	16887-00-6	E235.Cl-L	95.1 mg/L	100 mg/L	95.1	75.0	125	----
Anions and Nutrients (QCLot: 420813)										
CG2202277-001	RG_FBLANK_WS_GGCAMP_2022-02-28_NP	nitrate (as N)	14797-55-8	E235.NO3-L	2.41 mg/L	2.5 mg/L	96.4	75.0	125	----
Anions and Nutrients (QCLot: 420814)										
CG2202277-001	RG_FBLANK_WS_GGCAMP_2022-02-28_NP	nitrite (as N)	14797-65-0	E235.NO2-L	0.488 mg/L	0.5 mg/L	97.6	75.0	125	----
Anions and Nutrients (QCLot: 420883)										
CG2202276-003	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0658 mg/L	0.0676 mg/L	97.3	70.0	130	----
Anions and Nutrients (QCLot: 420943)										
CG2202276-003	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.103 mg/L	0.1 mg/L	103	75.0	125	----
Anions and Nutrients (QCLot: 421302)										
CG2202276-003	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0532 mg/L	0.05 mg/L	106	70.0	130	----
Anions and Nutrients (QCLot: 427209)										
CG2202264-002	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.74 mg/L	2.5 mg/L	110	70.0	130	----
Anions and Nutrients (QCLot: 427393)										
CG2202280-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.54 mg/L	2.5 mg/L	102	70.0	130	----
Organic / Inorganic Carbon (QCLot: 421012)										
CG2202277-001	RG_FBLANK_WS_GGCAMP_2022-02-28_NP	carbon, dissolved organic [DOC]	----	E358-L	5.30 mg/L	5 mg/L	106	70.0	130	----
Organic / Inorganic Carbon (QCLot: 421013)										

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Matrix Spike (MS) Report: Spike Concentration	Spike Target	Recovery (%) MS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Organic / Inorganic Carbon (QCLot: 421013) - continued										
CG2202277-001	RG_FBLANK_WS_GGCAMP_2022-02-28_NP	carbon, total organic [TOC]	----	E355-L	5.38 mg/L	5 mg/L	108	70.0	130	----
Total Metals (QCLot: 425020)										
CG2201847-002	Anonymous	mercury, total	7439-97-6	E508-L	5.15 ng/L	5 ng/L	103	70.0	130	----
Total Metals (QCLot: 425329)										
CG2202276-002	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.0772 mg/L	0.08 mg/L	96.5	70.0	130	----
Total Metals (QCLot: 425330)										
CG2202276-002	Anonymous	aluminum, total	7429-90-5	E420	0.380 mg/L	0.4 mg/L	94.9	70.0	130	----
		antimony, total	7440-36-0	E420	0.0418 mg/L	0.04 mg/L	104	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0394 mg/L	0.04 mg/L	98.5	70.0	130	----
		barium, total	7440-39-3	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0780 mg/L	0.08 mg/L	97.4	70.0	130	----
		bismuth, total	7440-69-9	E420	0.0180 mg/L	0.02 mg/L	90.0	70.0	130	----
		boron, total	7440-42-8	E420	0.199 mg/L	0.2 mg/L	99.4	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00752 mg/L	0.008 mg/L	94.0	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0374 mg/L	0.04 mg/L	93.6	70.0	130	----
		copper, total	7440-50-8	E420	0.0366 mg/L	0.04 mg/L	91.5	70.0	130	----
		iron, total	7439-89-6	E420	3.84 mg/L	4 mg/L	96.0	70.0	130	----
		lead, total	7439-92-1	E420	0.0370 mg/L	0.04 mg/L	92.5	70.0	130	----
		lithium, total	7439-93-2	E420	ND mg/L	0.1 mg/L	ND	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.0381 mg/L	0.04 mg/L	95.4	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0440 mg/L	0.04 mg/L	110	70.0	130	----
		nickel, total	7440-02-0	E420	0.0747 mg/L	0.08 mg/L	93.4	70.0	130	----
		potassium, total	7440-09-7	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		selenium, total	7782-49-2	E420	ND mg/L	0.04 mg/L	ND	70.0	130	----
		silicon, total	7440-21-3	E420	18.3 mg/L	20 mg/L	91.4	70.0	130	----
		silver, total	7440-22-4	E420	0.00800 mg/L	0.008 mg/L	100.0	70.0	130	----
		sodium, total	7440-23-5	E420	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		sulfur, total	7704-34-9	E420	ND mg/L	20 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.00748 mg/L	0.008 mg/L	93.5	70.0	130	----
		tin, total	7440-31-5	E420	0.0390 mg/L	0.04 mg/L	97.4	70.0	130	----
		titanium, total	7440-32-6	E420	0.0841 mg/L	0.08 mg/L	105	70.0	130	----
		uranium, total	7440-61-1	E420	ND mg/L	0.004 mg/L	ND	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*Target*	*MS*	*Low*	*High*	*Qualifier*
Total Metals (QCLot: 425330) - continued										
CG2202276-002	Anonymous	vanadium, total	7440-62-2	E420	0.197 mg/L	0.2 mg/L	98.6	70.0	130	----
		zinc, total	7440-66-6	E420	0.760 mg/L	0.8 mg/L	95.0	70.0	130	----
Dissolved Metals (QCLot: 425389)										
CG2202276-002	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.0809 mg/L	0.08 mg/L	101	70.0	130	----
Dissolved Metals (QCLot: 425390)										
CG2202276-002	Anonymous	aluminum, dissolved	7429-90-5	E421	0.390 mg/L	0.4 mg/L	97.6	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0396 mg/L	0.04 mg/L	99.0	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0429 mg/L	0.04 mg/L	107	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.04 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0734 mg/L	0.08 mg/L	91.7	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0150 mg/L	0.02 mg/L	75.0	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.181 mg/L	0.2 mg/L	90.6	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00801 mg/L	0.008 mg/L	100	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0380 mg/L	0.04 mg/L	95.0	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0367 mg/L	0.04 mg/L	91.8	70.0	130	----
		iron, dissolved	7439-89-6	E421	3.89 mg/L	4 mg/L	97.4	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0341 mg/L	0.04 mg/L	85.2	70.0	130	----
		lithium, dissolved	7439-93-2	E421	ND mg/L	0.1 mg/L	ND	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.0404 mg/L	0.04 mg/L	101	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0410 mg/L	0.04 mg/L	102	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0750 mg/L	0.08 mg/L	93.7	70.0	130	----
		potassium, dissolved	7440-09-7	E421	7.86 mg/L	8 mg/L	98.3	70.0	130	----
		selenium, dissolved	7782-49-2	E421	ND mg/L	0.04 mg/L	ND	70.0	130	----
		silicon, dissolved	7440-21-3	E421	18.7 mg/L	20 mg/L	93.3	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00737 mg/L	0.008 mg/L	92.1	70.0	130	----
		sodium, dissolved	7440-23-5	E421	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	ND mg/L	20 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00693 mg/L	0.008 mg/L	86.6	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0390 mg/L	0.04 mg/L	97.6	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0815 mg/L	0.08 mg/L	102	70.0	130	----
		uranium, dissolved	7440-61-1	E421	ND mg/L	0.004 mg/L	ND	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.202 mg/L	0.2 mg/L	101	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.805 mg/L	0.8 mg/L	101	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 426361)										
CG2202216-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000904 mg/L	0.0001 mg/L	90.4	70.0	130	----

Teck

COC ID: **February GGCAMP 2022** | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO

Facility Name / Job#	Regional Effects Program
Project Manager	Giovanna Diaz
Email	giovanna.diaz@teck.com
Address	421 Pine Ave
City	Sparwood — Province BC
Postal Code	V0B 2G0 — Country Canada
Phone Number	587-215-8447

LABORATORY

Lab Name	ALS Calgary
Lab Contact	Lyudmyla Shvets
Email	Lyudmyla.Shvets@ALSGlobal.com
Address	2559 29 Street NE
City	Calgary — Province AB
Postal Code	T1Y 7B5 — Country Canada
Phone Number	403 407 1794

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
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Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	AquaSciLab@teck.com	X	X	X
Email 5:	lbowron@minnow.ca	X	X	X
Email 6:	awiebe@minnow.ca	X	X	X
PO number	748510			

Environmental Division
Calgary
Work Order Reference
CG2202277

Telephone : +1 403 407 1800

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ALS_Package-DOC	ALS_Package-TKN/TOC	HG-D-CVAF-VA	HG-T-U-CVAF-VA	TECKCOAL-MET-D-VA	TECKCOAL-METNHG-T-CL	TECKCOAL-ROUTINE-VA
Filtered								F	N	F	N	F	N	N
Preservative								H2SO4	H2SO4	HCL	NONE	HNO3	HNO3	NONE
RG_FBLANK_WS_GGCAMP_2022-02-28_NP	RG_FBLANK	WS		2022/02/28	10		7	1	1	1	1	1	1	1
RG_GHBP_WS_GGCAMP_2022-02-28_NP	RG_GHBP	WS		2022/02/28		G	7	1	1	1	1	1	1	1
RG_RIVER_WS_GGCAMP_2022-02-28_NP	RG_RIVER	WS		2022/02/28		G	7	1	1	1	1	1	1	1
RG_TRIP_WS_GGCAMP_2022-02-28_NP	RG_TRIP	WS		2022/02/28			#NAME?	x	x	x	x	x	x	x
							#NAME?	3	3	3	3	3	3	3

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
			9:21 03/01/2022	~~10~~ C 6°C

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name		Mobile #	
Sampler's Signature		Date/Time	

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **CG2212274**	Page	: 1 of 6
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECT PROGRAM	Date Samples Received	: 10-Sep-2022 11:45
PO	: VPO00816101	Date Analysis Commenced	: 11-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 15-Sep-2022 16:02
Sampler	: Jennifer I.		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Inorganics, Calgary, Alberta
Dwayne Bennett	Supervisor - Inorganic	Metals, Calgary, Alberta
Elke Tabora		Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Metals, Calgary, Alberta
Millicent Brentnall	Laboratory Analyst	Metals, Calgary, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Sara Niroomand		Metals, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

We did not receive any samples for Sample ID RG_GHNF_WS_LAEMP_GC_2022-09_N

Qualifiers

Qualifier	*Description*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
TKNI	*TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHFF_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	08-Sep-2022	----	----	----	----
					CG2212274-001	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	----	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	274	----	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	334	----	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	274	----	----	----	----
conductivity	----	E100	2.0	µS/cm	1710	----	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	1230	----	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	236	----	----	----	----
pH	----	E108	0.10	pH units	8.17	----	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	1450	----	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	5.1	----	----	----	----
turbidity	----	E121	0.10	NTU	0.50	----	----	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	----	----	----	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.250 DLDS	----	----	----	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	2.24	----	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.195	----	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.393 TKNI	----	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	6.17	----	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0050 DLDS	----	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	----	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0052	----	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	932	----	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.33	----	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.39	----	----	----	----
Ion Balance									

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	RG_GHFF_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	08-Sep-2022	----	----	----	----
					CG2212274-001	--------	--------	--------	--------
					Result	----	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	25.4	----	----	----	----
cation sum	----	EC101	0.10	meq/L	24.7	----	----	----	----
ion balance (cations/anions)	----	EC101	0.010	%	97.2	----	----	----	----
ion balance (APHA)	----	EC101	0.010	%	1.40	----	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0070	----	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00046	----	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00025	----	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0484	----	----	----	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	----	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	----	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	----	----	----	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.0056	----	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	209	----	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00014	----	----	----	----
cobalt, total	7440-48-4	E420	0.10	µg/L	<0.10	----	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	----	----	----	----
iron, total	7439-89-6	E420	0.010	mg/L	<0.010	----	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	----	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0206	----	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	174	----	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.00102	----	----	----	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00164	----	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.0133	----	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	2.62	----	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	196	----	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	4.03	----	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	----	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L	2.57	----	----	----	----
strontium, total	7440-24-6	E420	0.00020	mg/L	0.211	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	RG_GHFF_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	08-Sep-2022	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	CG2212274-001	--------	--------	--------	--------
					Result	----	----	----	----
Total Metals									
sulfur, total	7704-34-9	E420	0.50	mg/L	294	----	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	----	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	----	----	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	----	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.00927	----	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00056	----	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	----	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0029	----	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00045	----	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	<0.00020 DLDS	----	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0483	----	----	----	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.040 DLDS	----	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000100 DLDS	----	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.020 DLDS	----	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	<0.0100 DLDS	----	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	202	----	----	----	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00020 DLDS	----	----	----	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.20 DLDS	----	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00040 DLDS	----	----	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.020 DLDS	----	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000100 DLDS	----	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0211	----	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	176	----	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00088	----	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00165	----	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.0130	----	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	2.46	----	----	----	----
selenium, dissolved	7782-49-2	E421	0.050	µg/L	194	----	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.73	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	RG_GHFF_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	08-Sep-2022	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2212274-001	--------	--------	--------	--------
					Result	----	----	----	----
Dissolved Metals									
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000020 DLDS	----	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	2.32	----	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.201	----	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	330	----	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000020 DLDS	----	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00020 DLDS	----	----	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00060 DLDS	----	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00927	----	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00100 DLDS	----	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0020 DLDS	----	----	----	----
dissolved mercury filtration location	----	EP509	-	-	Field	----	----	----	----
dissolved metals filtration location	----	EP421	-	-	Field	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2212274**	Page	: 1 of 12
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECT PROGRAM	Date Samples Received	: 10-Sep-2022 11:45
PO	: VPO00816101	Issue Date	: 15-Sep-2022 16:02
C-O-C number	: REP_LAEMP_GC_2022-09_ALS		
Sampler	: Jennifer I.		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_GHFF_WS_LAEMP_GC_2022-09_N	E298	08-Sep-2022	11-Sep-2022	----	----		11-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E235.Br-L	08-Sep-2022	11-Sep-2022	----	----		11-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E235.Cl-L	08-Sep-2022	11-Sep-2022	----	----		11-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E378-U	08-Sep-2022	11-Sep-2022	----	----		11-Sep-2022	3 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E235.F	08-Sep-2022	11-Sep-2022	----	----		11-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E235.NO3-L	08-Sep-2022	11-Sep-2022	3 days	3 days	✓	11-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E235.NO2-L	08-Sep-2022	11-Sep-2022	----	----		11-Sep-2022	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E235.SO4	08-Sep-2022	11-Sep-2022	----	----		11-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_GHFF_WS_LAEMP_GC_2022-09_N	E318	08-Sep-2022	12-Sep-2022	----	----		12-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) RG_GHFF_WS_LAEMP_GC_2022-09_N	E372-U	08-Sep-2022	12-Sep-2022	----	----		13-Sep-2022	28 days	5 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) RG_GHFF_WS_LAEMP_GC_2022-09_N	E421.Cr-L	08-Sep-2022	12-Sep-2022	----	----		13-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GHFF_WS_LAEMP_GC_2022-09_N	E509	08-Sep-2022	12-Sep-2022	----	----		12-Sep-2022	28 days	4 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) RG_GHFF_WS_LAEMP_GC_2022-09_N	E421	08-Sep-2022	12-Sep-2022	----	----		13-Sep-2022	180 days	6 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GHFF_WS_LAEMP_GC_2022-09_N	E358-L	08-Sep-2022	11-Sep-2022	----	----		11-Sep-2022	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GHFF_WS_LAEMP_GC_2022-09_N	E355-L	08-Sep-2022	11-Sep-2022	----	----		11-Sep-2022	28 days	3 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E283	08-Sep-2022	12-Sep-2022	----	----		12-Sep-2022	14 days	4 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Physical Tests : Alkalinity Species by Titration										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E290	08-Sep-2022	12-Sep-2022	----	----		12-Sep-2022	14 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E100	08-Sep-2022	12-Sep-2022	----	----		12-Sep-2022	28 days	4 days	✓
Physical Tests : ORP by Electrode										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E125	08-Sep-2022	----	----	----		12-Sep-2022	0.25 hrs	108 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E108	08-Sep-2022	12-Sep-2022	----	----		12-Sep-2022	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E162	08-Sep-2022	----	----	----		13-Sep-2022	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E160-L	08-Sep-2022	----	----	----		13-Sep-2022	7 days	6 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE RG_GHFF_WS_LAEMP_GC_2022-09_N	E121	08-Sep-2022	----	----	----		11-Sep-2022	3 days	3 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) RG_GHFF_WS_LAEMP_GC_2022-09_N	E420.Cr-L	08-Sep-2022	12-Sep-2022	----	----		13-Sep-2022	180 days	6 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) RG_GHFF_WS_LAEMP_GC_2022-09_N	E508	08-Sep-2022	12-Sep-2022	----	----		12-Sep-2022	28 days	4 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) RG_GHFF_WS_LAEMP_GC_2022-09_N	E420	08-Sep-2022	12-Sep-2022	----	----		13-Sep-2022	180 days	6 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	642501	1	17	5.8	5.0	✓
Alkalinity Species by Titration	E290	642497	1	17	5.8	5.0	✓
Ammonia by Fluorescence	E298	641825	1	16	6.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	641957	1	15	6.6	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	641958	1	15	6.6	5.0	✓
Conductivity in Water	E100	642496	1	17	5.8	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	643704	1	16	6.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	642719	1	17	5.8	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	643705	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	641869	1	14	7.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	641921	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	641956	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	641959	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	641960	1	19	5.2	5.0	✓
ORP by Electrode	E125	641962	1	15	6.6	5.0	✓
pH by Meter	E108	642495	1	17	5.8	5.0	✓
Sulfate in Water by IC	E235.SO4	641961	1	15	6.6	5.0	✓
TDS by Gravimetry	E162	645182	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	643302	1	16	6.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	642132	1	15	6.6	5.0	✓
Total Mercury in Water by CVAAS	E508	642722	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	643301	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	641870	1	15	6.6	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	642658	1	17	5.8	5.0	✓
Turbidity by Nephelometry	E121	641757	1	17	5.8	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	642501	1	17	5.8	5.0	✓
Alkalinity Species by Titration	E290	642497	1	17	5.8	5.0	✓
Ammonia by Fluorescence	E298	641825	1	16	6.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	641957	1	15	6.6	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	641958	1	15	6.6	5.0	✓
Conductivity in Water	E100	642496	1	17	5.8	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	643704	1	16	6.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	642719	1	17	5.8	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	643705	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	641869	1	14	7.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	641921	1	20	5.0	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Fluoride in Water by IC	E235.F	641956	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	641959	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	641960	1	19	5.2	5.0	✓
ORP by Electrode	E125	641962	1	15	6.6	5.0	✓
pH by Meter	E108	642495	1	17	5.8	5.0	✓
Sulfate in Water by IC	E235.SO4	641961	1	15	6.6	5.0	✓
TDS by Gravimetry	E162	645182	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	643302	1	16	6.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	642132	1	15	6.6	5.0	✓
Total Mercury in Water by CVAAS	E508	642722	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	643301	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	641870	1	15	6.6	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	642658	1	17	5.8	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	645179	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	641757	1	17	5.8	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	642501	1	17	5.8	5.0	✓
Alkalinity Species by Titration	E290	642497	1	17	5.8	5.0	✓
Ammonia by Fluorescence	E298	641825	1	16	6.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	641957	1	15	6.6	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	641958	1	15	6.6	5.0	✓
Conductivity in Water	E100	642496	1	17	5.8	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	643704	1	16	6.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	642719	1	17	5.8	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	643705	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	641869	1	14	7.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	641921	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	641956	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	641959	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	641960	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	641961	1	15	6.6	5.0	✓
TDS by Gravimetry	E162	645182	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	643302	1	16	6.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	642132	1	15	6.6	5.0	✓
Total Mercury in Water by CVAAS	E508	642722	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	643301	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	641870	1	15	6.6	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	642658	1	17	5.8	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	645179	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	641757	1	17	5.8	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	641825	1	16	6.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	641957	1	15	6.6	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	641958	1	15	6.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	643704	1	16	6.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	642719	1	17	5.8	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	643705	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	641869	1	14	7.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	641921	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	641956	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	641959	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	641960	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	641961	1	15	6.6	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	643302	1	16	6.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	642132	1	15	6.6	5.0	✓
Total Mercury in Water by CVAAS	E508	642722	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	643301	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	641870	1	15	6.6	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	642658	1	17	5.8	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Calgary - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAAS	E508 Calgary - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **CG2212274**	Page	: 1 of 18
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECT PROGRAM	Date Samples Received	: 10-Sep-2022 11:45
PO	: VPO00816101	Date Analysis Commenced	: 11-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 15-Sep-2022 16:02
Sampler	: Jennifer I.		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Calgary Inorganics, Calgary, Alberta
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Elke Tabora		Calgary Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Inorganics, Calgary, Alberta
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Millicent Brentnall	Laboratory Analyst	Calgary Metals, Calgary, Alberta
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Sara Niroomand		Calgary Inorganics, Calgary, Alberta
Sara Niroomand		Calgary Metals, Calgary, Alberta

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 641757)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	turbidity	----	E121	0.10	NTU	0.50	0.57	0.06	Diff <2x LOR	----
Physical Tests (QC Lot: 641962)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	oxidation-reduction potential [ORP]	----	E125	0.10	mV	236	236	0.212%	15%	----
Physical Tests (QC Lot: 642495)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	pH	----	E108	0.10	pH units	8.17	8.20	0.366%	4%	----
Physical Tests (QC Lot: 642496)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	conductivity	----	E100	2.0	µS/cm	1710	1710	0.468%	10%	----
Physical Tests (QC Lot: 642497)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	274	271	1.06%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	274	271	1.06%	20%	----
Physical Tests (QC Lot: 642501)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 645182)											
CG2212233-003	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	837	852	1.72%	20%	----
Anions and Nutrients (QC Lot: 641825)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 641921)											
CG2212270-021	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 641956)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	fluoride	16984-48-8	E235.F	0.100	mg/L	0.195	0.190	0.005	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 641957)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	bromide	24959-67-9	E235.Br-L	0.250	mg/L	<0.250	<0.250	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 641958)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	chloride	16887-00-6	E235.Cl-L	0.50	mg/L	2.24	2.22	0.01	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 641959)											

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Anions and Nutrients (QC Lot: 641959) - continued											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	nitrate (as N)	14797-55-8	E235.NO3-L	0.0250	mg/L	6.17	6.14	0.419%	20%	----
Anions and Nutrients (QC Lot: 641960)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	nitrite (as N)	14797-65-0	E235.NO2-L	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 641961)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	sulfate (as SO4)	14808-79-8	E235.SO4	1.50	mg/L	932	923	0.990%	20%	----
Anions and Nutrients (QC Lot: 642132)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.393	0.392	0.0005	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 642658)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0052	0.0031	0.0020	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 641869)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.33	1.37	0.04	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 641870)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.39	1.28	0.11	Diff <2x LOR	----
Total Metals (QC Lot: 642722)											
CG2212136-001	Anonymous	mercury, total	7439-97-6	E508	0.0000500	mg/L	<0.0000500	<0.0000500	0	Diff <2x LOR	----
Total Metals (QC Lot: 643301)											
CG2212204-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0203	0.0186	0.0017	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	0.00017	0.00017	0.000001	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00048	0.00046	0.00001	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0164	0.0163	0.465%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.032	0.031	0.001	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0142 µg/L	0.0000107	0.0000035	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	236	228	3.49%	20%	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	0.39 µg/L	0.00039	0.000004	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	0.169	0.170	0.725%	20%	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	0.163	0.154	5.65%	20%	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	151	153	1.04%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.0284	0.0288	1.56%	20%	----

Sub-Matrix: **Water**

Laboratory Duplicate (DUP) Report

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Total Metals (QC Lot: 643301) - continued											
CG2212204-001	Anonymous	molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00190	0.00187	1.74%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	0.00509	0.00520	2.10%	20%	----
		potassium, total	7440-09-7	E420	0.050	mg/L	4.58	4.63	1.15%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	0.808 µg/L	0.000831	2.79%	20%	----
		silicon, total	7440-21-3	E420	0.10	mg/L	3.22	3.23	0.333%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	10.5	10.6	1.54%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.542	0.539	0.538%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	266	268	0.696%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	0.000020	0.000018	0.000001	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	0.00017	0.00016	0.00002	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.00771	0.00771	0.0799%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Total Metals (QC Lot: 643302)											
CG2212204-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 642719)											
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 643704)											
CG2212019-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00017	0.00016	0.000004	Diff <2x LOR	----
Dissolved Metals (QC Lot: 643705)											
CG2212019-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0019	0.0011	0.0008	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00015	0.00015	0.000002	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00024	0.00024	0.000002	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0844	0.0843	0.120%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.028	0.030	0.001	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0223 µg/L	0.0000188	0.0000035	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	96.6	96.1	0.432%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	0.12 µg/L	0.00011	0.000004	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Dissolved Metals (QC Lot: 643705) - continued											
CG2212019-001	Anonymous	lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0145	0.0145	0.159%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	37.8	37.1	1.82%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00217	0.00221	1.79%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00106	0.00108	1.72%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00513	0.00512	0.225%	20%	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	1.17	1.15	1.90%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	4.74 µg/L	0.00472	0.351%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.07	2.05	1.03%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	10.2	10.1	1.39%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.347	0.341	1.84%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	83.8	81.5	2.76%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.000020	0.000018	0.000002	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00180	0.00184	2.32%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0010	0.0011	0.00009	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 641757)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 642496)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 642497)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 642501)						
acidity (as CaCO3)	----	E283	2	mg/L	2.1	----
Physical Tests (QCLot: 645179)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 645182)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 641825)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 641921)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 641956)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 641957)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 641958)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 641959)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 641960)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 641961)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 642132)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 642658)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 642658) - continued						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Organic / Inorganic Carbon (QCLot: 641869)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 641870)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 642722)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Total Metals (QCLot: 643301)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 643301) - continued						
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 643302)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 642719)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 643704)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 643705)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 643705) - continued						
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 641757)									
turbidity	----	E121	0.1	NTU	200 NTU	101	85.0	115	----
Physical Tests (QCLot: 641962)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	101	95.4	104	----
Physical Tests (QCLot: 642495)									
pH	----	E108	----	pH units	7 pH units	101	98.6	101	----
Physical Tests (QCLot: 642496)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	97.8	90.0	110	----
Physical Tests (QCLot: 642497)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	104	85.0	115	----
Physical Tests (QCLot: 642501)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	109	85.0	115	----
Physical Tests (QCLot: 645179)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	102	85.0	115	----
Physical Tests (QCLot: 645182)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	95.4	85.0	115	----
Anions and Nutrients (QCLot: 641825)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	97.9	85.0	115	----
Anions and Nutrients (QCLot: 641921)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	98.3	80.0	120	----
Anions and Nutrients (QCLot: 641956)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 641957)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	103	85.0	115	----
Anions and Nutrients (QCLot: 641958)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 641959)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 641960)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 641961)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 642132)									

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Anions and Nutrients (QCLot: 642132) - continued									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	100	75.0	125	----
Anions and Nutrients (QCLot: 642658)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.03 mg/L	99.4	80.0	120	----
Organic / Inorganic Carbon (QCLot: 641869)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	99.7	80.0	120	----
Organic / Inorganic Carbon (QCLot: 641870)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	97.1	80.0	120	----
Total Metals (QCLot: 642722)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	104	80.0	120	----
Total Metals (QCLot: 643301)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	95.1	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	105	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	97.6	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	99.8	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	96.1	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	101	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	92.7	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	96.1	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	96.0	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	95.3	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	96.2	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	105	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	99.7	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	93.8	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	95.6	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	99.2	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	102	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	96.0	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	97.1	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	92.5	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	100	60.0	140	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	91.0	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	96.7	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	103	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	102	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 643301) - continued									
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	101	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	99.0	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	93.0	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	91.7	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	96.9	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	93.8	80.0	120	----
Total Metals (QCLot: 643302)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	96.8	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	103	80.0	120	----
Dissolved Metals (QCLot: 643704)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
Dissolved Metals (QCLot: 643705)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	110	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	101	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	98.2	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	104	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	101	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	105	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	102	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	102	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	97.7	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	111	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	104	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	102	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	104	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	104	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	99.4	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	106	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	96.9	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	106	60.0	140	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	91.1	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	104	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	104	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Dissolved Metals (QCLot: 643705) - continued									
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	99.8	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	100	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	96.0	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	99.1	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	98.0	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	103	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	95.8	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 641825)										
CG2212276-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.101 mg/L	0.1 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 641921)										
CG2212273-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0538 mg/L	0.05 mg/L	108	70.0	130	----
Anions and Nutrients (QCLot: 641956)										
CG2212276-001	Anonymous	fluoride	16984-48-8	E235.F	0.982 mg/L	1 mg/L	98.2	75.0	125	----
Anions and Nutrients (QCLot: 641957)										
CG2212276-001	Anonymous	bromide	24959-67-9	E235.Br-L	0.514 mg/L	0.5 mg/L	103	75.0	125	----
Anions and Nutrients (QCLot: 641958)										
CG2212276-001	Anonymous	chloride	16887-00-6	E235.Cl-L	100 mg/L	100 mg/L	100	75.0	125	----
Anions and Nutrients (QCLot: 641959)										
CG2212276-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	ND mg/L	2.5 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 641960)										
CG2212276-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.509 mg/L	0.5 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 641961)										
CG2212276-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	ND mg/L	100 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 642132)										
CG2212276-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.80 mg/L	2.5 mg/L	112	70.0	130	----
Anions and Nutrients (QCLot: 642658)										
CG2212276-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0528 mg/L	0.05 mg/L	106	70.0	130	----
Organic / Inorganic Carbon (QCLot: 641869)										
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	carbon, dissolved organic [DOC]	----	E358-L	5.37 mg/L	5 mg/L	107	70.0	130	----
Organic / Inorganic Carbon (QCLot: 641870)										
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	carbon, total organic [TOC]	----	E355-L	5.54 mg/L	5 mg/L	111	70.0	130	----
Total Metals (QCLot: 642722)										
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	mercury, total	7439-97-6	E508	0.0000951 mg/L	0.0001 mg/L	95.1	70.0	130	----
Total Metals (QCLot: 643301)										
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	aluminum, total	7429-90-5	E420	2.06 mg/L	2 mg/L	103	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 643301) - continued										
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	antimony, total	7440-36-0	E420	0.208 mg/L	0.2 mg/L	104	70.0	130	----
		arsenic, total	7440-38-2	E420	0.211 mg/L	0.2 mg/L	106	70.0	130	----
		barium, total	7440-39-3	E420	0.220 mg/L	0.2 mg/L	110	70.0	130	----
		beryllium, total	7440-41-7	E420	0.391 mg/L	0.4 mg/L	97.8	70.0	130	----
		bismuth, total	7440-69-9	E420	0.0988 mg/L	0.1 mg/L	98.8	70.0	130	----
		boron, total	7440-42-8	E420	0.936 mg/L	1 mg/L	93.6	70.0	130	----
		cadmium, total	7440-43-9	E420	0.0441 mg/L	0.04 mg/L	110	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	0.213 mg/L	0.2 mg/L	106	70.0	130	----
		copper, total	7440-50-8	E420	0.216 mg/L	0.2 mg/L	108	70.0	130	----
		iron, total	7439-89-6	E420	21.6 mg/L	20 mg/L	108	70.0	130	----
		lead, total	7439-92-1	E420	0.197 mg/L	0.2 mg/L	98.7	70.0	130	----
		lithium, total	7439-93-2	E420	0.981 mg/L	1 mg/L	98.1	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.216 mg/L	0.2 mg/L	108	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.213 mg/L	0.2 mg/L	106	70.0	130	----
		nickel, total	7440-02-0	E420	0.429 mg/L	0.4 mg/L	107	70.0	130	----
		potassium, total	7440-09-7	E420	41.6 mg/L	40 mg/L	104	70.0	130	----
		selenium, total	7782-49-2	E420	0.420 mg/L	0.4 mg/L	105	70.0	130	----
		silicon, total	7440-21-3	E420	92.2 mg/L	100 mg/L	92.2	70.0	130	----
		silver, total	7440-22-4	E420	0.0428 mg/L	0.04 mg/L	107	70.0	130	----
		sodium, total	7440-23-5	E420	22.3 mg/L	20 mg/L	112	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.2 mg/L	ND	70.0	130	----
		sulfur, total	7704-34-9	E420	ND mg/L	200 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.0390 mg/L	0.04 mg/L	97.6	70.0	130	----
		tin, total	7440-31-5	E420	0.213 mg/L	0.2 mg/L	106	70.0	130	----
		titanium, total	7440-32-6	E420	0.408 mg/L	0.4 mg/L	102	70.0	130	----
		uranium, total	7440-61-1	E420	0.0396 mg/L	0.04 mg/L	99.1	70.0	130	----
		vanadium, total	7440-62-2	E420	1.07 mg/L	1 mg/L	107	70.0	130	----
		zinc, total	7440-66-6	E420	4.14 mg/L	4 mg/L	104	70.0	130	----
Total Metals (QCLot: 643302)										
CG2212274-001	RG_GHFF_WS_LAEMP_GC_2022-09_N	chromium, total	7440-47-3	E420.Cr-L	0.435 mg/L	0.4 mg/L	109	70.0	130	----
Dissolved Metals (QCLot: 642719)										
CG2212276-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.000102 mg/L	0.0001 mg/L	102	70.0	130	----
Dissolved Metals (QCLot: 643704)										

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*Target*	*MS*	*Low*	*High*	*Qualifier*
Dissolved Metals (QCLot: 643704) - continued										
CG2212204-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.372 mg/L	0.4 mg/L	93.1	70.0	130	----
Dissolved Metals (QCLot: 643705)										
CG2212204-001	Anonymous	aluminum, dissolved	7429-90-5	E421	1.89 mg/L	2 mg/L	94.7	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.184 mg/L	0.2 mg/L	92.2	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.182 mg/L	0.2 mg/L	91.1	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.186 mg/L	0.2 mg/L	93.3	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.364 mg/L	0.4 mg/L	91.0	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0891 mg/L	0.1 mg/L	89.1	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.969 mg/L	1 mg/L	96.9	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0392 mg/L	0.04 mg/L	97.9	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.185 mg/L	0.2 mg/L	92.6	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.181 mg/L	0.2 mg/L	90.6	70.0	130	----
		iron, dissolved	7439-89-6	E421	18.2 mg/L	20 mg/L	91.2	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.192 mg/L	0.2 mg/L	96.1	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.943 mg/L	1 mg/L	94.3	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.186 mg/L	0.2 mg/L	93.0	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.191 mg/L	0.2 mg/L	95.7	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.366 mg/L	0.4 mg/L	91.5	70.0	130	----
		potassium, dissolved	7440-09-7	E421	34.7 mg/L	40 mg/L	86.8	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.377 mg/L	0.4 mg/L	94.3	70.0	130	----
		silicon, dissolved	7440-21-3	E421	91.7 mg/L	100 mg/L	91.7	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0376 mg/L	0.04 mg/L	94.0	70.0	130	----
		sodium, dissolved	7440-23-5	E421	18.6 mg/L	20 mg/L	93.1	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.2 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	ND mg/L	200 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.0344 mg/L	0.04 mg/L	86.1	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.184 mg/L	0.2 mg/L	92.3	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.357 mg/L	0.4 mg/L	89.2	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.0368 mg/L	0.04 mg/L	91.9	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.937 mg/L	1 mg/L	93.7	70.0	130	----
		zinc, dissolved	7440-66-6	E421	3.66 mg/L	4 mg/L	91.5	70.0	130	----

Teck

COC ID:	REP_LAEMP_GC_2022-09_ALS	TURNAROUND TIME:	2-3 Business Days	RUSH:	Priorty

PROJECT/CLIENT INFO

Facility Name / Job#	Regional Effects Program		
Project Manager	Giovanna Diaz		
Email	Giovanna.Diaz@Teck.com		
Address	421 Pine Avenue		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	1-250-865-3048		

LABORATORY

Lab Name	ALS Calgary		
Lab Contact	Lyudmyla Shvets		
Email	Lyudmyla.Shvets@ALSGlobal.com		
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City	Calgary	Province	AB
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OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	Lisa.Bowron@minnow.ca	X	X	X
Email 5:	Awiebe@minnow.ca	X	X	X
Email 6:	Giovanna.Diaz@Teck.com	X	X	X
PO number	VPO00816101			

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	DOC	Mercury_Dissolved	Mercury_Total	TECKCOAL_METNHG_D	TECKCOAL_METNHG_T	TECKCOAL_ROUTINE	TOC_TKN_PT
Filt.								F	F	N	F	N	N	N
PRESERV.								H2SO4	HCL	HCL				H2SO4
RG_GHFF_WS_LAEMP_GC_2022-09_N	RG_GHFF	WS		2022/09/08	00:00	G	#NAME?	1	1	1	1	1	1	1
RG_GHNF_WS_LAEMP_GC_2022-09_N	RG_GHNF	WS		2022/09/09	00:00	G	#NAME?	1	1	1	1	1	1	1
		WS												
		WS												
		WS												
		WS												
		WS												
		WS												
		WS												
		WS												

Environmental Division
Calgary
Work Order Reference
CG2212274

Telephone : +1 403 407 1800

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

Dissolved metals were field filtered and to be lab preserved
Total metals to be lab preserved

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Jennifer Ings/Minnow	##############		9/10 1145

SERVICE REQUEST (rush - subject to availability)

Regular (default)	
Priority (2-3 business days) - 50% surcharge	X
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jennifer Ings	Mobile #	579-520-3444
Sampler's Signature	Jennifer Ings	Date/Time	9

Environmental Division
Calgary
Work Order Reference
CG2212274

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **CG2212409**	Page	: 1 of 6
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 13-Sep-2022 09:11
PO	: VPO00816101	Date Analysis Commenced	: 13-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 15-Sep-2022 15:27
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Elke Tabora		Inorganics, Calgary, Alberta
Kevin Baxter		Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Sara Niroomand		Metals, Calgary, Alberta
Sonthuong Bui	Laboratory Analyst	Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Inorganics, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
HTA	*Analytical holding time was exceeded.*
TKNI	*TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.*

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHNF_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	09-Sep-2022 13:05	----	----	----	----
					CG2212409-001	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	4.8	----	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	400	----	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	489	----	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	400	----	----	----	----
conductivity	----	E100	2.0	µS/cm	2080	----	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	1450	----	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	338	----	----	----	----
pH	----	E108	0.10	pH units	8.17	----	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	1910	----	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	14.6	----	----	----	----
turbidity	----	E121	0.10	NTU	1.31 HTA	----	----	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	----	----	----	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.250 DLDS	----	----	----	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	3.15	----	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	<0.100 DLDS	----	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.519 TKNI	----	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	8.55	----	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0050 DLDS	----	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010 HTA	----	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0292	----	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	1100	----	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.47	----	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	2.35	----	----	----	----

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

				Client sample ID	RG_GHNF_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	09-Sep-2022 13:05	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2212409-001	--------	--------	--------	--------
					Result	----	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	31.6	----	----	----	----
cation sum	----	EC101	0.10	meq/L	29.1	----	----	----	----
ion balance (cations/anions)	----	EC101	0.010	%	92.1	----	----	----	----
ion balance (APHA)	----	EC101	0.010	%	4.12	----	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0499	----	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00060	----	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00024	----	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0355	----	----	----	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	----	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	----	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	----	----	----	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.0351	----	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	252	----	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00016	----	----	----	----
cobalt, total	7440-48-4	E420	0.10	µg/L	0.15	----	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	0.00052	----	----	----	----
iron, total	7439-89-6	E420	0.010	mg/L	0.101	----	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	0.000128	----	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0219	----	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	220	----	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.0157	----	----	----	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00175	----	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.0252	----	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	2.85	----	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	270	----	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	3.31	----	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	----	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L	1.98	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	RG_GHNF_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	09-Sep-2022 13:05	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2212409-001	--------	--------	--------	--------
					Result	----	----	----	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.168	----	----	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	413	----	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	0.000019	----	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	----	----	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	0.00079	----	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.0146	----	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	----	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	0.0033	----	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	----	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00077	----	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00020	----	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0365	----	----	----	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.020	----	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	----	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	----	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	<0.0050	----	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	249	----	----	----	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	----	----	----	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.10	----	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00027	----	----	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	----	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	----	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0167	----	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	201	----	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00786	----	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00193	----	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.0222	----	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	3.03	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	**RG_GHNF_WS_LAEMP_GC_2022-09_N**	----	----	----	----
				Client sampling date / time	09-Sep-2022 13:05	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**CG2212409-001**	--------	--------	--------	--------
					Result	----	----	----	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	271	----	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.26	----	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	----	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	1.93	----	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.181	----	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	257	----	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	----	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	----	----	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	----	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.0136	----	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	----	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	----	----	----	----
dissolved mercury filtration location	----	EP509	-	-	Field	----	----	----	----
dissolved metals filtration location	----	EP421	-	-	Field	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2212409**	Page	: 1 of 12
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 13-Sep-2022 09:11
PO	: VPO00816101	Issue Date	: 15-Sep-2022 15:28
C-O-C number	: REP_LAEMP_GC_2022-09_ALS		
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: ✖ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_GHNF_WS_LAEMP_GC_2022-09_N	E298	09-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E235.Br-L	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E235.Cl-L	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E378-U	09-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	3 days	4 days	✖ EHTR-FM
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E235.F	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E235.NO3-L	09-Sep-2022	14-Sep-2022	3 days	5 days	✖ EHTR	14-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E235.NO2-L	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	3 days	5 days	✖ EHTR-FM

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E235.SO4	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_GHNF_WS_LAEMP_GC_2022-09_N	E318	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) RG_GHNF_WS_LAEMP_GC_2022-09_N	E372-U	09-Sep-2022	14-Sep-2022	----	----		15-Sep-2022	28 days	6 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) RG_GHNF_WS_LAEMP_GC_2022-09_N	E421.Cr-L	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GHNF_WS_LAEMP_GC_2022-09_N	E509	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) RG_GHNF_WS_LAEMP_GC_2022-09_N	E421	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	180 days	5 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GHNF_WS_LAEMP_GC_2022-09_N	E358-L	09-Sep-2022	13-Sep-2022	----	----		14-Sep-2022	28 days	4 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GHNF_WS_LAEMP_GC_2022-09_N	E355-L	09-Sep-2022	13-Sep-2022	----	----		14-Sep-2022	28 days	4 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E283	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	14 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E290	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	14 days	5 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E100	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	5 days	✓
Physical Tests : ORP by Electrode										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E125	09-Sep-2022	----	----	----		14-Sep-2022	0.25 hrs	118 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E108	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E162	09-Sep-2022	----	----	----		14-Sep-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E160-L	09-Sep-2022	----	----	----		14-Sep-2022	7 days	5 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE RG_GHNF_WS_LAEMP_GC_2022-09_N	E121	09-Sep-2022	----	----	----		13-Sep-2022	3 days	4 days	× EHTR
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) RG_GHNF_WS_LAEMP_GC_2022-09_N	E420.Cr-L	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	180 days	5 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) RG_GHNF_WS_LAEMP_GC_2022-09_N	E508	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) RG_GHNF_WS_LAEMP_GC_2022-09_N	E420	09-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	180 days	5 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHTR: Exceeded ALS recommended hold time prior to sample receipt.

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	646040	1	9	11.1	5.0	✓
Alkalinity Species by Titration	E290	646035	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	645526	1	9	11.1	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	645945	1	3	33.3	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	645946	1	3	33.3	5.0	✓
Conductivity in Water	E100	646037	1	5	20.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	646741	1	18	5.5	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	647532	1	13	7.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	646742	1	18	5.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	645441	1	9	11.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	645469	1	3	33.3	5.0	✓
Fluoride in Water by IC	E235.F	645942	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	645947	1	3	33.3	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	645948	1	3	33.3	5.0	✓
ORP by Electrode	E125	646219	1	9	11.1	5.0	✓
pH by Meter	E108	646036	1	5	20.0	5.0	✓
Sulfate in Water by IC	E235.SO4	645941	1	15	6.6	5.0	✓
TDS by Gravimetry	E162	647154	1	11	9.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	646084	1	5	20.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	645448	1	9	11.1	5.0	✓
Total Mercury in Water by CVAAS	E508	647531	1	13	7.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	646083	1	6	16.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	645442	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	646476	1	9	11.1	5.0	✓
Turbidity by Nephelometry	E121	645422	1	3	33.3	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	646040	1	9	11.1	5.0	✓
Alkalinity Species by Titration	E290	646035	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	645526	1	9	11.1	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	645945	1	3	33.3	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	645946	1	3	33.3	5.0	✓
Conductivity in Water	E100	646037	1	5	20.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	646741	1	18	5.5	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	647532	1	13	7.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	646742	1	18	5.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	645441	1	9	11.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	645469	1	3	33.3	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Control Samples (LCS) - Continued							
Fluoride in Water by IC	E235.F	645942	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	645947	1	3	33.3	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	645948	1	3	33.3	5.0	✓
ORP by Electrode	E125	646219	1	9	11.1	5.0	✓
pH by Meter	E108	646036	1	5	20.0	5.0	✓
Sulfate in Water by IC	E235.SO4	645941	1	15	6.6	5.0	✓
TDS by Gravimetry	E162	647154	1	11	9.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	646084	1	5	20.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	645448	1	9	11.1	5.0	✓
Total Mercury in Water by CVAAS	E508	647531	1	13	7.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	646083	1	6	16.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	645442	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	646476	1	9	11.1	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	647137	1	17	5.8	5.0	✓
Turbidity by Nephelometry	E121	645422	1	3	33.3	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	646040	1	9	11.1	5.0	✓
Alkalinity Species by Titration	E290	646035	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	645526	1	9	11.1	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	645945	1	3	33.3	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	645946	1	3	33.3	5.0	✓
Conductivity in Water	E100	646037	1	5	20.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	646741	1	18	5.5	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	647532	1	13	7.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	646742	1	18	5.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	645441	1	9	11.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	645469	1	3	33.3	5.0	✓
Fluoride in Water by IC	E235.F	645942	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	645947	1	3	33.3	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	645948	1	3	33.3	5.0	✓
Sulfate in Water by IC	E235.SO4	645941	1	15	6.6	5.0	✓
TDS by Gravimetry	E162	647154	1	11	9.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	646084	1	5	20.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	645448	1	9	11.1	5.0	✓
Total Mercury in Water by CVAAS	E508	647531	1	13	7.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	646083	1	6	16.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	645442	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	646476	1	9	11.1	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	647137	1	17	5.8	5.0	✓
Turbidity by Nephelometry	E121	645422	1	3	33.3	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	645526	1	9	11.1	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	645945	1	3	33.3	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	645946	1	3	33.3	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	646741	1	18	5.5	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	647532	1	13	7.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	646742	1	18	5.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	645441	1	9	11.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	645469	1	3	33.3	5.0	✓
Fluoride in Water by IC	E235.F	645942	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	645947	1	3	33.3	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	645948	1	3	33.3	5.0	✓
Sulfate in Water by IC	E235.SO4	645941	1	15	6.6	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	646084	1	5	20.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	645448	1	9	11.1	5.0	✓
Total Mercury in Water by CVAAS	E508	647531	1	13	7.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	646083	1	6	16.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	645442	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	646476	1	9	11.1	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO 2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Calgary - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAAS	E508 Calgary - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **CG2212409**	Page	: 1 of 18
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 13-Sep-2022 09:11
PO	: VPO00816101	Date Analysis Commenced	: 13-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 15-Sep-2022 15:28
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Elke Tabora		Calgary Inorganics, Calgary, Alberta
Kevin Baxter		Calgary Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Calgary Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Calgary Inorganics, Calgary, Alberta
Sara Niroomand		Calgary Inorganics, Calgary, Alberta
Sara Niroomand		Calgary Metals, Calgary, Alberta
Sonthuong Bui	Laboratory Analyst	Calgary Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Calgary Inorganics, Calgary, Alberta

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 645422)											
CG2212408-001	Anonymous	turbidity	----	E121	0.10	NTU	0.11	0.11	0.001	Diff <2x LOR	----
Physical Tests (QC Lot: 646035)											
CG2212400-003	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	575	594	3.33%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	2.0	mg/L	575	594	3.33%	20%	----
Physical Tests (QC Lot: 646036)											
CG2212407-001	Anonymous	pH	----	E108	0.10	pH units	8.38	8.38	0.00%	4%	----
Physical Tests (QC Lot: 646037)											
CG2212407-001	Anonymous	conductivity	----	E100	2.0	µS/cm	769	762	0.914%	10%	----
Physical Tests (QC Lot: 646040)											
CG2212395-001	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 646219)											
CG2212395-001	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	313	315	0.541%	15%	----
Physical Tests (QC Lot: 647154)											
CG2212395-001	Anonymous	solids, total dissolved [TDS]	----	E162	40	mg/L	529	542	2.43%	20%	----
Anions and Nutrients (QC Lot: 645448)											
CG2212395-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.500	mg/L	<0.500	<0.500	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 645469)											
CG2212408-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 645526)											
CG2212395-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 645941)											
CG2212394-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	1.50	mg/L	489	487	0.390%	20%	----
Anions and Nutrients (QC Lot: 645942)											
CG2212394-001	Anonymous	fluoride	16984-48-8	E235.F	0.100	mg/L	0.181	0.185	0.004	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 645945)											
CG2212408-001	Anonymous	bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 645946)											
CG2212408-001	Anonymous	chloride	16887-00-6	E235.Cl-L	0.10	mg/L	2.64	2.64	0.121%	20%	----
Anions and Nutrients (QC Lot: 645947)											

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Anions and Nutrients (QC Lot: 645947) - continued											
CG2212408-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	11.2	11.2	0.127%	20%	----
Anions and Nutrients (QC Lot: 645948)											
CG2212408-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0039	0.0038	0.0001	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 646476)											
CG2212395-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0071	0.0072	0.00009	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 645441)											
CG2212395-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 645442)											
CG2212395-001	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Total Metals (QC Lot: 646083)											
CG2212407-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0046	0.0048	0.0002	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	0.00011	0.00010	0.000007	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	<0.00010	0.00012	0.00002	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.109	0.108	1.48%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.011	0.010	0.0001	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0284 µg/L	0.0000292	0.0000008	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	97.2	98.5	1.30%	20%	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	0.0322	0.0312	3.20%	20%	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	45.2	44.6	1.36%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00160	0.00147	8.14%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00128	0.00128	0.270%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	0.00096	0.00088	0.00008	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	1.30	1.28	1.35%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	50.0 µg/L	0.0474	5.39%	20%	----
		silicon, total	7440-21-3	E420	0.10	mg/L	2.17	2.15	0.874%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	2.80	2.79	0.0809%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.145	0.145	0.295%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	68.2	68.4	0.334%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Total Metals (QC Lot: 646083) - continued											
CG2212407-001	Anonymous	thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.00220	0.00216	2.03%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Total Metals (QC Lot: 646084)											
CG2212407-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00012	0.00016	0.00003	Diff <2x LOR	----
Total Metals (QC Lot: 647531)											
CG2212395-001	Anonymous	mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 646741)											
CG2212207-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 646742)											
CG2212207-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00065	0.00067	0.00002	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00010	<0.00010	0.000003	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0502	0.0508	1.31%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.031	0.032	0.0007	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0869 µg/L	0.0000969	10.9%	20%	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	223	228	2.24%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.306	0.305	0.501%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	125	128	2.52%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00044	0.00048	0.00005	Diff <2x LOR	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00269	0.00280	3.97%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00659	0.00652	1.04%	20%	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	6.59	6.77	2.82%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	128 µg/L	0.135	5.63%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.60	2.66	2.27%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Dissolved Metals (QC Lot: 646742) - continued											
CG2212207-001	Anonymous	sodium, dissolved	7440-23-5	E421	0.050	mg/L	10.8	11.1	2.46%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.381	0.392	2.84%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	179	188	4.75%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.0113	0.0116	2.59%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0031	0.0032	0.00007	Diff <2x LOR	----
Dissolved Metals (QC Lot: 647532)											
CG2212395-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 645422)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 646035)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 646037)						
conductivity	----	E100	1	µS/cm	1.2	----
Physical Tests (QCLot: 646040)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 647137)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 647154)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 645448)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 645469)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 645526)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 645941)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 645942)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 645945)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 645946)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 645947)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 645948)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 646476)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 646476) - continued						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Organic / Inorganic Carbon (QCLot: 645441)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 645442)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 646083)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 646083) - continued						
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 646084)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 647531)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 646741)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 646742)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 646742) - continued						
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Dissolved Metals (QCLot: 647532)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 645422)									
turbidity	----	E121	0.1	NTU	200 NTU	106	85.0	115	----
Physical Tests (QCLot: 646035)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	104	85.0	115	----
Physical Tests (QCLot: 646036)									
pH	----	E108	----	pH units	7 pH units	101	98.6	101	----
Physical Tests (QCLot: 646037)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	96.9	90.0	110	----
Physical Tests (QCLot: 646040)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	104	85.0	115	----
Physical Tests (QCLot: 646219)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	102	95.4	104	----
Physical Tests (QCLot: 647137)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	99.8	85.0	115	----
Physical Tests (QCLot: 647154)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	99.0	85.0	115	----
Anions and Nutrients (QCLot: 645448)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	99.6	75.0	125	----
Anions and Nutrients (QCLot: 645469)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	96.8	80.0	120	----
Anions and Nutrients (QCLot: 645526)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	98.4	85.0	115	----
Anions and Nutrients (QCLot: 645941)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 645942)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 645945)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	104	85.0	115	----
Anions and Nutrients (QCLot: 645946)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 645947)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 645948)									

Sub-Matrix: **Water**

Laboratory Control Sample (LCS) Report

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Anions and Nutrients (QCLot: 645948) - continued									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 646476)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.03 mg/L	94.4	80.0	120	----
Organic / Inorganic Carbon (QCLot: 645441)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	103	80.0	120	----
Organic / Inorganic Carbon (QCLot: 645442)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	105	80.0	120	----
Total Metals (QCLot: 646083)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	98.5	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	95.8	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	93.0	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	96.0	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	95.5	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	102	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	92.3	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	94.6	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	93.0	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	93.9	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	93.0	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	104	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	102	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	102	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	102	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	96.2	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	96.5	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	93.9	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	97.2	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	90.8	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	103	60.0	140	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	83.2	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	98.3	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	95.7	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	93.9	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	97.8	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	96.1	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 646083) - continued									
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	91.7	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	91.5	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	94.1	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	91.0	80.0	120	----
Total Metals (QCLot: 646084)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	95.9	80.0	120	----
Total Metals (QCLot: 647531)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	100	80.0	120	----
Dissolved Metals (QCLot: 646741)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	99.0	80.0	120	----
Dissolved Metals (QCLot: 646742)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	103	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	101	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	99.1	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	99.7	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	106	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	98.2	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	98.6	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	98.8	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	95.4	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	96.0	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	96.5	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	108	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	98.7	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	91.7	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	94.9	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	96.4	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	99.5	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	94.7	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	99.2	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	90.2	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	100	60.0	140	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	89.0	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	99.7	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	101	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	99.0	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Dissolved Metals (QCLot: 646742) - continued									
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	99.4	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	97.2	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	98.8	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	96.2	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	99.8	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	103	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	104	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 645448)										
CG2212395-002	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.54 mg/L	2.5 mg/L	101	70.0	130	----
Anions and Nutrients (QCLot: 645469)										
CG2212409-001	RG_GHNF_WS_LAEMP_GC_2022-09_N	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0462 mg/L	0.05 mg/L	92.4	70.0	130	----
Anions and Nutrients (QCLot: 645526)										
CG2212395-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.109 mg/L	0.1 mg/L	109	75.0	125	----
Anions and Nutrients (QCLot: 645941)										
CG2212394-002	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	ND mg/L	100 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 645942)										
CG2212394-002	Anonymous	fluoride	16984-48-8	E235.F	1.04 mg/L	1 mg/L	104	75.0	125	----
Anions and Nutrients (QCLot: 645945)										
CG2212409-001	RG_GHNF_WS_LAEMP_GC_2022-09_N	bromide	24959-67-9	E235.Br-L	0.486 mg/L	0.5 mg/L	97.3	75.0	125	----
Anions and Nutrients (QCLot: 645946)										
CG2212409-001	RG_GHNF_WS_LAEMP_GC_2022-09_N	chloride	16887-00-6	E235.Cl-L	97.9 mg/L	100 mg/L	97.9	75.0	125	----
Anions and Nutrients (QCLot: 645947)										
CG2212409-001	RG_GHNF_WS_LAEMP_GC_2022-09_N	nitrate (as N)	14797-55-8	E235.NO3-L	ND mg/L	2.5 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 645948)										
CG2212409-001	RG_GHNF_WS_LAEMP_GC_2022-09_N	nitrite (as N)	14797-65-0	E235.NO2-L	0.499 mg/L	0.5 mg/L	99.9	75.0	125	----
Anions and Nutrients (QCLot: 646476)										
CG2212395-002	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0472 mg/L	0.05 mg/L	94.4	70.0	130	----
Organic / Inorganic Carbon (QCLot: 645441)										
CG2212395-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	5.72 mg/L	5 mg/L	114	70.0	130	----
Organic / Inorganic Carbon (QCLot: 645442)										
CG2212395-001	Anonymous	carbon, total organic [TOC]	----	E355-L	5.80 mg/L	5 mg/L	116	70.0	130	----
Total Metals (QCLot: 646083)										
CG2212407-001	Anonymous	aluminum, total	7429-90-5	E420	1.92 mg/L	2 mg/L	96.3	70.0	130	----
		antimony, total	7440-36-0	E420	0.186 mg/L	0.2 mg/L	93.2	70.0	130	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Matrix Spike (MS) Report: Spike Concentration	Spike Target	Recovery (%) MS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Total Metals (QCLot: 646083) - continued										
CG2212407-001	Anonymous	arsenic, total	7440-38-2	E420	0.190 mg/L	0.2 mg/L	94.8	70.0	130	----
		barium, total	7440-39-3	E420	0.178 mg/L	0.2 mg/L	88.8	70.0	130	----
		beryllium, total	7440-41-7	E420	0.373 mg/L	0.4 mg/L	93.2	70.0	130	----
		bismuth, total	7440-69-9	E420	0.0998 mg/L	0.1 mg/L	99.8	70.0	130	----
		boron, total	7440-42-8	E420	0.899 mg/L	1 mg/L	89.9	70.0	130	----
		cadmium, total	7440-43-9	E420	0.0393 mg/L	0.04 mg/L	98.2	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	0.192 mg/L	0.2 mg/L	95.8	70.0	130	----
		copper, total	7440-50-8	E420	0.194 mg/L	0.2 mg/L	97.0	70.0	130	----
		iron, total	7439-89-6	E420	19.1 mg/L	20 mg/L	95.4	70.0	130	----
		lead, total	7439-92-1	E420	0.203 mg/L	0.2 mg/L	102	70.0	130	----
		lithium, total	7439-93-2	E420	0.934 mg/L	1 mg/L	93.4	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.194 mg/L	0.2 mg/L	96.9	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.199 mg/L	0.2 mg/L	99.5	70.0	130	----
		nickel, total	7440-02-0	E420	0.384 mg/L	0.4 mg/L	96.0	70.0	130	----
		potassium, total	7440-09-7	E420	38.3 mg/L	40 mg/L	95.8	70.0	130	----
		selenium, total	7782-49-2	E420	0.388 mg/L	0.4 mg/L	97.0	70.0	130	----
		silicon, total	7440-21-3	E420	102 mg/L	100 mg/L	102	70.0	130	----
		silver, total	7440-22-4	E420	0.0384 mg/L	0.04 mg/L	96.1	70.0	130	----
		sodium, total	7440-23-5	E420	19.6 mg/L	20 mg/L	97.9	70.0	130	----
		strontium, total	7440-24-6	E420	0.197 mg/L	0.2 mg/L	98.5	70.0	130	----
		sulfur, total	7704-34-9	E420	174 mg/L	200 mg/L	87.0	70.0	130	----
		thallium, total	7440-28-0	E420	0.0361 mg/L	0.04 mg/L	90.2	70.0	130	----
		tin, total	7440-31-5	E420	0.184 mg/L	0.2 mg/L	91.9	70.0	130	----
		titanium, total	7440-32-6	E420	0.378 mg/L	0.4 mg/L	94.4	70.0	130	----
		uranium, total	7440-61-1	E420	0.0373 mg/L	0.04 mg/L	93.3	70.0	130	----
		vanadium, total	7440-62-2	E420	0.954 mg/L	1 mg/L	95.4	70.0	130	----
		zinc, total	7440-66-6	E420	3.84 mg/L	4 mg/L	95.9	70.0	130	----
Total Metals (QCLot: 646084)										
CG2212407-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.392 mg/L	0.4 mg/L	98.1	70.0	130	----
Total Metals (QCLot: 647531)										
CG2212395-002	Anonymous	mercury, total	7439-97-6	E508	0.000103 mg/L	0.0001 mg/L	103	70.0	130	----
Dissolved Metals (QCLot: 646741)										
CG2212207-002	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.451 mg/L	0.4 mg/L	113	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 646742)										
CG2212207-002	Anonymous	aluminum, dissolved	7429-90-5	E421	2.29 mg/L	2 mg/L	114	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.219 mg/L	0.2 mg/L	109	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.213 mg/L	0.2 mg/L	106	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.148 mg/L	0.2 mg/L	74.3	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.439 mg/L	0.4 mg/L	110	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.111 mg/L	0.1 mg/L	111	70.0	130	----
		boron, dissolved	7440-42-8	E421	1.05 mg/L	1 mg/L	105	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0445 mg/L	0.04 mg/L	111	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.216 mg/L	0.2 mg/L	108	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.220 mg/L	0.2 mg/L	110	70.0	130	----
		iron, dissolved	7439-89-6	E421	21.2 mg/L	20 mg/L	106	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.225 mg/L	0.2 mg/L	112	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.956 mg/L	1 mg/L	95.6	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.222 mg/L	0.2 mg/L	111	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.217 mg/L	0.2 mg/L	108	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.433 mg/L	0.4 mg/L	108	70.0	130	----
		potassium, dissolved	7440-09-7	E421	40.9 mg/L	40 mg/L	102	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.362 mg/L	0.4 mg/L	90.6	70.0	130	----
		silicon, dissolved	7440-21-3	E421	82.1 mg/L	100 mg/L	82.1	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0463 mg/L	0.04 mg/L	116	70.0	130	----
		sodium, dissolved	7440-23-5	E421	20.3 mg/L	20 mg/L	101	70.0	130	----
		strontium, dissolved	7440-24-6	E421	0.238 mg/L	0.2 mg/L	119	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	141 mg/L	200 mg/L	70.4	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.0425 mg/L	0.04 mg/L	106	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.222 mg/L	0.2 mg/L	111	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.451 mg/L	0.4 mg/L	113	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.0404 mg/L	0.04 mg/L	101	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	1.08 mg/L	1 mg/L	108	70.0	130	----
		zinc, dissolved	7440-66-6	E421	4.76 mg/L	4 mg/L	119	70.0	130	----
Dissolved Metals (QCLot: 647532)										
CG2212395-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.000100 mg/L	0.0001 mg/L	100	70.0	130	----

Teck

COC ID:	REP_LAEMP_GC_2022-09_ALS	TURNAROUND TIME:	2-3 Business Days	RUSH:	Priorty

PROJECT/CLIENT INFO

Facility Name / Job#	Regional Effects Program
Project Manager	Giovanna Diaz
Email	Giovanna.Diaz@Teck.com
Address	421 Pine Avenue
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	1-250-865-3048

LABORATORY

Lab Name	ALS Calgary
Lab Contact	Lyudmyla Shvets
Email	Lyudmyla.Shvets@ALSGlobal.com
Address	2559 29 Street NE
City	Calgary
Province	AB
Postal Code	T1Y 7B5
Country	Canada
Phone Number	403 407 1794

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	Lisa.Bowron@minnow.ca	X	X	X
Email 5:	Awiebe@minnow.ca	X	X	X
Email 6:	Giovanna.Diaz@Teck.com	X	X	X
PO number	VPO00816101			

Environmental Division
Calgary
Work Order Reference
CG2212409

Telephone : +1 403 407 1800

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	DOC	Mercury_Dissolved	Mercury_Total	TECKCOAL_METNHG_D	TECKCOAL_METNHG_T	TECKCOAL_ROUTINE	TOC_TKN_PT
Filt.								F	F	N	F	N	N	N
PRESERV.								H2SO4	HCL	HCL				H2SO4
RG_GHNF_WS_LAEMP_GC_2022-09_N	RG_GHNF	WS		2022/09/09	13:05	G	7	1	1	1	1	1	1	1
		WS												
		WS												
		WS												
		WS												
		WS												
		WS												
		WS												
		WS												
		WS												

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

Dissolved metals were field filtered and to be lab preserved
Total metals to be lab preserved

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Jennifer Ings/Minnow	##############	NC	13/09/22 09:11

SERVICE REQUEST (rush - subject to availability)

Regular (default)	
Priority (2-3 business days) - 50% surcharge	X
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jennifer Ings	5195003444	
Sampler's Signature		Date/Time	September 12, 2022

10°C

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **CG2212559**	Page	: 1 of 6
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 14-Sep-2022 17:41
PO	: VPO00816101	Date Analysis Commenced	: 15-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 19-Sep-2022 13:26
Sampler	: Jennifer Ings/Minnow		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Inorganics, Calgary, Alberta
Anthony Calero	Supervisor - Inorganic	Metals, Calgary, Alberta
Elke Tabora		Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Metals, Calgary, Alberta
Mackenzie Lamoureux	Laboratory Analyst	Metals, Calgary, Alberta
Millicent Brentnall	Laboratory Analyst	Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Sara Niroomand		Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Inorganics, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
TKNI	*TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

				Client sample ID	**RG_GHBP_WS_LAEMP_GC_2022-09_N**	**RG_RIVER_WS_LAEMP_GC_2022-09_N**	----	----	----
				Client sampling date / time	12-Sep-2022 07:44	12-Sep-2022 07:44	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**CG2212559-001**	**CG2212559-002**	--------	--------	--------
					Result	Result	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	238	234	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	290	285	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	7.6	10.6	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	4.6	6.4	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	<1.0	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	246	244	----	----	----
conductivity	----	E100	2.0	µS/cm	1540	1530	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	994	1020	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	314	314	----	----	----
pH	----	E108	0.10	pH units	8.33	8.35	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	1400	1400	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	2.2	1.7	----	----	----
turbidity	----	E121	0.10	NTU	1.62	1.34	----	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0084	0.0080	----	----	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.250 DLDS	<0.250 DLDS	----	----	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	1.85	1.71	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.147	0.143	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	1.67 TKNI	2.10 TKNI	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	4.34	4.45	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0102	0.0094	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0034	0.0043	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	780	797	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.86	1.68	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.70	1.62	----	----	----

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	RG_GHBP_WS_LAEMP_GC_2022-09_N	RG_RIVER_WS_LAEMP_GC_2022-09_N	----	----	----
Client sampling date / time					12-Sep-2022 07:44	12-Sep-2022 07:44	----	----	----
					CG2212559-001	CG2212559-002	--------	--------	--------
					Result	Result	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	21.5	21.8	----	----	----
cation sum	----	EC101	0.10	meq/L	20.0	20.6	----	----	----
ion balance (cations/anions)	----	EC101	0.010	%	93.0	94.5	----	----	----
ion balance (APHA)	----	EC101	0.010	%	3.61	2.83	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0091	0.0081	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00047	0.00048	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00028	0.00029	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0422	0.0418	----	----	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	<0.020	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L	0.013	0.012	----	----	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.0142	0.0098	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	157	156	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00016	0.00011	----	----	----
cobalt, total	7440-48-4	E420	0.10	µg/L	<0.10	<0.10	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	----	----	----
iron, total	7439-89-6	E420	0.010	mg/L	<0.010	<0.010	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0197	0.0200	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	151	146	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.00140	0.00137	----	----	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00168	0.00168	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00862	0.00833	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	2.45	2.38	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	149	150	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	3.54	3.60	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L	2.72	2.66	----	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHBP_WS_LAEMP_GC_2022-09_N	RG_RIVER_WS_LAEMP_GC_2022-09_N	----	----	----
				Client sampling date / time	12-Sep-2022 07:44	12-Sep-2022 07:44	----	----	----
					CG2212559-001	CG2212559-002	--------	--------	--------
					Result	Result	----	----	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.188	0.193	----	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	276	280	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	0.000024	<0.000010	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	----	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	0.00036	<0.00030	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.00864	0.00871	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00051	<0.00050	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	0.0079	<0.0030	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00042	0.00046	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00023	0.00021	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0427	0.0423	----	----	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.020	<0.020	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	0.0089	0.0096	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	141	155	----	----	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	<0.00010	----	----	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.10	<0.10	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00042	0.00033	----	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0168	0.0187	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	156	154	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00090	0.00079	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00146	0.00164	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00804	0.00818	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	2.38	2.33	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHBP_WS_LAEMP_GC_2022-09_N	RG_RIVER_WS_LAEMP_GC_2022-09_N	----	----	----
				Client sampling date / time	12-Sep-2022 07:44	12-Sep-2022 07:44	----	----	----
					CG2212559-001	**CG2212559-002**	--------	--------	--------
					Result	Result	----	----	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	163	168	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.31	3.28	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	2.55	2.54	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.171	0.191	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	295	289	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	----	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00732	0.00696	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0010	<0.0010	----	----	----
dissolved mercury filtration location	----	EP509	-	-	Field	Field	----	----	----
dissolved metals filtration location	----	EP421	-	-	Field	Field	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2212559**	Laboratory	: Calgary - Environmental
Client	: **Teck Coal Limited**	Account Manager	: Lyudmyla Shvets
Contact	: Giovanna Diaz	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Telephone	: +1 403 407 1800
Telephone	: ----	Date Samples Received	: 14-Sep-2022 17:41
Project	: REGIONAL EFFECTS PROGRAM	Issue Date	: 19-Sep-2022 13:27
PO	: VPO00816101		
C-O-C number	: REP_LAEMP_GC_2022-09_ALS		
Sampler	: Jennifer Ings/Minnow		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: ✘ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_GHBP_WS_LAEMP_GC_2022-09_N	E298	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_RIVER_WS_LAEMP_GC_2022-09_N	E298	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E235.Br-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E235.Br-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E235.Cl-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E235.Cl-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E378-U	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	3 days	4 days	✘ EHT

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E378-U	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	3 days	4 days	× EHT
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E235.F	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E235.F	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E235.NO3-L	12-Sep-2022	15-Sep-2022	3 days	4 days	× EHT	15-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E235.NO3-L	12-Sep-2022	15-Sep-2022	3 days	4 days	× EHT	15-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E235.NO2-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	3 days	4 days	× EHT
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E235.NO2-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	3 days	4 days	× EHT
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E235.SO4	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E235.SO4	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	4 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_GHBP_WS_LAEMP_GC_2022-09_N	E318	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_RIVER_WS_LAEMP_GC_2022-09_N	E318	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) RG_GHBP_WS_LAEMP_GC_2022-09_N	E372-U	12-Sep-2022	15-Sep-2022	----	----		16-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) RG_RIVER_WS_LAEMP_GC_2022-09_N	E372-U	12-Sep-2022	15-Sep-2022	----	----		16-Sep-2022	28 days	4 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) RG_GHBP_WS_LAEMP_GC_2022-09_N	E421.Cr-L	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	180 days	4 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) RG_RIVER_WS_LAEMP_GC_2022-09_N	E421.Cr-L	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	180 days	4 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GHBP_WS_LAEMP_GC_2022-09_N	E509	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	4 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_RIVER_WS_LAEMP_GC_2022-09_N	E509	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	4 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) RG_GHBP_WS_LAEMP_GC_2022-09_N	E421	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	180 days	4 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) RG_RIVER_WS_LAEMP_GC_2022-09_N	E421	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	180 days	4 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GHBP_WS_LAEMP_GC_2022-09_N	E358-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	3 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_RIVER_WS_LAEMP_GC_2022-09_N	E358-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GHBP_WS_LAEMP_GC_2022-09_N	E355-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_RIVER_WS_LAEMP_GC_2022-09_N	E355-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	3 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E283	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	14 days	4 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E283	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	14 days	4 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E290	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	14 days	4 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E290	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	14 days	4 days	✓

Matrix: **Water**

Evaluation: ✖ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Physical Tests : Conductivity in Water										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E100	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E100	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	4 days	✓
Physical Tests : ORP by Electrode										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E125	12-Sep-2022	----	----	----		16-Sep-2022	0.25 hrs	100 hrs	✖ EHTR-FM
Physical Tests : ORP by Electrode										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E125	12-Sep-2022	----	----	----		16-Sep-2022	0.25 hrs	100 hrs	✖ EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E108	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	0.25 hrs	0.25 hrs	✖ EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E108	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	0.25 hrs	0.25 hrs	✖ EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E162	12-Sep-2022	----	----	----		15-Sep-2022	7 days	4 days	✓
Physical Tests : TDS by Gravimetry										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E162	12-Sep-2022	----	----	----		15-Sep-2022	7 days	4 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E160-L	12-Sep-2022	----	----	----		15-Sep-2022	7 days	4 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E160-L	12-Sep-2022	----	----	----		15-Sep-2022	7 days	4 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE RG_GHBP_WS_LAEMP_GC_2022-09_N	E121	12-Sep-2022	----	----	----		15-Sep-2022	3 days	4 days	× EHT
Physical Tests : Turbidity by Nephelometry										
HDPE RG_RIVER_WS_LAEMP_GC_2022-09_N	E121	12-Sep-2022	----	----	----		15-Sep-2022	3 days	4 days	× EHT
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) RG_GHBP_WS_LAEMP_GC_2022-09_N	E420.Cr-L	12-Sep-2022	16-Sep-2022	----	----		17-Sep-2022	180 days	5 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) RG_RIVER_WS_LAEMP_GC_2022-09_N	E420.Cr-L	12-Sep-2022	16-Sep-2022	----	----		17-Sep-2022	180 days	5 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) RG_GHBP_WS_LAEMP_GC_2022-09_N	E508	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	4 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) RG_RIVER_WS_LAEMP_GC_2022-09_N	E508	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	4 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) RG_GHBP_WS_LAEMP_GC_2022-09_N	E420	12-Sep-2022	16-Sep-2022	----	----		17-Sep-2022	180 days	5 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) RG_RIVER_WS_LAEMP_GC_2022-09_N	E420	12-Sep-2022	16-Sep-2022	----	----		17-Sep-2022	180 days	5 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHT: Exceeded ALS recommended hold time prior to analysis.

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	651335	1	15	6.6	5.0	✓
Alkalinity Species by Titration	E290	651338	1	15	6.6	5.0	✓
Ammonia by Fluorescence	E298	649577	1	17	5.8	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	649645	1	3	33.3	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	649646	1	6	16.6	5.0	✓
Conductivity in Water	E100	651337	1	15	6.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	650493	1	4	25.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	650161	1	8	12.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	650494	1	4	25.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	649550	1	17	5.8	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	649627	2	26	7.6	5.0	✓
Fluoride in Water by IC	E235.F	649644	1	6	16.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	649647	1	6	16.6	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	649648	1	6	16.6	5.0	✓
ORP by Electrode	E125	650422	1	10	10.0	5.0	✓
pH by Meter	E108	651336	1	17	5.8	5.0	✓
Sulfate in Water by IC	E235.SO4	649649	1	3	33.3	5.0	✓
TDS by Gravimetry	E162	649536	1	16	6.2	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	650163	1	2	50.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	650197	1	6	16.6	5.0	✓
Total Mercury in Water by CVAAS	E508	650165	1	6	16.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	650162	1	4	25.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	649551	1	18	5.5	5.0	✓
Turbidity by Nephelometry	E121	649572	1	11	9.0	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	651335	1	15	6.6	5.0	✓
Alkalinity Species by Titration	E290	651338	1	15	6.6	5.0	✓
Ammonia by Fluorescence	E298	649577	1	17	5.8	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	649645	1	3	33.3	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	649646	1	6	16.6	5.0	✓
Conductivity in Water	E100	651337	1	15	6.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	650493	1	4	25.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	650161	1	8	12.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	650494	1	4	25.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	649550	1	17	5.8	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	649627	2	26	7.6	5.0	✓
Fluoride in Water by IC	E235.F	649644	1	6	16.6	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Control Samples (LCS) - Continued							
Nitrate in Water by IC (Low Level)	E235.NO3-L	649647	1	6	16.6	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	649648	1	6	16.6	5.0	✓
ORP by Electrode	E125	650422	1	10	10.0	5.0	✓
pH by Meter	E108	651336	1	17	5.8	5.0	✓
Sulfate in Water by IC	E235.SO4	649649	1	3	33.3	5.0	✓
TDS by Gravimetry	E162	649536	1	16	6.2	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	650163	1	2	50.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	650197	1	6	16.6	5.0	✓
Total Mercury in Water by CVAAS	E508	650165	1	6	16.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	650162	1	4	25.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	649551	1	18	5.5	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	649523	1	12	8.3	5.0	✓
Turbidity by Nephelometry	E121	649572	1	11	9.0	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	651335	1	15	6.6	5.0	✓
Alkalinity Species by Titration	E290	651338	1	15	6.6	5.0	✓
Ammonia by Fluorescence	E298	649577	1	17	5.8	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	649645	1	3	33.3	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	649646	1	6	16.6	5.0	✓
Conductivity in Water	E100	651337	1	15	6.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	650493	1	4	25.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	650161	1	8	12.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	650494	1	4	25.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	649550	1	17	5.8	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	649627	2	26	7.6	5.0	✓
Fluoride in Water by IC	E235.F	649644	1	6	16.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	649647	1	6	16.6	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	649648	1	6	16.6	5.0	✓
Sulfate in Water by IC	E235.SO4	649649	1	3	33.3	5.0	✓
TDS by Gravimetry	E162	649536	1	16	6.2	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	650163	1	2	50.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	650197	1	6	16.6	5.0	✓
Total Mercury in Water by CVAAS	E508	650165	1	6	16.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	650162	1	4	25.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	649551	1	18	5.5	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	649523	1	12	8.3	5.0	✓
Turbidity by Nephelometry	E121	649572	1	11	9.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	649577	1	17	5.8	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	649645	1	3	33.3	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS) - Continued							
Chloride in Water by IC (Low Level)	E235.Cl-L	649646	1	6	16.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	650493	1	4	25.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	650161	1	8	12.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	650494	1	4	25.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	649550	1	17	5.8	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	649627	2	26	7.6	5.0	✓
Fluoride in Water by IC	E235.F	649644	1	6	16.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	649647	1	6	16.6	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	649648	1	6	16.6	5.0	✓
Sulfate in Water by IC	E235.SO4	649649	1	3	33.3	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	650163	1	2	50.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	650197	1	6	16.6	5.0	✓
Total Mercury in Water by CVAAS	E508	650165	1	6	16.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	650162	1	4	25.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	649551	1	18	5.5	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO 2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Calgary - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAAS	E508 Calgary - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

QUALITY CONTROL REPORT

Work Order	: **CG2212559**	Page	: 1 of 18
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 14-Sep-2022 17:41
PO	: VPO00816101	Date Analysis Commenced	: 15-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 19-Sep-2022 13:26
Sampler	: Jennifer Ings/Minnow		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 2		
No. of samples analysed	: 2		

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Calgary Inorganics, Calgary, Alberta
Anthony Calero	Supervisor - Inorganic	Calgary Metals, Calgary, Alberta
Elke Tabora		Calgary Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Metals, Calgary, Alberta
Mackenzie Lamoureux	Laboratory Analyst	Calgary Metals, Calgary, Alberta
Millicent Brentnall	Laboratory Analyst	Calgary Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Calgary Inorganics, Calgary, Alberta
Sara Niroomand		Calgary Inorganics, Calgary, Alberta
Sara Niroomand		Calgary Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Calgary Inorganics, Calgary, Alberta

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 649536)											
CG2212460-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	1540	1550	0.453%	20%	----
Physical Tests (QC Lot: 649572)											
CG2212557-001	Anonymous	turbidity	----	E121	0.10	NTU	0.41	0.44	0.04	Diff <2x LOR	----
Physical Tests (QC Lot: 650422)											
CG2212550-001	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	302	299	0.765%	15%	----
Physical Tests (QC Lot: 651335)											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 651336)											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	pH	----	E108	0.10	pH units	8.33	8.34	0.120%	4%	----
Physical Tests (QC Lot: 651337)											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	conductivity	----	E100	2.0	µS/cm	1540	1530	0.783%	10%	----
Physical Tests (QC Lot: 651338)											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	238	252	5.95%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	7.6	8.2	0.6	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	246	261	6.00%	20%	----
Anions and Nutrients (QC Lot: 649577)											
CG2212550-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 649627)											
CG2212545-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 649628)											
CG2212559-002	RG_RIVER_WS_LAEMP_GC_2022-09_N	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 649644)											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	fluoride	16984-48-8	E235.F	0.100	mg/L	0.147	0.148	0.0007	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 649645)											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	bromide	24959-67-9	E235.Br-L	0.250	mg/L	<0.250	<0.250	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 649646)											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	chloride	16887-00-6	E235.Cl-L	0.50	mg/L	1.85	1.84	0.003	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Anions and Nutrients (QC Lot: 649647)											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	nitrate (as N)	14797-55-8	E235.NO3-L	0.0250	mg/L	4.34	4.32	0.351%	20%	----
Anions and Nutrients (QC Lot: 649648)											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	nitrite (as N)	14797-65-0	E235.NO2-L	0.0050	mg/L	0.0102	0.0099	0.0003	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 649649)											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	sulfate (as SO4)	14808-79-8	E235.SO4	1.50	mg/L	780	776	0.618%	20%	----
Anions and Nutrients (QC Lot: 650197)											
CG2212555-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.500	mg/L	2.23	2.12	0.109	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 649550)											
CG2212550-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 649551)											
CG2212550-001	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Total Metals (QC Lot: 650162)											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0091	0.0066	0.0025	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	0.00047	0.00046	0.000005	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00028	0.00027	0.000010	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0422	0.0427	1.25%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.013	0.012	0.0008	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0142 µg/L	0.0000126	0.0000015	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	157	154	2.20%	20%	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	0.0197	0.0190	4.00%	20%	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	151	150	0.665%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00140	0.00130	7.36%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00168	0.00165	1.93%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	0.00862	0.00859	0.374%	20%	----
		potassium, total	7440-09-7	E420	0.050	mg/L	2.45	2.40	2.33%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	149 µg/L	0.153	2.73%	20%	----
		silicon, total	7440-21-3	E420	0.10	mg/L	3.54	3.56	0.642%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Total Metals (QC Lot: 650162) - continued											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	2.72	2.73	0.235%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.188	0.186	0.870%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	276	279	1.01%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	0.000024	<0.000010	0.000014	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	0.00036	<0.00030	0.00006	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.00864	0.00850	1.60%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00051	<0.00050	0.000007	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	0.0079	<0.0030	0.0049	Diff <2x LOR	----
Total Metals (QC Lot: 650163)											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00016	0.00010	0.00006	Diff <2x LOR	----
Total Metals (QC Lot: 650165)											
CG2212559-001	RG_GHBP_WS_LAEMP_GC_2022-09_N	mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 650161)											
CG2212553-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 650493)											
CG2212553-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00011	<0.00010	0.00001	Diff <2x LOR	----
Dissolved Metals (QC Lot: 650494)											
CG2212553-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00012	0.00012	0.000008	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00018	0.00017	0.00001	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.128	0.123	4.45%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.015	0.015	0.0004	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0294 µg/L	0.0000220	0.0000074	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	65.5	65.4	0.186%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0085	0.0087	0.0002	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	24.7	24.3	1.38%	20%	----

Sub-Matrix: **Water**

Laboratory Duplicate (DUP) Report

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Dissolved Metals (QC Lot: 650494) - continued											
CG2212553-001	Anonymous	manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00051	0.00047	0.00004	Diff <2x LOR	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000784	0.000783	0.114%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00115	0.00114	0.000006	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.859	0.842	1.94%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	2.37 µg/L	0.00245	3.08%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.24	2.17	3.12%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	5.89	5.77	1.96%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.227	0.227	0.180%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	45.1	44.6	1.19%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000934	0.000945	1.25%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 649523)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 649536)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 649572)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 651335)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 651337)						
conductivity	----	E100	1	µS/cm	1.0	----
Physical Tests (QCLot: 651338)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Anions and Nutrients (QCLot: 649577)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 649627)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 649628)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 649644)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 649645)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 649646)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 649647)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 649648)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 649649)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 650197)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 650197) - continued						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Organic / Inorganic Carbon (QCLot: 649550)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 649551)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 650162)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 650162) - continued						
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 650163)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 650165)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 650161)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 650493)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 650494)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 650494) - continued						
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 649523)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	95.7	85.0	115	----
Physical Tests (QCLot: 649536)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	95.0	85.0	115	----
Physical Tests (QCLot: 649572)									
turbidity	----	E121	0.1	NTU	200 NTU	110	85.0	115	----
Physical Tests (QCLot: 650422)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	101	95.4	104	----
Physical Tests (QCLot: 651335)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	106	85.0	115	----
Physical Tests (QCLot: 651336)									
pH	----	E108	----	pH units	7 pH units	101	98.6	101	----
Physical Tests (QCLot: 651337)									
conductivity	----	E100	1	μS/cm	146.9 μS/cm	99.6	90.0	110	----
Physical Tests (QCLot: 651338)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	103	85.0	115	----
Anions and Nutrients (QCLot: 649577)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	99.2	85.0	115	----
Anions and Nutrients (QCLot: 649627)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	102	80.0	120	----
Anions and Nutrients (QCLot: 649628)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	102	80.0	120	----
Anions and Nutrients (QCLot: 649644)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 649645)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	103	85.0	115	----
Anions and Nutrients (QCLot: 649646)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 649647)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 649648)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 649649)									

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Anions and Nutrients (QCLot: 649649) - continued									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 650197)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	108	75.0	125	----
Organic / Inorganic Carbon (QCLot: 649550)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	90.6	80.0	120	----
Organic / Inorganic Carbon (QCLot: 649551)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	97.1	80.0	120	----
Total Metals (QCLot: 650162)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	107	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	100	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	100	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	102	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	95.0	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	100	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	97.0	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	99.3	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	98.7	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	96.4	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	106	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	97.7	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	107	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	100	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	103	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	96.9	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	103	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	84.0	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	115	60.0	140	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	94.5	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	101	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	102	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	107	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	96.1	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	97.9	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 650162) - continued									
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	105	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	97.7	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	102	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	96.4	80.0	120	----
Total Metals (QCLot: 650163)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	98.7	80.0	120	----
Total Metals (QCLot: 650165)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	94.5	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	82.7	80.0	120	----
Dissolved Metals (QCLot: 650493)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	94.5	80.0	120	----
Dissolved Metals (QCLot: 650494)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	102	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	104	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	96.5	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	98.2	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	95.5	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	97.2	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	95.5	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	97.1	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	97.2	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	97.1	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	96.0	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	99.4	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	97.9	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	99.0	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	103	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	101	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	96.8	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	96.5	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	92.8	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	99.6	60.0	140	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	95.2	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	97.1	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	98.6	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 650494) - continued									
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	101	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	98.9	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	96.8	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	99.6	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	96.0	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	99.8	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	97.3	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 649577)										
CG2212550-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.102 mg/L	0.1 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 649627)										
CG2212545-002	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0468 mg/L	0.05 mg/L	93.6	70.0	130	----
Anions and Nutrients (QCLot: 649628)										
CG2212560-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0470 mg/L	0.05 mg/L	93.9	70.0	130	----
Anions and Nutrients (QCLot: 649644)										
CG2212559-002	RG_RIVER_WS_LAEMP_GC_2022-09_N	fluoride	16984-48-8	E235.F	0.889 mg/L	1 mg/L	88.9	75.0	125	----
Anions and Nutrients (QCLot: 649645)										
CG2212559-002	RG_RIVER_WS_LAEMP_GC_2022-09_N	bromide	24959-67-9	E235.Br-L	0.488 mg/L	0.5 mg/L	97.7	75.0	125	----
Anions and Nutrients (QCLot: 649646)										
CG2212559-002	RG_RIVER_WS_LAEMP_GC_2022-09_N	chloride	16887-00-6	E235.Cl-L	101 mg/L	100 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 649647)										
CG2212559-002	RG_RIVER_WS_LAEMP_GC_2022-09_N	nitrate (as N)	14797-55-8	E235.NO3-L	ND mg/L	2.5 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 649648)										
CG2212559-002	RG_RIVER_WS_LAEMP_GC_2022-09_N	nitrite (as N)	14797-65-0	E235.NO2-L	0.510 mg/L	0.5 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 649649)										
CG2212559-002	RG_RIVER_WS_LAEMP_GC_2022-09_N	sulfate (as SO4)	14808-79-8	E235.SO4	ND mg/L	100 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 650197)										
CG2212555-002	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	ND mg/L	2.5 mg/L	ND	70.0	130	----
Organic / Inorganic Carbon (QCLot: 649550)										
CG2212550-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	5.18 mg/L	5 mg/L	104	70.0	130	----
Organic / Inorganic Carbon (QCLot: 649551)										
CG2212550-001	Anonymous	carbon, total organic [TOC]	----	E355-L	5.41 mg/L	5 mg/L	108	70.0	130	----
Total Metals (QCLot: 650162)										
CG2212559-002	RG_RIVER_WS_LAEMP_GC_2022-09_N	aluminum, total	7429-90-5	E420	2.12 mg/L	2 mg/L	106	70.0	130	----
		antimony, total	7440-36-0	E420	0.220 mg/L	0.2 mg/L	110	70.0	130	----

Sub-Matrix: **Water**

Matrix Spike (MS) Report

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Spike		Recovery (%)	Recovery Limits (%)		Qualifier
					Concentration	Target	MS	Low	High	
Total Metals (QCLot: 650162) - continued										
CG2212559-002	RG_RIVER_WS_LAEMP_GC_2022-09_N	arsenic, total	7440-38-2	E420	0.213 mg/L	0.2 mg/L	106	70.0	130	----
		barium, total	7440-39-3	E420	0.220 mg/L	0.2 mg/L	110	70.0	130	----
		beryllium, total	7440-41-7	E420	0.444 mg/L	0.4 mg/L	111	70.0	130	----
		bismuth, total	7440-69-9	E420	0.110 mg/L	0.1 mg/L	110	70.0	130	----
		boron, total	7440-42-8	E420	1.18 mg/L	1 mg/L	118	70.0	130	----
		cadmium, total	7440-43-9	E420	0.0474 mg/L	0.04 mg/L	118	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	0.222 mg/L	0.2 mg/L	111	70.0	130	----
		copper, total	7440-50-8	E420	0.220 mg/L	0.2 mg/L	110	70.0	130	----
		iron, total	7439-89-6	E420	22.3 mg/L	20 mg/L	112	70.0	130	----
		lead, total	7439-92-1	E420	0.227 mg/L	0.2 mg/L	113	70.0	130	----
		lithium, total	7439-93-2	E420	1.12 mg/L	1 mg/L	112	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.219 mg/L	0.2 mg/L	110	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.224 mg/L	0.2 mg/L	112	70.0	130	----
		nickel, total	7440-02-0	E420	0.439 mg/L	0.4 mg/L	110	70.0	130	----
		potassium, total	7440-09-7	E420	42.9 mg/L	40 mg/L	107	70.0	130	----
		selenium, total	7782-49-2	E420	0.457 mg/L	0.4 mg/L	114	70.0	130	----
		silicon, total	7440-21-3	E420	104 mg/L	100 mg/L	104	70.0	130	----
		silver, total	7440-22-4	E420	0.0467 mg/L	0.04 mg/L	117	70.0	130	----
		sodium, total	7440-23-5	E420	21.8 mg/L	20 mg/L	109	70.0	130	----
		strontium, total	7440-24-6	E420	0.228 mg/L	0.2 mg/L	114	70.0	130	----
		sulfur, total	7704-34-9	E420	ND mg/L	200 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.0428 mg/L	0.04 mg/L	107	70.0	130	----
		tin, total	7440-31-5	E420	0.222 mg/L	0.2 mg/L	111	70.0	130	----
		titanium, total	7440-32-6	E420	0.436 mg/L	0.4 mg/L	109	70.0	130	----
		uranium, total	7440-61-1	E420	0.0459 mg/L	0.04 mg/L	115	70.0	130	----
		vanadium, total	7440-62-2	E420	1.09 mg/L	1 mg/L	109	70.0	130	----
		zinc, total	7440-66-6	E420	4.37 mg/L	4 mg/L	109	70.0	130	----
Total Metals (QCLot: 650163)										
CG2212559-002	RG_RIVER_WS_LAEMP_GC_2022-09_N	chromium, total	7440-47-3	E420.Cr-L	0.441 mg/L	0.4 mg/L	110	70.0	130	----
Total Metals (QCLot: 650165)										
CG2212559-002	RG_RIVER_WS_LAEMP_GC_2022-09_N	mercury, total	7439-97-6	E508	0.0000947 mg/L	0.0001 mg/L	94.7	70.0	130	----
Dissolved Metals (QCLot: 650161)										
CG2212553-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.000100 mg/L	0.0001 mg/L	100	70.0	130	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Matrix Spike (MS) Report: Spike Concentration	Spike Target	Recovery (%) MS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Dissolved Metals (QCLot: 650493)										
CG2212553-002	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.384 mg/L	0.4 mg/L	95.9	70.0	130	----
Dissolved Metals (QCLot: 650494)										
CG2212553-002	Anonymous	aluminum, dissolved	7429-90-5	E421	1.77 mg/L	2 mg/L	88.6	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.205 mg/L	0.2 mg/L	102	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.195 mg/L	0.2 mg/L	97.3	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.189 mg/L	0.2 mg/L	94.7	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.362 mg/L	0.4 mg/L	90.5	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0978 mg/L	0.1 mg/L	97.8	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.928 mg/L	1 mg/L	92.8	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0391 mg/L	0.04 mg/L	97.7	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.200 mg/L	0.2 mg/L	99.8	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.196 mg/L	0.2 mg/L	97.8	70.0	130	----
		iron, dissolved	7439-89-6	E421	17.8 mg/L	20 mg/L	88.9	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.195 mg/L	0.2 mg/L	97.6	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.915 mg/L	1 mg/L	91.5	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.198 mg/L	0.2 mg/L	98.9	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.200 mg/L	0.2 mg/L	100	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.394 mg/L	0.4 mg/L	98.4	70.0	130	----
		potassium, dissolved	7440-09-7	E421	38.1 mg/L	40 mg/L	95.2	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.397 mg/L	0.4 mg/L	99.4	70.0	130	----
		silicon, dissolved	7440-21-3	E421	92.3 mg/L	100 mg/L	92.3	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0428 mg/L	0.04 mg/L	107	70.0	130	----
		sodium, dissolved	7440-23-5	E421	18.4 mg/L	20 mg/L	92.2	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.2 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	163 mg/L	200 mg/L	81.5	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.0393 mg/L	0.04 mg/L	98.2	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.192 mg/L	0.2 mg/L	96.0	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.396 mg/L	0.4 mg/L	98.9	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.0387 mg/L	0.04 mg/L	96.8	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.980 mg/L	1 mg/L	98.0	70.0	130	----
		zinc, dissolved	7440-66-6	E421	4.12 mg/L	4 mg/L	103	70.0	130	----

Teck

COC ID:	REP_LAEMP_GC_2022-09_ALS	TURNAROUND TIME:	2-3 Business Days	RUSH:	Priorty

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO			
Facility Name / Job#	Regional Effects Program	Lab Name	ALS Calgary	Report Format / Distribution	Excel	PDF	EDD
Project Manager	Giovanna Diaz	Lab Contact	Lyudmyla Shvets	Email 1: AquaSciLab@Teck.com	X	X	X
Email	Giovanna.Diaz@Teck.com	Email	Lyudmyla.Shvets@ALSGlobal.com	Email 2: teckcoal@equisonline.com			X
Address	421 Pine Avenue	Address	2559 29 Street NE	Email 3: Teck.Lab.Results@teck.com	X	X	X
				Email 4: Lisa.Bowron@minnow.ca	X	X	X
City	Sparwood, Province BC	City	Calgary, Province AB	Email 5: Awiebe@minnow.ca	X	X	X
Postal Code	V0B 2G0, Country Canada	Postal Code	T1Y 7B5, Country Canada	Email 6: Giovanna.Diaz@Teck.com	X	X	X
Phone Number	1-250-865-3048	Phone Number	403 407 1794	PO number	VPO00816101		

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	DOC (F, H2SO4)	Mercury_Dissolved (F, HCL)	Mercury_Total (N, HCL)	TECKCOAL_METNHG_D (F)	TECKCOAL_METNHG_T (N)	TECKCOAL_ROUTINE (N)	TOC_TKN_PT (N, H2SO4)
RG_GHBP_WS_LAEMP_GC_2022-09_N	RG_GHBP	WS		2022/09/12	7:44	G	7	1	1	1	1	1	1	1
RG_RIVER_WS_LAEMP_GC_2022-09_N	RG_RIVER	WS		2022/09/12	7:44	G	7	1	1	1	1	1	1	1
		WS												
		WS												
		WS												
		WS												
		WS												
		WS												
		WS												
		WS												

Environmental Division
Calgary
Work Order Reference
CG2212559

Telephone : +1 403 407 1800

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Dissolved metals were field filtered and to be lab preserved Total metals to be lab preserved	Jennifer Ings/Minnow	#############	[signature]	9/14 9:00

SERVICE REQUEST (rush - subject to availability)	
Regular (default)	
Priority (2-3 business days) - 50% surcharge	X
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jennifer Ings	5195003444	
Sampler's Signature	[signature]	Date/Time	September 13, 2022

11c

Environmental Division
Calgary
Work Order Reference
CG2212559

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **CG2212624**	Page	: 1 of 6
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECT PROGRAM	Date Samples Received	: 15-Sep-2022 08:50
PO	: VPO00816101	Date Analysis Commenced	: 16-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 17-Sep-2022 17:53
Sampler	: Jennifer Ings/Minnow		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Metals, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Mackenzie Lamoureux	Laboratory Analyst	Metals, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Sara Niroomand		Metals, Calgary, Alberta
Sheida Aria	Lab Assistant	Metals, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLB	*Detection Limit Raised. Analyte detected at comparable level in Method Blank.*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
HTA	*Analytical holding time was exceeded.*

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GANF_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	13-Sep-2022 09:25	----	----	----	----
					CG2212624-001	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	----	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	293	----	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	358	----	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	9.0	----	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	5.4	----	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	302	----	----	----	----
conductivity	----	E100	2.0	µS/cm	1300	----	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	826	----	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	322	----	----	----	----
pH	----	E108	0.10	pH units	8.33	----	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	1070	----	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	1.2	----	----	----	----
turbidity	----	E121	0.10	NTU	0.30 HTA	----	----	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	----	----	----	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.250 DLDS	----	----	----	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	2.26	----	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.386	----	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	<0.500 DLM	----	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.211	----	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0050 DLDS	----	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	----	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0046	----	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	576	----	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	0.97	----	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.20	----	----	----	----

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID: RG_GANF_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	13-Sep-2022 09:25	----	----	----	----
					CG2212624-001	--------	--------	--------	--------
					Result	----	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	18.1	----	----	----	----
cation sum	----	EC101	0.10	meq/L	16.8	----	----	----	----
ion balance (cations/anions)	----	EC101	0.010	%	92.8	----	----	----	----
ion balance (APHA)	----	EC101	0.010	%	3.72	----	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0070	----	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00013	----	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00025	----	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0698	----	----	----	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	----	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	----	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L	0.016	----	----	----	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.0075	----	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	143	----	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00014	----	----	----	----
cobalt, total	7440-48-4	E420	0.10	µg/L	<0.10	----	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	----	----	----	----
iron, total	7439-89-6	E420	0.010	mg/L	<0.010	----	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	----	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0339	----	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	112	----	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.00094	----	----	----	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00124	----	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00135	----	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	2.76	----	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	7.28	----	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	3.14	----	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	----	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L	4.65	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GANF_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	13-Sep-2022 09:25	----	----	----	----
					CG2212624-001	--------	--------	--------	--------
					Result	----	----	----	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.263	----	----	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	200	----	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	----	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	----	----	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	----	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.00357	----	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00250 DLB	----	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	----	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	----	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	----	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00015	----	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0745	----	----	----	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.020	----	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	----	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	0.013	----	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	0.0051	----	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	146	----	----	----	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00012	----	----	----	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.10	----	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	----	----	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	----	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	----	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0309	----	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	112	----	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00113	----	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00128	----	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00128	----	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	2.94	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	RG_GANF_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	13-Sep-2022 09:25	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2212624-001	--------	--------	--------	--------
					Result	----	----	----	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	7.52	----	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	4.04	----	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	----	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	4.73	----	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.266	----	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	210	----	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	----	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	----	----	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	----	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00360	----	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	----	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	----	----	----	----
dissolved mercury filtration location	----	EP509	-	-	Field	----	----	----	----
dissolved metals filtration location	----	EP421	-	-	Field	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2212624**	Page	: 1 of 13
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECT PROGRAM	Date Samples Received	: 15-Sep-2022 08:50
PO	: VPO00816101	Issue Date	: 17-Sep-2022 17:54
C-O-C number	: REP_LAEMP_GC_2022-09_ALS		
Sampler	: Jennifer Ings/Minnow		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- Method Blank value outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Water**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Method Blank (MB) Values								
Total Metals	QC-MRG2-651675001	----	vanadium, total	7440-62-2	E420	0.00052 mg/L MB-LOR	0.0005 mg/L	Blank result exceeds permitted value

Result Qualifiers

Qualifier	*Description*
MB-LOR	*Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_GANF_WS_LAEMP_GC_2022-09_N	E298	13-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GANF_WS_LAEMP_GC_2022-09_N	E235.Br-L	13-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GANF_WS_LAEMP_GC_2022-09_N	E235.Cl-L	13-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE RG_GANF_WS_LAEMP_GC_2022-09_N	E378-U	13-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	3 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GANF_WS_LAEMP_GC_2022-09_N	E235.F	13-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GANF_WS_LAEMP_GC_2022-09_N	E235.NO3-L	13-Sep-2022	16-Sep-2022	3 days	3 days	✓	16-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GANF_WS_LAEMP_GC_2022-09_N	E235.NO2-L	13-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times Rec*	*Holding Times Actual*	*Eval*	*Analysis Date*	*Holding Times Rec*	*Holding Times Actual*	*Eval*
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GANF_WS_LAEMP_GC_2022-09_N	E235.SO4	13-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_GANF_WS_LAEMP_GC_2022-09_N	E318	13-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) RG_GANF_WS_LAEMP_GC_2022-09_N	E372-U	13-Sep-2022	16-Sep-2022	----	----		17-Sep-2022	28 days	4 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) RG_GANF_WS_LAEMP_GC_2022-09_N	E421.Cr-L	13-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	180 days	4 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GANF_WS_LAEMP_GC_2022-09_N	E509	13-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	28 days	4 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) RG_GANF_WS_LAEMP_GC_2022-09_N	E421	13-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	180 days	4 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GANF_WS_LAEMP_GC_2022-09_N	E358-L	13-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GANF_WS_LAEMP_GC_2022-09_N	E355-L	13-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	3 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_GANF_WS_LAEMP_GC_2022-09_N	E283	13-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	14 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Physical Tests : Alkalinity Species by Titration										
HDPE										
RG_GANF_WS_LAEMP_GC_2022-09_N	E290	13-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	14 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE										
RG_GANF_WS_LAEMP_GC_2022-09_N	E100	13-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	3 days	✓
Physical Tests : ORP by Electrode										
HDPE										
RG_GANF_WS_LAEMP_GC_2022-09_N	E125	13-Sep-2022	----	----	----		16-Sep-2022	0.25 hrs	84 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE										
RG_GANF_WS_LAEMP_GC_2022-09_N	E108	13-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	0.25 hrs	0.25 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE										
RG_GANF_WS_LAEMP_GC_2022-09_N	E162	13-Sep-2022	----	----	----		16-Sep-2022	7 days	3 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE										
RG_GANF_WS_LAEMP_GC_2022-09_N	E160-L	13-Sep-2022	----	----	----		16-Sep-2022	7 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
RG_GANF_WS_LAEMP_GC_2022-09_N	E121	13-Sep-2022	----	----	----		16-Sep-2022	3 days	3 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved)										
RG_GANF_WS_LAEMP_GC_2022-09_N	E420.Cr-L	13-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	180 days	4 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid)										
RG_GANF_WS_LAEMP_GC_2022-09_N	E508	13-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	28 days	4 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved)										
RG_GANF_WS_LAEMP_GC_2022-09_N	E420	13-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	180 days	4 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	651426	1	17	5.8	5.0	✓
Alkalinity Species by Titration	E290	651429	1	17	5.8	5.0	✓
Ammonia by Fluorescence	E298	651485	1	17	5.8	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	651474	1	20	5.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	651475	1	20	5.0	5.0	✓
Conductivity in Water	E100	651428	1	17	5.8	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	652076	1	15	6.6	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	651966	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	652077	1	17	5.8	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	651436	1	15	6.6	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	651462	1	17	5.8	5.0	✓
Fluoride in Water by IC	E235.F	651473	1	20	5.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	651476	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	651477	1	20	5.0	5.0	✓
ORP by Electrode	E125	651554	1	17	5.8	5.0	✓
pH by Meter	E108	651427	1	17	5.8	5.0	✓
Sulfate in Water by IC	E235.SO4	651478	1	20	5.0	5.0	✓
TDS by Gravimetry	E162	651516	1	19	5.2	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	651675	1	17	5.8	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	651465	1	17	5.8	5.0	✓
Total Mercury in Water by CVAAS	E508	651965	1	16	6.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	651676	1	17	5.8	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	651437	1	17	5.8	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	651459	1	17	5.8	5.0	✓
Turbidity by Nephelometry	E121	651454	1	9	11.1	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	651426	1	17	5.8	5.0	✓
Alkalinity Species by Titration	E290	651429	1	17	5.8	5.0	✓
Ammonia by Fluorescence	E298	651485	1	17	5.8	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	651474	1	20	5.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	651475	1	20	5.0	5.0	✓
Conductivity in Water	E100	651428	1	17	5.8	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	652076	1	15	6.6	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	651966	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	652077	1	17	5.8	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	651436	1	15	6.6	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	651462	1	17	5.8	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Fluoride in Water by IC	E235.F	651473	1	20	5.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	651476	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	651477	1	20	5.0	5.0	✓
ORP by Electrode	E125	651554	1	17	5.8	5.0	✓
pH by Meter	E108	651427	1	17	5.8	5.0	✓
Sulfate in Water by IC	E235.SO4	651478	1	20	5.0	5.0	✓
TDS by Gravimetry	E162	651516	1	19	5.2	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	651675	1	17	5.8	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	651465	1	17	5.8	5.0	✓
Total Mercury in Water by CVAAS	E508	651965	1	16	6.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	651676	1	17	5.8	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	651437	1	17	5.8	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	651459	1	17	5.8	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	651515	1	19	5.2	5.0	✓
Turbidity by Nephelometry	E121	651454	1	9	11.1	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	651426	1	17	5.8	5.0	✓
Alkalinity Species by Titration	E290	651429	1	17	5.8	5.0	✓
Ammonia by Fluorescence	E298	651485	1	17	5.8	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	651474	1	20	5.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	651475	1	20	5.0	5.0	✓
Conductivity in Water	E100	651428	1	17	5.8	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	652076	1	15	6.6	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	651966	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	652077	1	17	5.8	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	651436	1	15	6.6	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	651462	1	17	5.8	5.0	✓
Fluoride in Water by IC	E235.F	651473	1	20	5.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	651476	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	651477	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	651478	1	20	5.0	5.0	✓
TDS by Gravimetry	E162	651516	1	19	5.2	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	651675	1	17	5.8	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	651465	1	17	5.8	5.0	✓
Total Mercury in Water by CVAAS	E508	651965	1	16	6.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	651676	1	17	5.8	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	651437	1	17	5.8	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	651459	1	17	5.8	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	651515	1	19	5.2	5.0	✓
Turbidity by Nephelometry	E121	651454	1	9	11.1	5.0	✓

Matrix: **Water**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	651485	1	17	5.8	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	651474	1	20	5.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	651475	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	652076	1	15	6.6	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	651966	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	652077	1	17	5.8	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	651436	1	15	6.6	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	651462	1	17	5.8	5.0	✓
Fluoride in Water by IC	E235.F	651473	1	20	5.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	651476	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	651477	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	651478	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	651675	1	17	5.8	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	651465	1	17	5.8	5.0	✓
Total Mercury in Water by CVAAS	E508	651965	1	16	6.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	651676	1	17	5.8	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	651437	1	17	5.8	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	651459	1	17	5.8	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Calgary - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAAS	E508 Calgary - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

QUALITY CONTROL REPORT

Work Order	: **CG2212624**	Page	: 1 of 17
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECT PROGRAM	Date Samples Received	: 15-Sep-2022 08:50
PO	: VPO00816101	Date Analysis Commenced	: 16-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 17-Sep-2022 17:54
Sampler	: Jennifer Ings/Minnow		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Calgary Metals, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Inorganics, Calgary, Alberta
Mackenzie Lamoureux	Laboratory Analyst	Calgary Metals, Calgary, Alberta
Sara Niroomand		Calgary Inorganics, Calgary, Alberta
Sara Niroomand		Calgary Metals, Calgary, Alberta
Sheida Aria	Lab Assistant	Calgary Metals, Calgary, Alberta

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 651426)											
CG2212617-001	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 651427)											
CG2212617-001	Anonymous	pH	----	E108	0.10	pH units	8.25	8.25	0.00%	4%	----
Physical Tests (QC Lot: 651428)											
CG2212617-001	Anonymous	conductivity	----	E100	2.0	µS/cm	732	724	1.10%	10%	----
Physical Tests (QC Lot: 651429)											
CG2212617-001	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	189	184	2.52%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	189	184	2.52%	20%	----
Physical Tests (QC Lot: 651454)											
CG2212624-001	RG_GANF_WS_LAEMP_GC_2022-09_N	turbidity	----	E121	0.10	NTU	0.30	0.32	0.02	Diff <2x LOR	----
Physical Tests (QC Lot: 651516)											
CG2212617-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	512	523	2.03%	20%	----
Physical Tests (QC Lot: 651554)											
CG2212617-001	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	315	318	0.854%	15%	----
Anions and Nutrients (QC Lot: 651459)											
CG2212617-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0050	0.0048	0.0001	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651462)											
CG2212617-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651465)											
CG2212617-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.500	mg/L	<0.500	<0.500	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651473)											
CG2212617-001	Anonymous	fluoride	16984-48-8	E235.F	0.020	mg/L	0.192	0.195	0.003	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651474)											
CG2212617-001	Anonymous	bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651475)											
CG2212617-001	Anonymous	chloride	16887-00-6	E235.Cl-L	0.10	mg/L	1.00	1.00	0.234%	20%	----
Anions and Nutrients (QC Lot: 651476)											
CG2212617-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.728	0.726	0.316%	20%	----
Anions and Nutrients (QC Lot: 651477)											

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Anions and Nutrients (QC Lot: 651477) - continued											
CG2212617-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0013	0.0013	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651478)											
CG2212617-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	230	230	0.0432%	20%	----
Anions and Nutrients (QC Lot: 651485)											
CG2212617-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0058	0.0051	0.0007	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 651436)											
CG2212617-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 651437)											
CG2212617-001	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Total Metals (QC Lot: 651675)											
CG2212617-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00018	0.00016	0.00001	Diff <2x LOR	----
Total Metals (QC Lot: 651676)											
CG2212617-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0066	0.0066	0.00006	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	0.00017	0.00017	0.000005	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00030	0.00032	0.00003	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0803	0.0784	2.39%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.033	0.034	0.001	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0226 µg/L	0.0000234	0.0000008	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	87.9	88.1	0.204%	20%	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	0.10 µg/L	<0.00010	0.000004	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	0.0156	0.0158	1.71%	20%	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	37.8	36.6	3.10%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00168	0.00167	0.701%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000895	0.000886	1.04%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	0.00507	0.00491	0.00016	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	1.18	1.15	2.05%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	5.06 µg/L	0.00527	4.15%	20%	----
		silicon, total	7440-21-3	E420	0.10	mg/L	1.72	1.62	6.41%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	10.3	10.1	2.22%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Total Metals (QC Lot: 651676) - continued											
CG2212617-001	Anonymous	strontium, total	7440-24-6	E420	0.00020	mg/L	0.352	0.353	0.533%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	81.3	80.3	1.33%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	0.000020	0.000020	0.00000004	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.00196	0.00202	3.16%	20%	----
		vanadium, total	7440-62-2	E420	0.00250	mg/L	<0.00250	<0.00250	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Total Metals (QC Lot: 651965)											
CG2212617-001	Anonymous	mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 651966)											
CG2212467-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 652076)											
CG2212617-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00017	0.00015	0.00002	Diff <2x LOR	----
Dissolved Metals (QC Lot: 652077)											
CG2212617-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0012	<0.0010	0.0002	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00017	0.00017	0.000006	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00024	0.00026	0.00001	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0877	0.0868	0.999%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.029	0.031	0.002	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0202 µg/L	0.0000195	0.0000006	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	91.0	89.5	1.57%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	0.10 µg/L	0.00010	0.00000006	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0153	0.0155	1.53%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	38.7	38.6	0.203%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00191	0.00194	1.56%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000953	0.000939	1.42%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00503	0.00494	0.00009	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	1.30	1.28	1.79%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	5.03 µg/L	0.00516	2.69%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Dissolved Metals (QC Lot: 652077) - continued											
CG2212617-001	Anonymous	silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.11	2.10	0.595%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	11.0	10.9	1.05%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.364	0.368	1.28%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	84.3	84.0	0.292%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.000021	0.000020	0.000001	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00204	0.00204	0.194%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 651426)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 651428)						
conductivity	----	E100	1	μS/cm	1.3	----
Physical Tests (QCLot: 651429)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 651454)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 651515)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 651516)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 651459)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 651462)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 651465)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 651473)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 651474)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 651475)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 651476)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 651477)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 651478)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 651485)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 651485) - continued						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Organic / Inorganic Carbon (QCLot: 651436)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 651437)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 651675)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 651676)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 651676) - continued						
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	# 0.00052	MB-LOR
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 651965)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 651966)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 652076)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 652077)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 652077) - continued						
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----

Qualifiers

Qualifier	*Description*
MB-LOR	*Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.*

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 651426)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	106	85.0	115	----
Physical Tests (QCLot: 651427)									
pH	----	E108	----	pH units	7 pH units	101	98.6	101	----
Physical Tests (QCLot: 651428)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	100	90.0	110	----
Physical Tests (QCLot: 651429)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	103	85.0	115	----
Physical Tests (QCLot: 651454)									
turbidity	----	E121	0.1	NTU	200 NTU	105	85.0	115	----
Physical Tests (QCLot: 651515)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	93.9	85.0	115	----
Physical Tests (QCLot: 651516)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	93.0	85.0	115	----
Physical Tests (QCLot: 651554)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	101	95.4	104	----
Anions and Nutrients (QCLot: 651459)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.03 mg/L	103	80.0	120	----
Anions and Nutrients (QCLot: 651462)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	93.9	80.0	120	----
Anions and Nutrients (QCLot: 651465)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	104	75.0	125	----
Anions and Nutrients (QCLot: 651473)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 651474)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	103	85.0	115	----
Anions and Nutrients (QCLot: 651475)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 651476)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 651477)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	99.7	90.0	110	----
Anions and Nutrients (QCLot: 651478)									

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike	Recovery (%)	Recovery Limits (%)		Qualifier
					Concentration	LCS	Low	High	
Anions and Nutrients (QCLot: 651478) - continued									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 651485)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	97.8	85.0	115	----
Organic / Inorganic Carbon (QCLot: 651436)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	95.4	80.0	120	----
Organic / Inorganic Carbon (QCLot: 651437)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	96.8	80.0	120	----
Total Metals (QCLot: 651675)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	96.7	80.0	120	----
Total Metals (QCLot: 651676)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	100	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	97.1	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	95.4	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	98.0	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	99.9	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	91.2	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	99.7	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	94.3	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	92.1	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	93.1	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	92.9	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	106	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	93.3	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	108	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	96.7	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	99.8	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	96.2	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	94.0	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	96.8	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	97.2	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	89.3	60.0	140	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	89.3	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	95.8	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	98.4	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	107	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Total Metals (QCLot: 651676) - continued									
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	92.1	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	96.3	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	97.2	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	94.3	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	96.1	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	94.8	80.0	120	----
Total Metals (QCLot: 651965)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	101	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	97.0	80.0	120	----
Dissolved Metals (QCLot: 652076)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	99.0	80.0	120	----
Dissolved Metals (QCLot: 652077)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	101	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	97.7	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	95.8	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	97.8	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	103	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	93.8	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	104	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	102	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	94.7	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	99.0	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	98.3	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	111	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	97.8	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	106	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	97.4	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	100	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	97.4	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	96.6	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	92.8	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	106	60.0	140	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	94.2	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	98.2	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	101	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	High	Qualifier
Dissolved Metals (QCLot: 652077) - continued									
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	92.8	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	94.0	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	101	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	101	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	99.0	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	99.7	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	97.3	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 651459)										
CG2212617-002	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0531 mg/L	0.05 mg/L	106	70.0	130	----
Anions and Nutrients (QCLot: 651462)										
CG2212617-002	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0510 mg/L	0.05 mg/L	102	70.0	130	----
Anions and Nutrients (QCLot: 651465)										
CG2212617-002	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.68 mg/L	2.5 mg/L	107	70.0	130	----
Anions and Nutrients (QCLot: 651473)										
CG2212630-006	Anonymous	fluoride	16984-48-8	E235.F	1.02 mg/L	1 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 651474)										
CG2212630-006	Anonymous	bromide	24959-67-9	E235.Br-L	0.516 mg/L	0.5 mg/L	103	75.0	125	----
Anions and Nutrients (QCLot: 651475)										
CG2212630-006	Anonymous	chloride	16887-00-6	E235.Cl-L	99.7 mg/L	100 mg/L	99.7	75.0	125	----
Anions and Nutrients (QCLot: 651476)										
CG2212630-006	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	2.50 mg/L	2.5 mg/L	100	75.0	125	----
Anions and Nutrients (QCLot: 651477)										
CG2212630-006	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.508 mg/L	0.5 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 651478)										
CG2212630-006	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	101 mg/L	100 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 651485)										
CG2212617-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0997 mg/L	0.1 mg/L	99.7	75.0	125	----
Organic / Inorganic Carbon (QCLot: 651436)										
CG2212617-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	5.35 mg/L	5 mg/L	107	70.0	130	----
Organic / Inorganic Carbon (QCLot: 651437)										
CG2212617-001	Anonymous	carbon, total organic [TOC]	----	E355-L	5.65 mg/L	5 mg/L	113	70.0	130	----
Total Metals (QCLot: 651675)										
CG2212617-002	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.402 mg/L	0.4 mg/L	100	70.0	130	----
Total Metals (QCLot: 651676)										
CG2212617-002	Anonymous	aluminum, total	7429-90-5	E420	1.88 mg/L	2 mg/L	94.3	70.0	130	----
		antimony, total	7440-36-0	E420	0.204 mg/L	0.2 mg/L	102	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*Target*	*MS*	*Low*	*High*	*Qualifier*
Total Metals (QCLot: 651676) - continued										
CG2212617-002	Anonymous	arsenic, total	7440-38-2	E420	0.189 mg/L	0.2 mg/L	94.4	70.0	130	----
		barium, total	7440-39-3	E420	0.187 mg/L	0.2 mg/L	93.3	70.0	130	----
		beryllium, total	7440-41-7	E420	0.420 mg/L	0.4 mg/L	105	70.0	130	----
		bismuth, total	7440-69-9	E420	0.102 mg/L	0.1 mg/L	102	70.0	130	----
		boron, total	7440-42-8	E420	1.13 mg/L	1 mg/L	113	70.0	130	----
		cadmium, total	7440-43-9	E420	0.0413 mg/L	0.04 mg/L	103	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	0.199 mg/L	0.2 mg/L	99.6	70.0	130	----
		copper, total	7440-50-8	E420	0.201 mg/L	0.2 mg/L	100	70.0	130	----
		iron, total	7439-89-6	E420	20.4 mg/L	20 mg/L	102	70.0	130	----
		lead, total	7439-92-1	E420	0.195 mg/L	0.2 mg/L	97.7	70.0	130	----
		lithium, total	7439-93-2	E420	1.04 mg/L	1 mg/L	104	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.200 mg/L	0.2 mg/L	100	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.191 mg/L	0.2 mg/L	95.3	70.0	130	----
		nickel, total	7440-02-0	E420	0.400 mg/L	0.4 mg/L	100	70.0	130	----
		potassium, total	7440-09-7	E420	37.8 mg/L	40 mg/L	94.5	70.0	130	----
		selenium, total	7782-49-2	E420	0.480 mg/L	0.4 mg/L	120	70.0	130	----
		silicon, total	7440-21-3	E420	75.8 mg/L	100 mg/L	75.8	70.0	130	----
		silver, total	7440-22-4	E420	0.0403 mg/L	0.04 mg/L	101	70.0	130	----
		sodium, total	7440-23-5	E420	ND mg/L	20 mg/L	ND	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.2 mg/L	ND	70.0	130	----
		sulfur, total	7704-34-9	E420	151 mg/L	200 mg/L	75.7	70.0	130	----
		thallium, total	7440-28-0	E420	0.0376 mg/L	0.04 mg/L	94.1	70.0	130	----
		tin, total	7440-31-5	E420	0.204 mg/L	0.2 mg/L	102	70.0	130	----
		titanium, total	7440-32-6	E420	0.386 mg/L	0.4 mg/L	96.4	70.0	130	----
		uranium, total	7440-61-1	E420	0.0403 mg/L	0.04 mg/L	101	70.0	130	----
		vanadium, total	7440-62-2	E420	0.970 mg/L	1 mg/L	97.0	70.0	130	----
		zinc, total	7440-66-6	E420	4.02 mg/L	4 mg/L	100	70.0	130	----
Total Metals (QCLot: 651965)										
CG2212617-002	Anonymous	mercury, total	7439-97-6	E508	0.0000968 mg/L	0.0001 mg/L	96.8	70.0	130	----
Dissolved Metals (QCLot: 651966)										
CG2212467-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.000106 mg/L	0.0001 mg/L	106	70.0	130	----
Dissolved Metals (QCLot: 652076)										
CG2212617-002	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.378 mg/L	0.4 mg/L	94.4	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 652077)										
CG2212617-002	Anonymous	aluminum, dissolved	7429-90-5	E421	1.87 mg/L	2 mg/L	93.6	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.188 mg/L	0.2 mg/L	94.1	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.183 mg/L	0.2 mg/L	91.6	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.169 mg/L	0.2 mg/L	84.7	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.372 mg/L	0.4 mg/L	92.9	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0930 mg/L	0.1 mg/L	93.0	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.978 mg/L	1 mg/L	97.8	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0398 mg/L	0.04 mg/L	99.5	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.192 mg/L	0.2 mg/L	95.8	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.191 mg/L	0.2 mg/L	95.4	70.0	130	----
		iron, dissolved	7439-89-6	E421	18.9 mg/L	20 mg/L	94.4	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.189 mg/L	0.2 mg/L	94.4	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.922 mg/L	1 mg/L	92.2	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.189 mg/L	0.2 mg/L	94.7	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.191 mg/L	0.2 mg/L	95.6	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.375 mg/L	0.4 mg/L	93.8	70.0	130	----
		potassium, dissolved	7440-09-7	E421	36.6 mg/L	40 mg/L	91.5	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.372 mg/L	0.4 mg/L	93.0	70.0	130	----
		silicon, dissolved	7440-21-3	E421	93.6 mg/L	100 mg/L	93.6	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0400 mg/L	0.04 mg/L	99.9	70.0	130	----
		sodium, dissolved	7440-23-5	E421	ND mg/L	20 mg/L	ND	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.2 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	143 mg/L	200 mg/L	71.6	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.0363 mg/L	0.04 mg/L	90.9	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.188 mg/L	0.2 mg/L	94.1	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.378 mg/L	0.4 mg/L	94.6	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.0379 mg/L	0.04 mg/L	94.8	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.935 mg/L	1 mg/L	93.5	70.0	130	----
		zinc, dissolved	7440-66-6	E421	3.79 mg/L	4 mg/L	94.8	70.0	130	----

Teck

COC ID:	REP_LAEMP_GC_2022-09_ALS	TURNAROUND TIME:	2-3 Business Days	RUSH:	Priorty

PROJECT/CLIENT INFO

Facility Name / Job#	Regional Effects Program
Project Manager	Giovanna Diaz
Email	Giovanna.Diaz@Teck.com
Address	421 Pine Avenue
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	1-250-865-3048

LABORATORY

Lab Name	ALS Calgary
Lab Contact	Lyudmyla Shvets
Email	Lyudmyla.Shvets@ALSGlobal.com
Address	2559 29 Street NE
City	Calgary
Province	AB
Postal Code	T1Y 7B5
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Phone Number	403 407 1794

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	Lisa.Bowron@minnow.ca	X	X	X
Email 5:	Awiebe@minnow.ca	X	X	X
Email 6:	Giovanna.Diaz@Teck.com	X	X	X
PO number	VPO00816101			

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	DOC	Mercury_Dissolved	Mercury_Total	TECKCOAL_METNHG_D	TECKCOAL_METNHG_T	TECKCOAL_ROUTINE	TOC_TKN_PT
Filt.								F	F	N	F	N	N	N
PRESERV.								H2SO4	HCL	HCL				H2SO4
RG_GANF_WS_LAEMP_GC_2022-09_N	RG_GANF	WS		2022/09/13	9:25	G	7	1	1	1	1	1	1	1

Environmental Division
Calgary
Work Order Reference
CG2212624

Telephone : +1 403 407 1800

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

Dissolved metals were field filtered and to be lab preserved
Total metals to be lab preserved

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Jennifer Ings/Minnow	#############		9/15 858

SERVICE REQUEST (rush - subject to availability)

Regular (default)	
Priority (2-3 business days) - 50% surcharge	X
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jennifer Ings	5195003444	
Sampler's Signature		Date/Time	September 14, 2022

Environmental Division
Calgary
Work Order Reference
CG2212624

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **CG2212661**	Page	: 1 of 6
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: Regional Effects Program	Date Samples Received	: 16-Sep-2022 08:50
PO	: VPO00816101	Date Analysis Commenced	: 16-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 20-Sep-2022 19:16
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Inorganics, Calgary, Alberta
Anthony Calero	Supervisor - Inorganic	Metals, Calgary, Alberta
Elke Tabora		Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Mackenzie Lamoureux	Laboratory Analyst	Metals, Calgary, Alberta
Millicent Brentnall	Laboratory Analyst	Metals, Calgary, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Shirley Li		Metals, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
HTD	*Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.*

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GAUT_WS_LAEMP_GC_2022-09_N	RG_FBLANK_WS_LAEMP_GC_2022-09_N	----	----	----
				Client sampling date / time	14-Sep-2022 08:50	14-Sep-2022 08:50	----	----	----
					CG2212661-001	CG2212661-002	--------	--------	--------
					Result	Result	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	222	<1.0	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	271	<1.0	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	<1.0	<1.0	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	<1.0	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	222	<1.0	----	----	----
conductivity	----	E100	2.0	µS/cm	466	<2.0	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	243	<0.50	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	276	510	----	----	----
pH	----	E108	0.10	pH units	8.26	5.26	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	292	<10	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	64.9	<1.0	----	----	----
turbidity	----	E121	0.10	NTU	17.6	<0.10	----	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	----	----	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	----	----	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	2.46	<0.10	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.132	<0.020	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.097	<0.050	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.0357	<0.0050 HTD	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	<0.0010	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0145	<0.0010	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0249	<0.0020	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	64.7	<0.30	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	2.77	<0.50	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	2.90	<0.50	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GAUT_WS_LAEMP_GC_2022-09_N	RG_FBLANK_WS_LAEMP_GC_2022-09_N	----	----	----
				Client sampling date / time	14-Sep-2022 08:50	14-Sep-2022 08:50	----	----	----
					CG2212661-001	CG2212661-002	--------	--------	--------
					Result	Result	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	5.86	<0.10	----	----	----
cation sum	----	EC101	0.10	meq/L	5.03	<0.10	----	----	----
ion balance (cations/anions)	----	EC101	0.010	%	85.8	100	----	----	----
ion balance (APHA)	----	EC101	0.010	%	7.62	<0.010	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0997	<0.0030	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00021	<0.00010	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00031	<0.00010	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.134	<0.00010	----	----	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	<0.020	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L	0.014	<0.010	----	----	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.0279	<0.0050	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	72.4	<0.050	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00018	<0.00010	----	----	----
cobalt, total	7440-48-4	E420	0.10	µg/L	0.17	<0.10	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	0.00051	<0.00050	----	----	----
iron, total	7439-89-6	E420	0.010	mg/L	0.108	<0.010	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	0.000110	<0.000050	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0087	<0.0010	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	25.0	<0.0050	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.00721	<0.00010	----	----	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000879	<0.000050	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00217	<0.00050	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	1.35	<0.050	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	0.856	<0.050	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	4.20	<0.10	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L	3.65	<0.050	----	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GAUT_WS_LAEMP_GC_2022-09_N	RG_FBLANK_WS_LAEMP_GC_2022-09_N	----	----	----
Client sampling date / time					14-Sep-2022 08:50	14-Sep-2022 08:50	----	----	----
					CG2212661-001	CG2212661-002	--------	--------	--------
					Result	Result	----	----	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.244	<0.00020	----	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	25.4	<0.50	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	----	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	0.00231	<0.00030	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.000535	<0.000010	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00075	<0.00050	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0036	<0.0010	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00015	<0.00010	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00024	<0.00010	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.110	<0.00010	----	----	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.020	<0.020	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	0.010	<0.010	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	0.0163	<0.0050	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	62.5	<0.050	----	----	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	<0.00010	----	----	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.10	<0.10	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00035	<0.00020	----	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0085	<0.0010	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	21.2	<0.0050	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00389	<0.00010	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000734	<0.000050	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00168	<0.00050	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	1.16	<0.050	----	----	----

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	RG_GAUT_WS_LAEMP_GC_2022-09_N	RG_FBLANK_WS_LAEMP_GC_2022-09_N	----	----	----
Client sampling date / time					14-Sep-2022 08:50	14-Sep-2022 08:50	----	----	----
					CG2212661-001	CG2212661-002	--------	--------	--------
					Result	Result	----	----	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	0.744	<0.050	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.58	<0.050	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	3.25	<0.050	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.223	<0.00020	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	21.6	<0.50	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	----	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000482	<0.000010	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0012	<0.0010	----	----	----
dissolved mercury filtration location	----	EP509	-	-	Field	Field	----	----	----
dissolved metals filtration location	----	EP421	-	-	Field	Field	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2212661**	Page	: 1 of 15
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: Regional Effects Program	Date Samples Received	: 16-Sep-2022 08:50
PO	: VPO00816101	Issue Date	: 20-Sep-2022 19:17
C-O-C number	: REP_LAEMP_GC_2022-09_ALS		
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_FBLANK_WS_LAEMP_GC_2022-09_N	E298	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_GAUT_WS_LAEMP_GC_2022-09_N	E298	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E235.Br-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E235.Br-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E235.Cl-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E235.Cl-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E378-U	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	3 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E378-U	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	3 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E235.F	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E235.F	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E235.NO3-L	14-Sep-2022	16-Sep-2022	3 days	2 days	✓	16-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E235.NO3-L	14-Sep-2022	16-Sep-2022	3 days	2 days	✓	20-Sep-2022	3 days	4 days	×
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E235.NO2-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E235.NO2-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	3 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E235.SO4	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E235.SO4	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_FBLANK_WS_LAEMP_GC_2022-09_N	E318	14-Sep-2022	18-Sep-2022	----	----		18-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_GAUT_WS_LAEMP_GC_2022-09_N	E318	14-Sep-2022	18-Sep-2022	----	----		18-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) RG_FBLANK_WS_LAEMP_GC_2022-09_N	E372-U	14-Sep-2022	19-Sep-2022	----	----		20-Sep-2022	28 days	6 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) RG_GAUT_WS_LAEMP_GC_2022-09_N	E372-U	14-Sep-2022	19-Sep-2022	----	----		20-Sep-2022	28 days	6 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) RG_FBLANK_WS_LAEMP_GC_2022-09_N	E421.Cr-L	14-Sep-2022	19-Sep-2022	----	----		19-Sep-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) RG_GAUT_WS_LAEMP_GC_2022-09_N	E421.Cr-L	14-Sep-2022	19-Sep-2022	----	----		19-Sep-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_FBLANK_WS_LAEMP_GC_2022-09_N	E509	14-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	6 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GAUT_WS_LAEMP_GC_2022-09_N	E509	14-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) RG_FBLANK_WS_LAEMP_GC_2022-09_N	E421	14-Sep-2022	19-Sep-2022	----	----		19-Sep-2022	180 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) RG_GAUT_WS_LAEMP_GC_2022-09_N	E421	14-Sep-2022	19-Sep-2022	----	----		19-Sep-2022	180 days	5 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_FBLANK_WS_LAEMP_GC_2022-09_N	E358-L	14-Sep-2022	16-Sep-2022	----	----		17-Sep-2022	28 days	3 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GAUT_WS_LAEMP_GC_2022-09_N	E358-L	14-Sep-2022	16-Sep-2022	----	----		17-Sep-2022	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_FBLANK_WS_LAEMP_GC_2022-09_N	E355-L	14-Sep-2022	16-Sep-2022	----	----		17-Sep-2022	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GAUT_WS_LAEMP_GC_2022-09_N	E355-L	14-Sep-2022	16-Sep-2022	----	----		17-Sep-2022	28 days	3 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E283	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	14 days	3 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E283	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E290	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E290	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	14 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Physical Tests : Conductivity in Water										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E100	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E100	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	28 days	3 days	✓
Physical Tests : ORP by Electrode										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E125	14-Sep-2022	----	----	----		17-Sep-2022	0.25 hrs	73 hrs	× EHTR-FM
Physical Tests : ORP by Electrode										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E125	14-Sep-2022	----	----	----		17-Sep-2022	0.25 hrs	73 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E108	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	0.25 hrs	0.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E108	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	0.25 hrs	0.25 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E162	14-Sep-2022	----	----	----		17-Sep-2022	7 days	3 days	✓
Physical Tests : TDS by Gravimetry										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E162	14-Sep-2022	----	----	----		17-Sep-2022	7 days	3 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE [TSS-WB] RG_FBLANK_WS_LAEMP_GC_2022-09_N	E160-L	14-Sep-2022	----	----	----		17-Sep-2022	7 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE [TSS-WB] RG_GAUT_WS_LAEMP_GC_2022-09_N	E160-L	14-Sep-2022	----	----	----		17-Sep-2022	7 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE RG_FBLANK_WS_LAEMP_GC_2022-09_N	E121	14-Sep-2022	----	----	----		16-Sep-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE RG_GAUT_WS_LAEMP_GC_2022-09_N	E121	14-Sep-2022	----	----	----		16-Sep-2022	3 days	3 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) RG_FBLANK_WS_LAEMP_GC_2022-09_N	E420.Cr-L	14-Sep-2022	18-Sep-2022	----	----		18-Sep-2022	180 days	4 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) RG_GAUT_WS_LAEMP_GC_2022-09_N	E420.Cr-L	14-Sep-2022	18-Sep-2022	----	----		18-Sep-2022	180 days	4 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) RG_FBLANK_WS_LAEMP_GC_2022-09_N	E508	14-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	6 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) RG_GAUT_WS_LAEMP_GC_2022-09_N	E508	14-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) RG_FBLANK_WS_LAEMP_GC_2022-09_N	E420	14-Sep-2022	18-Sep-2022	----	----		18-Sep-2022	180 days	4 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) RG_GAUT_WS_LAEMP_GC_2022-09_N	E420	14-Sep-2022	18-Sep-2022	----	----		18-Sep-2022	180 days	4 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	652128	1	19	5.2	5.0	✓
Alkalinity Species by Titration	E290	652131	1	19	5.2	5.0	✓
Ammonia by Fluorescence	E298	651651	1	12	8.3	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	651629	1	11	9.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	651630	1	11	9.0	5.0	✓
Conductivity in Water	E100	652130	1	19	5.2	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	653366	1	18	5.5	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	655111	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	653367	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	651624	1	6	16.6	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	651928	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	651628	1	11	9.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	651631	1	11	9.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	651632	1	11	9.0	5.0	✓
ORP by Electrode	E125	652149	1	19	5.2	5.0	✓
pH by Meter	E108	652129	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	651633	1	11	9.0	5.0	✓
TDS by Gravimetry	E162	652293	1	17	5.8	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	652278	1	15	6.6	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	652134	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	655100	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	652279	1	15	6.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	651625	1	6	16.6	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	653712	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	651627	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	652128	1	19	5.2	5.0	✓
Alkalinity Species by Titration	E290	652131	1	19	5.2	5.0	✓
Ammonia by Fluorescence	E298	651651	1	12	8.3	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	651629	1	11	9.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	651630	1	11	9.0	5.0	✓
Conductivity in Water	E100	652130	1	19	5.2	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	653366	1	18	5.5	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	655111	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	653367	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	651624	1	6	16.6	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	651928	1	20	5.0	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type / Analytical Methods	Method	QC Lot #	Count		Frequency (%)		
			QC	Regular	Actual	Expected	Evaluation
Laboratory Control Samples (LCS) - Continued							
Fluoride in Water by IC	E235.F	651628	1	11	9.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	651631	1	11	9.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	651632	1	11	9.0	5.0	✓
ORP by Electrode	E125	652149	1	19	5.2	5.0	✓
pH by Meter	E108	652129	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	651633	1	11	9.0	5.0	✓
TDS by Gravimetry	E162	652293	1	17	5.8	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	652278	1	15	6.6	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	652134	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	655100	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	652279	1	15	6.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	651625	1	6	16.6	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	653712	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	652292	1	17	5.8	5.0	✓
Turbidity by Nephelometry	E121	651627	1	20	5.0	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	652128	1	19	5.2	5.0	✓
Alkalinity Species by Titration	E290	652131	1	19	5.2	5.0	✓
Ammonia by Fluorescence	E298	651651	1	12	8.3	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	651629	1	11	9.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	651630	1	11	9.0	5.0	✓
Conductivity in Water	E100	652130	1	19	5.2	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	653366	1	18	5.5	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	655111	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	653367	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	651624	1	6	16.6	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	651928	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	651628	1	11	9.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	651631	1	11	9.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	651632	1	11	9.0	5.0	✓
Sulfate in Water by IC	E235.SO4	651633	1	11	9.0	5.0	✓
TDS by Gravimetry	E162	652293	1	17	5.8	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	652278	1	15	6.6	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	652134	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	655100	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	652279	1	15	6.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	651625	1	6	16.6	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	653712	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	652292	1	17	5.8	5.0	✓
Turbidity by Nephelometry	E121	651627	1	20	5.0	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	651651	1	12	8.3	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	651629	1	11	9.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	651630	1	11	9.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	653366	1	18	5.5	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	655111	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	653367	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	651624	1	6	16.6	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	651928	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	651628	1	11	9.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	651631	1	11	9.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	651632	1	11	9.0	5.0	✓
Sulfate in Water by IC	E235.SO4	651633	1	11	9.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	652278	1	15	6.6	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	652134	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	655100	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	652279	1	15	6.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	651625	1	6	16.6	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	653712	1	20	5.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	*Method / Lab*	*Matrix*	*Method Reference*	*Method Descriptions*
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Calgary - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAAS	E508 Calgary - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	“Hardness (as CaCO3), dissolved” is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. “Total Hardness” refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **CG2212661**	Page	: 1 of 18
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: Regional Effects Program	Date Samples Received	: 16-Sep-2022 08:50
PO	: VPO00816101	Date Analysis Commenced	: 16-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 20-Sep-2022 19:16
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
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General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 651627)											
CG2212619-005	Anonymous	turbidity	----	E121	0.10	NTU	<0.10	<0.10	0	Diff <2x LOR	----
Physical Tests (QC Lot: 652128)											
CG2212650-001	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 652129)											
CG2212650-001	Anonymous	pH	----	E108	0.10	pH units	8.34	8.31	0.360%	4%	----
Physical Tests (QC Lot: 652130)											
CG2212650-001	Anonymous	conductivity	----	E100	2.0	µS/cm	287	288	0.348%	10%	----
Physical Tests (QC Lot: 652131)											
CG2212650-001	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	144	156	7.92%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	6.8	5.4	1.4	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	151	162	6.72%	20%	----
Physical Tests (QC Lot: 652149)											
CG2212650-001	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	268	269	0.186%	15%	----
Physical Tests (QC Lot: 652293)											
CG2212657-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	1400	1420	1.38%	20%	----
Anions and Nutrients (QC Lot: 651628)											
CG2212647-001	Anonymous	fluoride	16984-48-8	E235.F	0.020	mg/L	0.144	0.144	0.0003	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651629)											
CG2212647-001	Anonymous	bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651630)											
CG2212647-001	Anonymous	chloride	16887-00-6	E235.Cl-L	0.10	mg/L	0.17	0.18	0.009	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651631)											
CG2212647-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.0455	0.0466	0.0011	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651632)											
CG2212647-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651633)											
CG2212647-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	46.8	46.7	0.379%	20%	----
Anions and Nutrients (QC Lot: 651651)											
CG2212588-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651928)											

Sub-Matrix: **Water**

Laboratory Duplicate (DUP) Report

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Anions and Nutrients (QC Lot: 651928) - continued											
CG2212626-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0048	0.0047	0.00008	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 652134)											
CG2212616-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.770	0.768	0.260%	20%	----
Anions and Nutrients (QC Lot: 653712)											
CG2212650-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0033	0.0035	0.0002	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 651624)											
CG2212650-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 651625)											
CG2212650-001	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Total Metals (QC Lot: 652278)											
CG2212385-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
Total Metals (QC Lot: 652279)											
CG2212385-001	Anonymous	aluminum, total	7429-90-5	E420	0.0060	mg/L	0.0110	0.0110	0.00003	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00020	mg/L	0.00031	0.00029	0.00001	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00020	mg/L	0.0320	0.0300	6.28%	20%	----
		beryllium, total	7440-41-7	E420	0.000040	mg/L	<0.040 µg/L	<0.000040	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000100	mg/L	0.0406 µg/L	0.0000339	0.0000067	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.100	mg/L	318	304	4.43%	20%	----
		cobalt, total	7440-48-4	E420	0.00020	mg/L	<0.20 µg/L	<0.00020	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0020	mg/L	0.0380	0.0349	8.66%	20%	----
		magnesium, total	7439-95-4	E420	0.0100	mg/L	186	178	4.04%	20%	----
		manganese, total	7439-96-5	E420	0.00020	mg/L	0.0264	0.0255	3.63%	20%	----
		molybdenum, total	7439-98-7	E420	0.000100	mg/L	0.00194	0.00175	9.93%	20%	----
		nickel, total	7440-02-0	E420	0.00100	mg/L	0.00108	0.00106	0.00002	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.100	mg/L	3.69	3.52	4.69%	20%	----
		selenium, total	7782-49-2	E420	0.000100	mg/L	225 µg/L	0.214	4.91%	20%	----
		silicon, total	7440-21-3	E420	0.20	mg/L	6.30	5.96	5.64%	20%	----
		silver, total	7440-22-4	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.100	mg/L	20.2	19.4	3.98%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	**Client sample ID**	**Analyte**	**CAS Number**	**Method**	**LOR**	**Unit**	**Original Result**	**Duplicate Result**	**RPD(%) or Difference**	**Duplicate Limits**	**Qualifier**
Total Metals (QC Lot: 652279) - continued											
CG2212385-001	Anonymous	strontium, total	7440-24-6	E420	0.00040	mg/L	0.208	0.200	3.65%	20%	----
		sulfur, total	7704-34-9	E420	1.00	mg/L	350	329	6.05%	20%	----
		thallium, total	7440-28-0	E420	0.000020	mg/L	0.000109	0.000105	0.000004	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00060	mg/L	<0.00060	<0.00060	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000020	mg/L	0.00759	0.00737	2.94%	20%	----
		vanadium, total	7440-62-2	E420	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0060	mg/L	<0.0060	<0.0060	0	Diff <2x LOR	----
Total Metals (QC Lot: 655100)											
CG2212650-001	Anonymous	mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	0.0000055	0.0000005	Diff <2x LOR	----
Dissolved Metals (QC Lot: 653366)											
CG2212376-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00018	0.00017	0.00002	Diff <2x LOR	----
Dissolved Metals (QC Lot: 653367)											
CG2212376-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00014	0.00012	0.00002	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0432	0.0414	4.29%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	<0.0050 µg/L	<0.0000050	0	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	44.6	43.6	2.14%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0038	0.0036	0.0001	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	12.1	11.7	2.73%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000923	0.000900	2.55%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.260	0.262	0.001	Diff <2x LOR	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	3.40 µg/L	0.00320	6.14%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	1.63	1.56	4.72%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory Duplicate (DUP) Report

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Dissolved Metals (QC Lot: 653367) - continued											
CG2212376-001	Anonymous	sodium, dissolved	7440-23-5	E421	0.050	mg/L	1.30	1.27	2.53%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.159	0.154	2.87%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	19.1	18.0	5.64%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00111	0.00119	7.45%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0016	0.0013	0.0003	Diff <2x LOR	----
Dissolved Metals (QC Lot: 655111)											
CG2212650-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 651627)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 652128)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 652130)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 652131)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 652292)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 652293)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 651628)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 651629)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 651630)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 651631)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 651632)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 651633)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 651651)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 651928)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 652134)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 653712)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 653712) - continued						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Organic / Inorganic Carbon (QCLot: 651624)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 651625)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 652278)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 652279)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 652279) - continued						
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 655100)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 653366)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 653367)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 653367) - continued						
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Dissolved Metals (QCLot: 655111)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 651627)									
turbidity	----	E121	0.1	NTU	200 NTU	113	85.0	115	----
Physical Tests (QCLot: 652128)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	106	85.0	115	----
Physical Tests (QCLot: 652129)									
pH	----	E108	----	pH units	7 pH units	100	98.6	101	----
Physical Tests (QCLot: 652130)									
conductivity	----	E100	1	μS/cm	146.9 μS/cm	97.3	90.0	110	----
Physical Tests (QCLot: 652131)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	101	85.0	115	----
Physical Tests (QCLot: 652149)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	100	95.4	104	----
Physical Tests (QCLot: 652292)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	88.9	85.0	115	----
Physical Tests (QCLot: 652293)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	92.5	85.0	115	----
Anions and Nutrients (QCLot: 651628)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 651629)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	102	85.0	115	----
Anions and Nutrients (QCLot: 651630)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 651631)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 651632)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	99.7	90.0	110	----
Anions and Nutrients (QCLot: 651633)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 651651)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	97.4	85.0	115	----
Anions and Nutrients (QCLot: 651928)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	92.8	80.0	120	----
Anions and Nutrients (QCLot: 652134)									

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Anions and Nutrients (QCLot: 652134) - continued									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	95.2	75.0	125	----
Anions and Nutrients (QCLot: 653712)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.03 mg/L	95.2	80.0	120	----
Organic / Inorganic Carbon (QCLot: 651624)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	97.9	80.0	120	----
Organic / Inorganic Carbon (QCLot: 651625)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	102	80.0	120	----
Total Metals (QCLot: 652278)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	89.3	80.0	120	----
Total Metals (QCLot: 652279)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	103	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	108	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	90.0	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	105	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	88.2	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	91.5	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	86.2	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	88.6	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	104	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	87.4	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	89.1	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	108	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	90.7	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	99.2	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	87.4	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	95.1	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	93.1	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	91.1	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	90.4	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	84.0	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	108	60.0	140	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	86.2	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	90.3	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	95.5	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	97.6	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 652279) - continued									
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	91.5	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	104	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	93.4	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	102	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	89.7	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	108	80.0	120	----
Total Metals (QCLot: 655100)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	118	80.0	120	----
Dissolved Metals (QCLot: 653366)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	99.4	80.0	120	----
Dissolved Metals (QCLot: 653367)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	104	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	101	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	97.7	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	97.2	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	98.6	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	95.6	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	86.6	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	96.4	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	99.0	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	98.0	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	95.5	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	113	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	94.6	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	104	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	96.8	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	101	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	97.4	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	98.7	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	90.7	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	103	60.0	140	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	86.3	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	100	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	97.8	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	96.7	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 653367) - continued									
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	95.4	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	94.8	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	92.7	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	92.8	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	99.0	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	99.4	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	95.8	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*Target*	*MS*	*Low*	*High*	*Qualifier*
Anions and Nutrients (QCLot: 651628)										
CG2212647-002	Anonymous	fluoride	16984-48-8	E235.F	1.02 mg/L	1 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 651629)										
CG2212647-002	Anonymous	bromide	24959-67-9	E235.Br-L	0.510 mg/L	0.5 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 651630)										
CG2212647-002	Anonymous	chloride	16887-00-6	E235.Cl-L	100 mg/L	100 mg/L	100	75.0	125	----
Anions and Nutrients (QCLot: 651631)										
CG2212647-002	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	2.53 mg/L	2.5 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 651632)										
CG2212647-002	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.515 mg/L	0.5 mg/L	103	75.0	125	----
Anions and Nutrients (QCLot: 651633)										
CG2212647-002	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	102 mg/L	100 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 651651)										
CG2212588-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.106 mg/L	0.1 mg/L	106	75.0	125	----
Anions and Nutrients (QCLot: 651928)										
CG2212650-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0514 mg/L	0.05 mg/L	103	70.0	130	----
Anions and Nutrients (QCLot: 652134)										
CG2212647-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.47 mg/L	2.5 mg/L	98.8	70.0	130	----
Anions and Nutrients (QCLot: 653712)										
CG2212650-002	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0504 mg/L	0.05 mg/L	101	70.0	130	----
Organic / Inorganic Carbon (QCLot: 651624)										
CG2212650-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	5.19 mg/L	5 mg/L	104	70.0	130	----
Organic / Inorganic Carbon (QCLot: 651625)										
CG2212650-001	Anonymous	carbon, total organic [TOC]	----	E355-L	5.52 mg/L	5 mg/L	110	70.0	130	----
Total Metals (QCLot: 652278)										
CG2212385-002	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.459 mg/L	0.4 mg/L	115	70.0	130	----
Total Metals (QCLot: 652279)										
CG2212385-002	Anonymous	aluminum, total	7429-90-5	E420	2.34 mg/L	2 mg/L	117	70.0	130	----
		antimony, total	7440-36-0	E420	0.215 mg/L	0.2 mg/L	107	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 652279) - continued										
CG2212385-002	Anonymous	arsenic, total	7440-38-2	E420	0.224 mg/L	0.2 mg/L	112	70.0	130	----
		barium, total	7440-39-3	E420	0.242 mg/L	0.2 mg/L	121	70.0	130	----
		beryllium, total	7440-41-7	E420	0.414 mg/L	0.4 mg/L	103	70.0	130	----
		bismuth, total	7440-69-9	E420	0.0981 mg/L	0.1 mg/L	98.1	70.0	130	----
		boron, total	7440-42-8	E420	1.02 mg/L	1 mg/L	102	70.0	130	----
		cadmium, total	7440-43-9	E420	0.0472 mg/L	0.04 mg/L	118	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	0.232 mg/L	0.2 mg/L	116	70.0	130	----
		copper, total	7440-50-8	E420	0.224 mg/L	0.2 mg/L	112	70.0	130	----
		iron, total	7439-89-6	E420	23.1 mg/L	20 mg/L	116	70.0	130	----
		lead, total	7439-92-1	E420	0.202 mg/L	0.2 mg/L	101	70.0	130	----
		lithium, total	7439-93-2	E420	1.03 mg/L	1 mg/L	103	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	ND mg/L	0.2 mg/L	ND	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.213 mg/L	0.2 mg/L	106	70.0	130	----
		nickel, total	7440-02-0	E420	0.452 mg/L	0.4 mg/L	113	70.0	130	----
		potassium, total	7440-09-7	E420	47.4 mg/L	40 mg/L	118	70.0	130	----
		selenium, total	7782-49-2	E420	0.472 mg/L	0.4 mg/L	118	70.0	130	----
		silicon, total	7440-21-3	E420	92.1 mg/L	100 mg/L	92.1	70.0	130	----
		silver, total	7440-22-4	E420	0.0429 mg/L	0.04 mg/L	107	70.0	130	----
		sodium, total	7440-23-5	E420	16.3 mg/L	20 mg/L	81.3	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.2 mg/L	ND	70.0	130	----
		sulfur, total	7704-34-9	E420	ND mg/L	200 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.0402 mg/L	0.04 mg/L	100	70.0	130	----
		tin, total	7440-31-5	E420	0.208 mg/L	0.2 mg/L	104	70.0	130	----
		titanium, total	7440-32-6	E420	0.450 mg/L	0.4 mg/L	112	70.0	130	----
		uranium, total	7440-61-1	E420	0.0416 mg/L	0.04 mg/L	104	70.0	130	----
		vanadium, total	7440-62-2	E420	1.17 mg/L	1 mg/L	117	70.0	130	----
		zinc, total	7440-66-6	E420	4.52 mg/L	4 mg/L	113	70.0	130	----
Total Metals (QCLot: 655100)										
CG2212650-002	Anonymous	mercury, total	7439-97-6	E508	0.0000937 mg/L	0.0001 mg/L	93.7	70.0	130	----
Dissolved Metals (QCLot: 653366)										
CG2212376-002	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.366 mg/L	0.4 mg/L	91.5	70.0	130	----
Dissolved Metals (QCLot: 653367)										
CG2212376-002	Anonymous	aluminum, dissolved	7429-90-5	E421	1.87 mg/L	2 mg/L	93.6	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.188 mg/L	0.2 mg/L	94.1	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*Target*	*MS*	*Low*	*High*	*Qualifier*
Dissolved Metals (QCLot: 653367) - continued										
CG2212376-002	Anonymous	arsenic, dissolved	7440-38-2	E421	0.176 mg/L	0.2 mg/L	88.0	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.182 mg/L	0.2 mg/L	91.3	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.369 mg/L	0.4 mg/L	92.2	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0851 mg/L	0.1 mg/L	85.1	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.824 mg/L	1 mg/L	82.4	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0355 mg/L	0.04 mg/L	88.8	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.182 mg/L	0.2 mg/L	91.0	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.181 mg/L	0.2 mg/L	90.4	70.0	130	----
		iron, dissolved	7439-89-6	E421	17.9 mg/L	20 mg/L	89.7	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.174 mg/L	0.2 mg/L	86.9	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.983 mg/L	1 mg/L	98.3	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.182 mg/L	0.2 mg/L	91.2	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.184 mg/L	0.2 mg/L	92.2	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.363 mg/L	0.4 mg/L	90.8	70.0	130	----
		potassium, dissolved	7440-09-7	E421	35.4 mg/L	40 mg/L	88.6	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.339 mg/L	0.4 mg/L	84.8	70.0	130	----
		silicon, dissolved	7440-21-3	E421	72.6 mg/L	100 mg/L	72.6	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0363 mg/L	0.04 mg/L	90.7	70.0	130	----
		sodium, dissolved	7440-23-5	E421	18.6 mg/L	20 mg/L	92.8	70.0	130	----
		strontium, dissolved	7440-24-6	E421	0.183 mg/L	0.2 mg/L	91.4	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	171 mg/L	200 mg/L	85.4	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.0342 mg/L	0.04 mg/L	85.4	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.176 mg/L	0.2 mg/L	88.2	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.355 mg/L	0.4 mg/L	88.8	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.0347 mg/L	0.04 mg/L	86.8	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.881 mg/L	1 mg/L	88.1	70.0	130	----
		zinc, dissolved	7440-66-6	E421	3.80 mg/L	4 mg/L	95.1	70.0	130	----
Dissolved Metals (QCLot: 655111)										
CG2212650-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000938 mg/L	0.0001 mg/L	93.8	70.0	130	----

Teck

COC ID: REP_LAEMP_GC_2022-09_ALS | **TURNAROUND TIME:** 2-3 Business Days | **RUSH:** Priorty

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Regional Effects Program			Lab Name	ALS Calgary			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Giovanna Diaz			Lab Contact	Lyudmyla Shvets			Email 1:	AquaSciLab@Teck.com	X	X	X
Email	Giovanna.Diaz@Teck.com			Email	Lyudmyla.Shvets@ALSGlobal.com			Email 2:	teckcoal@equisonline.com			X
Address	421 Pine Avenue			Address	2559 29 Street NE			Email 3:	Teck.Lab.Results@teck.com	X	X	X
								Email 4:	Lisa.Bowron@minnow.ca	X	X	X
City	Sparwood	Province	BC	City	Calgary	Province	AB	Email 5:	Awiebe@minnow.ca	X	X	X
Postal Code	V0B 2G0	Country	Canada	Postal Code	T1Y 7B5	Country	Canada	Email 6:	Giovanna.Diaz@Teck.com	X	X	X
Phone Number	1-250-865-3048			Phone Number	403 407 1794			PO number	VPO00816101			

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	DOC	Mercury_Dissolved	Mercury_Total	TECKCOAL_METNHG_D	TECKCOAL_METNHG_T	TECKCOAL_ROUTINE	TOC_TKN_PT
PRESERV.								H2SO4	HCL	HCL				H2SO4
Filt.								F	F	N	F	N	N	N
RG_GAUT_WS_LAEMP_GC_2022-09_N	RG_GAUT	WS		2022/09/14	8:50	G	7	1	1	1	1	1	1	1
RG_FBLANK_WS_LAEMP_GC_2022-09_N	RG_FBLANK	WS		2022/09/14	8:50	G	7	1	1	1	1	1	1	1

Environmental Division
Calgary
Work Order Reference
CG2212661

Telephone : +1 403 407 1800

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Dissolved metals were field filtered and to be lab preserved Total metals to be lab preserved	Jennifer Ings/Minnow	##############		9/16 850

SERVICE REQUEST (rush - subject to availability)					
Regular (default)		Sampler's Name	Jennifer Ings	5195003444	8
Priority (2-3 business days) - 50% surcharge	X				
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	September 15, 2022
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Environmental Division
Calgary
Work Order Reference
CG2212661

CERTIFICATE OF ANALYSIS

Work Order	: **CG2212819**	Page	: 1 of 6
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 17-Sep-2022 11:38
PO	: VPO00816101	Date Analysis Commenced	: 20-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 22-Sep-2022 17:24
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Metals, Calgary, Alberta
Dwayne Bennett	Supervisor - Inorganic	Inorganics, Calgary, Alberta
Dwayne Bennett	Supervisor - Inorganic	Metals, Calgary, Alberta
Elke Tabora		Inorganics, Calgary, Alberta
Mackenzie Lamoureux	Laboratory Analyst	Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Summie Lo	Lab Assistant	Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Inorganics, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
HTA	*Analytical holding time was exceeded.*
RRV	*Reported result verified by repeat analysis.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

				Client sample ID	RG_GHUT_WS_LAEMP_GC_2022-09_N	RG_GHCKD_WS_LAEMP_GC_2022-09_N	RG_GHDT_WS_LAEMP_GC_2022-09_N	RG_TRIP_WS_LAEMP_GC_2022-09_N	----
				Client sampling date / time	15-Sep-2022 08:05	15-Sep-2022 13:40	15-Sep-2022 08:55	15-Sep-2022 08:55	----
Analyte	CAS Number	Method	LOR	Unit	CG2212819-001	CG2212819-002	CG2212819-003	CG2212819-004	--------
					Result	Result	Result	Result	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	8.1	<2.0	<2.0	<2.0	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	443	223	308	<1.0	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	540	272	376	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	23.0	20.2	<1.0	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	<1.0	13.8	12.1	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	443	246	328	<1.0	----
conductivity	----	E100	2.0	µS/cm	2170	1550	1990	<2.0	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	1500	1010	1320	<0.50	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	377	372	376	469	----
pH	----	E108	0.10	pH units	8.02	8.46	8.38	5.31	----
solids, total dissolved [TDS]	----	E162	10	mg/L	1920	1350	1710	<10	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	44.0	1.4	2.0	<1.0	----
turbidity	----	E121	0.10	NTU	33.3 HTA	0.99 HTA	0.14 HTA	<0.10 HTA	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0132	0.0099	<0.0050	0.0385 RRV	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.250 DLDS	<0.250 DLDS	<0.250 DLDS	<0.050	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	1.62	1.55	1.57	<0.10	----
fluoride	16984-48-8	E235.F	0.020	mg/L	<0.100 DLDS	0.136	<0.100 DLDS	<0.020	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.679	<0.500 DLM	<0.500 DLM	<0.050	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	8.94	4.51	8.06	<0.0050	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0050 DLDS	0.0107	<0.0050 DLDS	<0.0010	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0026 HTA	0.0019 HTA	0.0015 HTA	<0.0010 HTA	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0321	0.0043	0.0135	<0.0020	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	1110	812	1080	<0.30	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.59	2.13	1.86	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	4.64	2.02	1.79	<0.50	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHUT_WS_LAEMP_GC_2022-09_N	RG_GHCKD_WS_LAEMP_GC_2022-09_N	RG_GHDT_WS_LAEMP_GC_2022-09_N	RG_TRIP_WS_LAEMP_GC_2022-09_N	----
Client sampling date / time					15-Sep-2022 08:05	15-Sep-2022 13:40	15-Sep-2022 08:55	15-Sep-2022 08:55	----
					CG2212819-001	CG2212819-002	CG2212819-003	CG2212819-004	--------
					Result	Result	Result	Result	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	32.6	22.2	29.7	<0.10	----
cation sum	----	EC101	0.10	meq/L	30.0	20.4	26.6	<0.10	----
ion balance (cations/anions)	----	EC101	0.010	%	92.0	91.9	89.6	100	----
ion balance (APHA)	----	EC101	0.010	%	4.15	4.22	5.51	<0.010	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.237	0.0081	0.0044	<0.0030	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00078	0.00042	0.00058	<0.00010	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00036	0.00032	0.00019	<0.00010	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0431	0.0392	0.0354	<0.00010	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.040 DLDS	<0.020	<0.020	<0.020	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000100 DLDS	<0.000050	<0.000050	<0.000050	----
boron, total	7440-42-8	E420	0.010	mg/L	<0.020 DLDS	0.011	<0.010	<0.010	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.786	0.0080	0.0073	<0.0050	----
calcium, total	7440-70-2	E420	0.050	mg/L	303	159	213	<0.050	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00047	0.00010	<0.00010	<0.00010	----
cobalt, total	7440-48-4	E420	0.10	µg/L	0.52	<0.10	<0.10	<0.10	----
copper, total	7440-50-8	E420	0.00050	mg/L	0.00200	<0.00050	<0.00050	<0.00050	----
iron, total	7439-89-6	E420	0.010	mg/L	0.279	<0.010	<0.010	<0.010	----
lead, total	7439-92-1	E420	0.000050	mg/L	0.000604	<0.000050	<0.000050	<0.000050	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0207	0.0168	0.0167	<0.0010	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	230	152	208	<0.0050	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.0219	0.00192	0.00155	<0.00010	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00186	0.00162	0.00154	<0.000050	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.0348	0.00795	0.0180	<0.00050	----
potassium, total	7440-09-7	E420	0.050	mg/L	3.28	2.52	2.76	<0.050	----
selenium, total	7782-49-2	E420	0.050	µg/L	258	148	240	<0.050	----
silicon, total	7440-21-3	E420	0.10	mg/L	3.74	3.52	3.44	<0.10	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000020 DLDS	<0.000010	<0.000010	<0.000010	----
sodium, total	7440-23-5	E420	0.050	mg/L	1.92	2.62	1.98	<0.050	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHUT_WS_LAEMP_GC_2022-09_N	RG_GHCKD_WS_LAEMP_GC_2022-09_N	RG_GHDT_WS_LAEMP_GC_2022-09_N	RG_TRIP_WS_LAEMP_GC_2022-09_N	----
Client sampling date / time					15-Sep-2022 08:05	15-Sep-2022 13:40	15-Sep-2022 08:55	15-Sep-2022 08:55	----
					CG2212819-001	CG2212819-002	CG2212819-003	CG2212819-004	--------
					Result	Result	Result	Result	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.171	0.191	0.161	<0.00020	----
sulfur, total	7704-34-9	E420	0.50	mg/L	434	298	392	<0.50	----
thallium, total	7440-28-0	E420	0.000010	mg/L	0.000044	<0.000010	<0.000010	<0.000010	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00020 DLDS	<0.00010	<0.00010	<0.00010	----
titanium, total	7440-32-6	E420	0.00030	mg/L	0.00670	<0.00030	<0.00030	<0.00030	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.0142	0.00849	0.0116	<0.000010	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00124	0.00065	<0.00050	<0.00050	----
zinc, total	7440-66-6	E420	0.0030	mg/L	0.0450	<0.0030	<0.0030	<0.0030	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0021	0.0012	0.0033	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00064	0.00042	0.00057	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00022	0.00021	<0.00020 DLDS	<0.00010	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0367	0.0405	0.0376	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.040 DLDS	<0.020	<0.040 DLDS	<0.020	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000100 DLDS	<0.000050	<0.000100 DLDS	<0.000050	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.020 DLDS	<0.010	<0.020 DLDS	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	0.580	0.0081	<0.0100 DLDS	<0.0050	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	269	147	213	<0.050	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00020 DLDS	<0.00010	<0.00020 DLDS	<0.00010	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.20 DLDS	<0.10	<0.20 DLDS	<0.10	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00052	0.00030	<0.00040 DLDS	<0.00020	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.020 DLDS	<0.010	<0.020 DLDS	<0.010	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000100 DLDS	<0.000050	<0.000100 DLDS	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0207	0.0154	0.0190	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	200	157	192	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00900	0.00087	0.00148	<0.00010	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00170	0.00159	0.00155	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.0312	0.00804	0.0182	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	2.93	2.60	2.68	<0.050	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	RG_GHUT_WS_LAEMP_GC_2022-09_N	RG_GHCKD_WS_LAEMP_GC_2022-09_N	RG_GHDT_WS_LAEMP_GC_2022-09_N	RG_TRIP_WS_LAEMP_GC_2022-09_N	----
				Client sampling date / time	15-Sep-2022 08:05	15-Sep-2022 13:40	15-Sep-2022 08:55	15-Sep-2022 08:55	----
Analyte	CAS Number	Method	LOR	Unit	CG2212819-001	CG2212819-002	CG2212819-003	CG2212819-004	--------
					Result	Result	Result	Result	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	287	173	270	<0.050	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.86	3.46	3.10	<0.050	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000020 DLDS	<0.000010	<0.000020 DLDS	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	1.76	2.59	1.86	<0.050	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.163	0.181	0.168	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	348	285	334	<0.50	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.000021	<0.000010	<0.000020 DLDS	<0.000010	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00020 DLDS	<0.00010	<0.00020 DLDS	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00060 DLDS	<0.00030	<0.00060 DLDS	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.0124	0.00780	0.0114	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00100 DLDS	<0.00050	<0.00100 DLDS	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0332	<0.0010	<0.0020 DLDS	<0.0010	----
dissolved mercury filtration location	----	EP509	-	-	Field	Field	Field	----	----
dissolved metals filtration location	----	EP421	-	-	Field	Field	Field	Laboratory	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2212819**	Page	: 1 of 20
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 17-Sep-2022 11:38
PO	: VPO00816101	Issue Date	: 22-Sep-2022 17:25
C-O-C number	: REP_LAEMP_GC_2022-09_ALS		
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_GHCKD_WS_LAEMP_GC_2022-09_N	E298	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_GHDT_WS_LAEMP_GC_2022-09_N	E298	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_GHUT_WS_LAEMP_GC_2022-09_N	E298	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_TRIP_WS_LAEMP_GC_2022-09_N	E298	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E235.Br-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E235.Br-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E235.Br-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓

Work Order : CG2212819
Client : Teck Coal Limited
Project : REGIONAL EFFECTS PROGRAM

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E235.Br-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E235.Cl-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E235.Cl-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E235.Cl-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E235.Cl-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E378-U	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	3 days	5 days	× EHT
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E378-U	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	3 days	5 days	× EHT
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E378-U	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	3 days	5 days	× EHT
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E378-U	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	3 days	5 days	× EHT

Matrix: **Water**

Evaluation: ✘ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E235.F	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E235.F	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E235.F	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E235.F	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E235.NO3-L	15-Sep-2022	20-Sep-2022	3 days	5 days	✘ EHT	20-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E235.NO3-L	15-Sep-2022	20-Sep-2022	3 days	5 days	✘ EHT	20-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E235.NO3-L	15-Sep-2022	20-Sep-2022	3 days	5 days	✘ EHT	20-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E235.NO3-L	15-Sep-2022	20-Sep-2022	3 days	5 days	✘ EHT	20-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E235.NO2-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	3 days	5 days	✘ EHT

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E235.NO2-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	3 days	5 days	× EHT
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E235.NO2-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	3 days	5 days	× EHT
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E235.NO2-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	3 days	5 days	× EHT
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E235.SO4	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E235.SO4	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E235.SO4	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E235.SO4	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_GHCKD_WS_LAEMP_GC_2022-09_N	E318	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	28 days	6 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_GHDT_WS_LAEMP_GC_2022-09_N	E318	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	28 days	6 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_GHUT_WS_LAEMP_GC_2022-09_N	E318	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	28 days	6 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_TRIP_WS_LAEMP_GC_2022-09_N	E318	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	28 days	6 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) RG_GHCKD_WS_LAEMP_GC_2022-09_N	E372-U	15-Sep-2022	20-Sep-2022	----	----		21-Sep-2022	28 days	6 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) RG_GHDT_WS_LAEMP_GC_2022-09_N	E372-U	15-Sep-2022	20-Sep-2022	----	----		21-Sep-2022	28 days	6 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) RG_GHUT_WS_LAEMP_GC_2022-09_N	E372-U	15-Sep-2022	20-Sep-2022	----	----		21-Sep-2022	28 days	6 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) RG_TRIP_WS_LAEMP_GC_2022-09_N	E372-U	15-Sep-2022	20-Sep-2022	----	----		21-Sep-2022	28 days	6 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) RG_GHCKD_WS_LAEMP_GC_2022-09_N	E421.Cr-L	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) RG_GHDT_WS_LAEMP_GC_2022-09_N	E421.Cr-L	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) RG_GHUT_WS_LAEMP_GC_2022-09_N	E421.Cr-L	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) RG_TRIP_WS_LAEMP_GC_2022-09_N	E421.Cr-L	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GHCKD_WS_LAEMP_GC_2022-09_N	E509	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GHDT_WS_LAEMP_GC_2022-09_N	E509	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GHUT_WS_LAEMP_GC_2022-09_N	E509	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) RG_GHCKD_WS_LAEMP_GC_2022-09_N	E421	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) RG_GHDT_WS_LAEMP_GC_2022-09_N	E421	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) RG_GHUT_WS_LAEMP_GC_2022-09_N	E421	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) RG_TRIP_WS_LAEMP_GC_2022-09_N	E421	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GHCKD_WS_LAEMP_GC_2022-09_N	E358-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GHDT_WS_LAEMP_GC_2022-09_N	E358-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GHUT_WS_LAEMP_GC_2022-09_N	E358-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GHCKD_WS_LAEMP_GC_2022-09_N	E355-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GHDT_WS_LAEMP_GC_2022-09_N	E355-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GHUT_WS_LAEMP_GC_2022-09_N	E355-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_TRIP_WS_LAEMP_GC_2022-09_N	E355-L	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E283	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	14 days	5 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E283	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	14 days	5 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E283	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	14 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Acidity by Titration										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E283	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	14 days	5 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E290	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	14 days	5 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E290	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	14 days	5 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E290	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	14 days	5 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E290	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	14 days	5 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E100	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E100	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E100	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E100	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Physical Tests : ORP by Electrode										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E125	15-Sep-2022	----	----	----		20-Sep-2022	0.25 hrs	127 hrs	× EHTR-FM
Physical Tests : ORP by Electrode										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E125	15-Sep-2022	----	----	----		20-Sep-2022	0.25 hrs	132 hrs	× EHTR-FM
Physical Tests : ORP by Electrode										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E125	15-Sep-2022	----	----	----		20-Sep-2022	0.25 hrs	132 hrs	× EHTR-FM
Physical Tests : ORP by Electrode										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E125	15-Sep-2022	----	----	----		20-Sep-2022	0.25 hrs	133 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E108	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	0.25 hrs	0.28 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E108	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	0.25 hrs	0.28 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E108	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	0.25 hrs	0.28 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E108	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	0.25 hrs	0.28 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E162	15-Sep-2022	----	----	----		20-Sep-2022	7 days	5 days	✓

Matrix: **Water**

Evaluation: ✖ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TDS by Gravimetry										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E162	15-Sep-2022	----	----	----		20-Sep-2022	7 days	5 days	✓
Physical Tests : TDS by Gravimetry										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E162	15-Sep-2022	----	----	----		20-Sep-2022	7 days	5 days	✓
Physical Tests : TDS by Gravimetry										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E162	15-Sep-2022	----	----	----		20-Sep-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E160-L	15-Sep-2022	----	----	----		20-Sep-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E160-L	15-Sep-2022	----	----	----		20-Sep-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E160-L	15-Sep-2022	----	----	----		20-Sep-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E160-L	15-Sep-2022	----	----	----		20-Sep-2022	7 days	5 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE RG_GHCKD_WS_LAEMP_GC_2022-09_N	E121	15-Sep-2022	----	----	----		20-Sep-2022	3 days	5 days	✖ EHT
Physical Tests : Turbidity by Nephelometry										
HDPE RG_GHDT_WS_LAEMP_GC_2022-09_N	E121	15-Sep-2022	----	----	----		20-Sep-2022	3 days	5 days	✖ EHT

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Turbidity by Nephelometry										
HDPE RG_GHUT_WS_LAEMP_GC_2022-09_N	E121	15-Sep-2022	----	----	----		20-Sep-2022	3 days	5 days	× EHT
Physical Tests : Turbidity by Nephelometry										
HDPE RG_TRIP_WS_LAEMP_GC_2022-09_N	E121	15-Sep-2022	----	----	----		20-Sep-2022	3 days	5 days	× EHT
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) RG_GHCKD_WS_LAEMP_GC_2022-09_N	E420.Cr-L	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) RG_GHDT_WS_LAEMP_GC_2022-09_N	E420.Cr-L	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) RG_GHUT_WS_LAEMP_GC_2022-09_N	E420.Cr-L	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) RG_TRIP_WS_LAEMP_GC_2022-09_N	E420.Cr-L	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) RG_GHCKD_WS_LAEMP_GC_2022-09_N	E508	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) RG_GHDT_WS_LAEMP_GC_2022-09_N	E508	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) RG_GHUT_WS_LAEMP_GC_2022-09_N	E508	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) RG_TRIP_WS_LAEMP_GC_2022-09_N	E508	15-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	5 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) RG_GHCKD_WS_LAEMP_GC_2022-09_N	E420	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) RG_GHDT_WS_LAEMP_GC_2022-09_N	E420	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) RG_GHUT_WS_LAEMP_GC_2022-09_N	E420	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) RG_TRIP_WS_LAEMP_GC_2022-09_N	E420	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	6 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHT: Exceeded ALS recommended hold time prior to analysis.

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	656371	1	8	12.5	5.0	✓
Alkalinity Species by Titration	E290	656374	1	13	7.6	5.0	✓
Ammonia by Fluorescence	E298	656499	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	656315	1	4	25.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	656316	1	4	25.0	5.0	✓
Conductivity in Water	E100	656373	1	13	7.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	656675	1	7	14.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	656310	1	3	33.3	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	656676	1	7	14.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	656344	1	10	10.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	656519	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	656314	1	4	25.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	656317	1	4	25.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	656318	1	4	25.0	5.0	✓
ORP by Electrode	E125	656358	1	12	8.3	5.0	✓
pH by Meter	E108	656372	1	13	7.6	5.0	✓
Sulfate in Water by IC	E235.SO4	656319	1	4	25.0	5.0	✓
TDS by Gravimetry	E162	656430	1	13	7.6	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	656559	1	9	11.1	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	656243	1	4	25.0	5.0	✓
Total Mercury in Water by CVAAS	E508	656309	1	5	20.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	656560	1	9	11.1	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	656345	1	11	9.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	656497	1	11	9.0	5.0	✓
Turbidity by Nephelometry	E121	656258	1	5	20.0	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	656371	1	8	12.5	5.0	✓
Alkalinity Species by Titration	E290	656374	1	13	7.6	5.0	✓
Ammonia by Fluorescence	E298	656499	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	656315	1	4	25.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	656316	1	4	25.0	5.0	✓
Conductivity in Water	E100	656373	1	13	7.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	656675	1	7	14.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	656310	1	3	33.3	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	656676	1	7	14.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	656344	1	10	10.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	656519	1	20	5.0	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Fluoride in Water by IC	E235.F	656314	1	4	25.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	656317	1	4	25.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	656318	1	4	25.0	5.0	✓
ORP by Electrode	E125	656358	1	12	8.3	5.0	✓
pH by Meter	E108	656372	1	13	7.6	5.0	✓
Sulfate in Water by IC	E235.SO4	656319	1	4	25.0	5.0	✓
TDS by Gravimetry	E162	656430	1	13	7.6	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	656559	1	9	11.1	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	656243	1	4	25.0	5.0	✓
Total Mercury in Water by CVAAS	E508	656309	1	5	20.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	656560	1	9	11.1	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	656345	1	11	9.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	656497	1	11	9.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	656431	1	16	6.2	5.0	✓
Turbidity by Nephelometry	E121	656258	1	5	20.0	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	656371	1	8	12.5	5.0	✓
Alkalinity Species by Titration	E290	656374	1	13	7.6	5.0	✓
Ammonia by Fluorescence	E298	656499	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	656315	1	4	25.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	656316	1	4	25.0	5.0	✓
Conductivity in Water	E100	656373	1	13	7.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	656675	1	7	14.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	656310	1	3	33.3	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	656676	1	7	14.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	656344	1	10	10.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	656519	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	656314	1	4	25.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	656317	1	4	25.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	656318	1	4	25.0	5.0	✓
Sulfate in Water by IC	E235.SO4	656319	1	4	25.0	5.0	✓
TDS by Gravimetry	E162	656430	1	13	7.6	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	656559	1	9	11.1	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	656243	1	4	25.0	5.0	✓
Total Mercury in Water by CVAAS	E508	656309	1	5	20.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	656560	1	9	11.1	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	656345	1	11	9.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	656497	1	11	9.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	656431	1	16	6.2	5.0	✓
Turbidity by Nephelometry	E121	656258	1	5	20.0	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	656499	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	656315	1	4	25.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	656316	1	4	25.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	656675	1	7	14.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	656310	1	3	33.3	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	656676	1	7	14.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	656344	1	10	10.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	656519	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	656314	1	4	25.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	656317	1	4	25.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	656318	1	4	25.0	5.0	✓
Sulfate in Water by IC	E235.SO4	656319	1	4	25.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	656559	1	9	11.1	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	656243	1	4	25.0	5.0	✓
Total Mercury in Water by CVAAS	E508	656309	1	5	20.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	656560	1	9	11.1	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	656345	1	11	9.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	656497	1	11	9.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Calgary - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAAS	E508 Calgary - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

QUALITY CONTROL REPORT

Work Order	: **CG2212819**	Page	: 1 of 18
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 17-Sep-2022 11:38
PO	: VPO00816101	Date Analysis Commenced	: 20-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 22-Sep-2022 17:25
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 4		
No. of samples analysed	: 4		

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Calgary Metals, Calgary, Alberta
Dwayne Bennett	Supervisor - Inorganic	Calgary Inorganics, Calgary, Alberta
Dwayne Bennett	Supervisor - Inorganic	Calgary Metals, Calgary, Alberta
Elke Tabora		Calgary Inorganics, Calgary, Alberta
Mackenzie Lamoureux	Laboratory Analyst	Calgary Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Calgary Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Calgary Inorganics, Calgary, Alberta
Sara Niroomand		Calgary Inorganics, Calgary, Alberta
Summie Lo	Lab Assistant	Calgary Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Calgary Inorganics, Calgary, Alberta

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 656258)											
CG2212812-001	Anonymous	turbidity	----	E121	0.10	NTU	0.89	0.89	0.0006	Diff <2x LOR	----
Physical Tests (QC Lot: 656358)											
CG2212779-001	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	395	401	1.38%	15%	----
Physical Tests (QC Lot: 656371)											
CG2212819-001	RG_GHUT_WS_LAEMP_GC_2022-09_N	acidity (as CaCO3)	----	E283	2.0	mg/L	8.1	6.4	1.7	Diff <2x LOR	----
Physical Tests (QC Lot: 656372)											
CG2212658-001	Anonymous	pH	----	E108	0.10	pH units	8.20	8.24	0.487%	4%	----
Physical Tests (QC Lot: 656373)											
CG2212658-001	Anonymous	conductivity	----	E100	2.0	µS/cm	514	512	0.390%	10%	----
Physical Tests (QC Lot: 656374)											
CG2212658-001	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	144	142	1.39%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	144	142	1.39%	20%	----
Physical Tests (QC Lot: 656430)											
CG2212800-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	440	438	0.569%	20%	----
Anions and Nutrients (QC Lot: 656243)											
CG2212819-001	RG_GHUT_WS_LAEMP_GC_2022-09_N	Kjeldahl nitrogen, total [TKN]	----	E318	0.500	mg/L	0.679	0.732	0.053	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 656314)											
CG2212819-001	RG_GHUT_WS_LAEMP_GC_2022-09_N	fluoride	16984-48-8	E235.F	0.100	mg/L	<0.100	<0.100	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 656315)											
CG2212819-001	RG_GHUT_WS_LAEMP_GC_2022-09_N	bromide	24959-67-9	E235.Br-L	0.250	mg/L	<0.250	<0.250	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 656316)											
CG2212819-001	RG_GHUT_WS_LAEMP_GC_2022-09_N	chloride	16887-00-6	E235.Cl-L	0.50	mg/L	1.62	1.61	0.007	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 656317)											
CG2212819-001	RG_GHUT_WS_LAEMP_GC_2022-09_N	nitrate (as N)	14797-55-8	E235.NO3-L	0.0250	mg/L	8.94	8.95	0.0693%	20%	----
Anions and Nutrients (QC Lot: 656318)											
CG2212819-001	RG_GHUT_WS_LAEMP_GC_2022-09_N	nitrite (as N)	14797-65-0	E235.NO2-L	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Anions and Nutrients (QC Lot: 656319)											
CG2212819-001	RG_GHUT_WS_LAEMP_GC_2022-09_N	sulfate (as SO4)	14808-79-8	E235.SO4	1.50	mg/L	1110	1120	0.287%	20%	----
Anions and Nutrients (QC Lot: 656497)											
CG2212779-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0092	0.0076	0.0017	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 656499)											
CG2212779-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0238	0.0232	0.0006	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 656519)											
CG2212694-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0015	0.0015	0.00001	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 656344)											
CG2212792-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 656345)											
CG2212792-001	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Total Metals (QC Lot: 656309)											
CG2212616-001	Anonymous	mercury, total	7439-97-6	E508	0.0000050	mg/L	0.0000075	0.0000055	0.0000020	Diff <2x LOR	----
Total Metals (QC Lot: 656559)											
CG2212819-001	RG_GHUT_WS_LAEMP_GC_2022-09_N	chromium, total	7440-47-3	E420.Cr-L	0.00020	mg/L	0.00047	0.00046	0.000006	Diff <2x LOR	----
Total Metals (QC Lot: 656560)											
CG2212819-001	RG_GHUT_WS_LAEMP_GC_2022-09_N	aluminum, total	7429-90-5	E420	0.0060	mg/L	0.237	0.250	5.10%	20%	----
		antimony, total	7440-36-0	E420	0.00020	mg/L	0.00078	0.00075	0.00003	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00020	mg/L	0.00036	0.00041	0.00004	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00020	mg/L	0.0431	0.0439	1.77%	20%	----
		beryllium, total	7440-41-7	E420	0.000040	mg/L	<0.040 µg/L	<0.000040	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000100	mg/L	0.786 µg/L	0.000759	3.47%	20%	----
		calcium, total	7440-70-2	E420	0.100	mg/L	303	315	3.75%	20%	----
		cobalt, total	7440-48-4	E420	0.00020	mg/L	0.52 µg/L	0.00054	0.00001	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00100	mg/L	0.00200	0.00202	0.00002	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.020	mg/L	0.279	0.296	5.89%	20%	----
		lead, total	7439-92-1	E420	0.000100	mg/L	0.000604	0.000638	0.000034	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0020	mg/L	0.0207	0.0208	0.298%	20%	----
		magnesium, total	7439-95-4	E420	0.0100	mg/L	230	225	1.91%	20%	----
		manganese, total	7439-96-5	E420	0.00020	mg/L	0.0219	0.0216	1.35%	20%	----
		molybdenum, total	7439-98-7	E420	0.000100	mg/L	0.00186	0.00192	3.13%	20%	----
		nickel, total	7440-02-0	E420	0.00100	mg/L	0.0348	0.0348	0.160%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Total Metals (QC Lot: 656560) - continued											
CG2212819-001	RG_GHUT_WS_LAEMP_GC_2022-09_N	potassium, total	7440-09-7	E420	0.100	mg/L	3.28	3.29	0.156%	20%	----
		selenium, total	7782-49-2	E420	0.000100	mg/L	258 µg/L	0.262	1.58%	20%	----
		silicon, total	7440-21-3	E420	0.20	mg/L	3.74	3.82	2.29%	20%	----
		silver, total	7440-22-4	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.100	mg/L	1.92	1.90	0.826%	20%	----
		strontium, total	7440-24-6	E420	0.00040	mg/L	0.171	0.182	6.56%	20%	----
		sulfur, total	7704-34-9	E420	1.00	mg/L	434	431	0.662%	20%	----
		thallium, total	7440-28-0	E420	0.000020	mg/L	0.000044	0.000044	0.0000004	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00060	mg/L	0.00670	0.00612	9.12%	20%	----
		uranium, total	7440-61-1	E420	0.000020	mg/L	0.0142	0.0141	0.484%	20%	----
		vanadium, total	7440-62-2	E420	0.00100	mg/L	0.00124	0.00117	0.00007	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0060	mg/L	0.0450	0.0450	0.00002	Diff <2x LOR	----
Dissolved Metals (QC Lot: 656310)											
CG2212819-001	RG_GHUT_WS_LAEMP_GC_2022-09_N	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 656675)											
CG2212518-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 656676)											
CG2212518-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0020	mg/L	0.0023	0.0021	0.0002	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00020	mg/L	0.00143	0.00146	0.00003	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00020	mg/L	0.0107	0.0111	3.45%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000040	mg/L	<0.040 µg/L	<0.000040	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000100	mg/L	0.0205 µg/L	0.0000179	0.0000026	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.100	mg/L	349	357	2.30%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.00020	mg/L	9.65 µg/L	0.00976	1.13%	20%	----
		copper, dissolved	7440-50-8	E421	0.00040	mg/L	<0.00040	<0.00040	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0020	mg/L	0.153	0.148	3.29%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0100	mg/L	322	321	0.218%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00020	mg/L	0.473	0.474	0.353%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Dissolved Metals (QC Lot: 656676) - continued											
CG2212518-001	Anonymous	molybdenum, dissolved	7439-98-7	E421	0.000100	mg/L	0.0130	0.0131	0.616%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00100	mg/L	0.0915	0.0929	1.50%	20%	----
		potassium, dissolved	7440-09-7	E421	0.100	mg/L	6.18	6.23	0.705%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000100	mg/L	249 µg/L	0.262	4.95%	20%	----
		silicon, dissolved	7440-21-3	E421	0.100	mg/L	1.25	1.26	1.24%	20%	----
		silver, dissolved	7440-22-4	E421	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.100	mg/L	1.56	1.56	0.0937%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00040	mg/L	0.166	0.169	2.15%	20%	----
		sulfur, dissolved	7704-34-9	E421	1.00	mg/L	601	609	1.37%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000020	mg/L	0.000034	0.000037	0.000003	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00060	mg/L	<0.00060	<0.00060	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000020	mg/L	0.0127	0.0127	0.137%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0020	mg/L	<0.0020	<0.0020	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 656258)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 656371)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 656373)						
conductivity	----	E100	1	μS/cm	1.4	----
Physical Tests (QCLot: 656374)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 656430)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 656431)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Anions and Nutrients (QCLot: 656243)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 656314)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 656315)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 656316)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 656317)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 656318)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 656319)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 656497)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 656499)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 656519)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 656519) - continued						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Organic / Inorganic Carbon (QCLot: 656344)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 656345)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 656309)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Total Metals (QCLot: 656559)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 656560)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 656560) - continued						
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Dissolved Metals (QCLot: 656310)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 656675)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 656676)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 656676) - continued						
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 656258)									
turbidity	----	E121	0.1	NTU	200 NTU	104	85.0	115	----
Physical Tests (QCLot: 656358)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	99.4	95.4	104	----
Physical Tests (QCLot: 656371)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	106	85.0	115	----
Physical Tests (QCLot: 656372)									
pH	----	E108	----	pH units	7 pH units	101	98.6	101	----
Physical Tests (QCLot: 656373)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	98.8	90.0	110	----
Physical Tests (QCLot: 656374)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	103	85.0	115	----
Physical Tests (QCLot: 656430)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	95.5	85.0	115	----
Physical Tests (QCLot: 656431)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	93.3	85.0	115	----
Anions and Nutrients (QCLot: 656243)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	103	75.0	125	----
Anions and Nutrients (QCLot: 656314)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 656315)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	97.2	85.0	115	----
Anions and Nutrients (QCLot: 656316)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	99.2	90.0	110	----
Anions and Nutrients (QCLot: 656317)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	99.8	90.0	110	----
Anions and Nutrients (QCLot: 656318)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 656319)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 656497)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.03 mg/L	102	80.0	120	----
Anions and Nutrients (QCLot: 656499)									

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Anions and Nutrients (QCLot: 656499) - continued									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	104	85.0	115	----
Anions and Nutrients (QCLot: 656519)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	102	80.0	120	----
Organic / Inorganic Carbon (QCLot: 656344)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	100	80.0	120	----
Organic / Inorganic Carbon (QCLot: 656345)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	101	80.0	120	----
Total Metals (QCLot: 656309)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	113	80.0	120	----
Total Metals (QCLot: 656559)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	97.5	80.0	120	----
Total Metals (QCLot: 656560)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	104	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	100	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	97.2	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	94.4	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	95.8	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	95.0	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	99.5	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	94.6	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	93.3	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	97.5	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	96.3	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	95.2	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	94.3	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	88.8	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	108	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	99.6	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	97.6	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	95.2	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	104	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	91.6	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	102	60.0	140	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	93.4	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	103	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Total Metals (QCLot: 656560) - continued									
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	90.4	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	109	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	92.6	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	98.4	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	92.2	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	92.0	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	101	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	96.7	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	93.8	80.0	120	----
Dissolved Metals (QCLot: 656675)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
Dissolved Metals (QCLot: 656676)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	108	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	100	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	100	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	98.6	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	100	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	93.3	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	101	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	97.8	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	99.4	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	98.5	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	108	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	101	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	108	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	102	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	102	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	102	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	104	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	98.2	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	102	60.0	140	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	90.5	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	105	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	104	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 656676) - continued									
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	86.8	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	98.9	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	103	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	104	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	94.8	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	106	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	95.0	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 656243)										
CG2212819-002	RG_GHCKD_WS_LAEMP_GC_2022-09_N	Kjeldahl nitrogen, total [TKN]	----	E318	2.60 mg/L	2.5 mg/L	104	70.0	130	----
Anions and Nutrients (QCLot: 656314)										
CG2212819-004	RG_TRIP_WS_LAEMP_GC_2022-09_N	fluoride	16984-48-8	E235.F	1.11 mg/L	1 mg/L	111	75.0	125	----
Anions and Nutrients (QCLot: 656315)										
CG2212819-004	RG_TRIP_WS_LAEMP_GC_2022-09_N	bromide	24959-67-9	E235.Br-L	0.495 mg/L	0.5 mg/L	99.0	75.0	125	----
Anions and Nutrients (QCLot: 656316)										
CG2212819-004	RG_TRIP_WS_LAEMP_GC_2022-09_N	chloride	16887-00-6	E235.Cl-L	111 mg/L	100 mg/L	111	75.0	125	----
Anions and Nutrients (QCLot: 656317)										
CG2212819-004	RG_TRIP_WS_LAEMP_GC_2022-09_N	nitrate (as N)	14797-55-8	E235.NO3-L	2.77 mg/L	2.5 mg/L	111	75.0	125	----
Anions and Nutrients (QCLot: 656318)										
CG2212819-004	RG_TRIP_WS_LAEMP_GC_2022-09_N	nitrite (as N)	14797-65-0	E235.NO2-L	0.566 mg/L	0.5 mg/L	113	75.0	125	----
Anions and Nutrients (QCLot: 656319)										
CG2212819-004	RG_TRIP_WS_LAEMP_GC_2022-09_N	sulfate (as SO4)	14808-79-8	E235.SO4	106 mg/L	100 mg/L	106	75.0	125	----
Anions and Nutrients (QCLot: 656497)										
CG2212818-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0448 mg/L	0.05 mg/L	89.6	70.0	130	----
Anions and Nutrients (QCLot: 656499)										
CG2212792-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.112 mg/L	0.1 mg/L	112	75.0	125	----
Anions and Nutrients (QCLot: 656519)										
CG2212694-002	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0525 mg/L	0.05 mg/L	105	70.0	130	----
Organic / Inorganic Carbon (QCLot: 656344)										
CG2212792-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	4.78 mg/L	5 mg/L	95.6	70.0	130	----
Organic / Inorganic Carbon (QCLot: 656345)										
CG2212792-001	Anonymous	carbon, total organic [TOC]	----	E355-L	5.20 mg/L	5 mg/L	104	70.0	130	----
Total Metals (QCLot: 656309)										
CG2212819-001	RG_GHUT_WS_LAEMP_GC_2022-09_N	mercury, total	7439-97-6	E508	0.0000956 mg/L	0.0001 mg/L	95.6	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 656559)										
CG2212819-002	RG_GHCKD_WS_LAEMP_GC_2022-09_N	chromium, total	7440-47-3	E420.Cr-L	0.420 mg/L	0.4 mg/L	105	70.0	130	----
Total Metals (QCLot: 656560)										
CG2212819-002	RG_GHCKD_WS_LAEMP_GC_2022-09_N	aluminum, total	7429-90-5	E420	2.12 mg/L	2 mg/L	106	70.0	130	----
		antimony, total	7440-36-0	E420	0.230 mg/L	0.2 mg/L	115	70.0	130	----
		arsenic, total	7440-38-2	E420	0.209 mg/L	0.2 mg/L	104	70.0	130	----
		barium, total	7440-39-3	E420	0.200 mg/L	0.2 mg/L	99.8	70.0	130	----
		beryllium, total	7440-41-7	E420	0.410 mg/L	0.4 mg/L	103	70.0	130	----
		bismuth, total	7440-69-9	E420	0.116 mg/L	0.1 mg/L	116	70.0	130	----
		boron, total	7440-42-8	E420	1.10 mg/L	1 mg/L	110	70.0	130	----
		cadmium, total	7440-43-9	E420	0.0421 mg/L	0.04 mg/L	105	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	0.213 mg/L	0.2 mg/L	106	70.0	130	----
		copper, total	7440-50-8	E420	0.211 mg/L	0.2 mg/L	105	70.0	130	----
		iron, total	7439-89-6	E420	21.2 mg/L	20 mg/L	106	70.0	130	----
		lead, total	7439-92-1	E420	0.243 mg/L	0.2 mg/L	121	70.0	130	----
		lithium, total	7439-93-2	E420	1.02 mg/L	1 mg/L	102	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.222 mg/L	0.2 mg/L	111	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.211 mg/L	0.2 mg/L	106	70.0	130	----
		nickel, total	7440-02-0	E420	0.418 mg/L	0.4 mg/L	104	70.0	130	----
		potassium, total	7440-09-7	E420	43.9 mg/L	40 mg/L	110	70.0	130	----
		selenium, total	7782-49-2	E420	0.425 mg/L	0.4 mg/L	106	70.0	130	----
		silicon, total	7440-21-3	E420	118 mg/L	100 mg/L	118	70.0	130	----
		silver, total	7440-22-4	E420	0.0433 mg/L	0.04 mg/L	108	70.0	130	----
		sodium, total	7440-23-5	E420	21.0 mg/L	20 mg/L	105	70.0	130	----
		strontium, total	7440-24-6	E420	0.235 mg/L	0.2 mg/L	118	70.0	130	----
		sulfur, total	7704-34-9	E420	ND mg/L	200 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.0408 mg/L	0.04 mg/L	102	70.0	130	----
		tin, total	7440-31-5	E420	0.211 mg/L	0.2 mg/L	106	70.0	130	----
		titanium, total	7440-32-6	E420	0.441 mg/L	0.4 mg/L	110	70.0	130	----
		uranium, total	7440-61-1	E420	0.0400 mg/L	0.04 mg/L	100	70.0	130	----
		vanadium, total	7440-62-2	E420	1.06 mg/L	1 mg/L	106	70.0	130	----
		zinc, total	7440-66-6	E420	4.10 mg/L	4 mg/L	103	70.0	130	----
Dissolved Metals (QCLot: 656310)										
CG2212819-002	RG_GHCKD_WS_LAEMP_GC_2022-09_N	mercury, dissolved	7439-97-6	E509	0.000109 mg/L	0.0001 mg/L	109	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 656675)										
CG2212818-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.393 mg/L	0.4 mg/L	98.3	70.0	130	----
Dissolved Metals (QCLot: 656676)										
CG2212818-001	Anonymous	aluminum, dissolved	7429-90-5	E421	1.89 mg/L	2 mg/L	94.6	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.195 mg/L	0.2 mg/L	97.5	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.196 mg/L	0.2 mg/L	97.9	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.198 mg/L	0.2 mg/L	99.1	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.352 mg/L	0.4 mg/L	88.0	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0934 mg/L	0.1 mg/L	93.4	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.903 mg/L	1 mg/L	90.3	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0393 mg/L	0.04 mg/L	98.2	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.198 mg/L	0.2 mg/L	98.9	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.194 mg/L	0.2 mg/L	97.0	70.0	130	----
		iron, dissolved	7439-89-6	E421	20.0 mg/L	20 mg/L	100	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.199 mg/L	0.2 mg/L	99.4	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.934 mg/L	1 mg/L	93.4	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.204 mg/L	0.2 mg/L	102	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.203 mg/L	0.2 mg/L	101	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.404 mg/L	0.4 mg/L	101	70.0	130	----
		potassium, dissolved	7440-09-7	E421	38.6 mg/L	40 mg/L	96.6	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.416 mg/L	0.4 mg/L	104	70.0	130	----
		silicon, dissolved	7440-21-3	E421	90.9 mg/L	100 mg/L	90.9	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0390 mg/L	0.04 mg/L	97.4	70.0	130	----
		sodium, dissolved	7440-23-5	E421	19.7 mg/L	20 mg/L	98.7	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.2 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	ND mg/L	200 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.0363 mg/L	0.04 mg/L	90.8	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.193 mg/L	0.2 mg/L	96.5	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.410 mg/L	0.4 mg/L	102	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.0376 mg/L	0.04 mg/L	93.9	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	1.01 mg/L	1 mg/L	101	70.0	130	----
		zinc, dissolved	7440-66-6	E421	3.76 mg/L	4 mg/L	94.1	70.0	130	----

COC ID:	REP_LAEMP_GC_2022-09_ALS	TURNAROUND TIME: 2-3 Business Days	RUSH: Priorty

PROJECT/CLIENT INFO

Facility Name / Job#	Regional Effects Program		
Project Manager	Giovanna Diaz		
Email	Giovanna.Diaz@Teck.com		
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Postal Code	V0B 2G0	Country	Canada
Phone Number	1-250-865-3048		

LABORATORY

Lab Name	ALS Calgary		
Lab Contact	Lyudmyla Shvets		
Email	Lyudmyla.Shvets@ALSGlobal.com		
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OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
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Email 3:	Teck.Lab.Results@teck.com	X	X	X
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Email 5:	Awiebe@minnow.ca	X	X	X
Email 6:	Giovanna.Diaz@Teck.com	X	X	X
PO number	VPO00816101			

Environmental Division
Calgary
Work Order Reference
CG2212819

Telephone : +1 403 407 1800

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	DOC	Mercury_Dissolved	Mercury_Total	TECKCOAL_METNHG_D	TECKCOAL_METNHG_T	TECKCOAL_ROUTINE	TOC_TKN_PT
Filt.								F	F	N	F	N	N	N
PRESERV.								H2SO4	HCL	HCL				H2SO4
RG_GHUT_WS_LAEMP_GC_2022-09_N	RG_GHUT	WS		2022/09/15	8:05	G	7	1	1	1	1	1	1	1
RG_GHCKD_WS_LAEMP_GC_2022-09_N	RG_GHCKD	WS		2022/09/15	13:40	G	7	1	1	1	1	1	1	1
RG_GHDT_WS_LAEMP_GC_2022-09_N	RG_GHDT	WS		2022/09/16	8:55	G	7	1	1	1	1	1	1	1
RG_TRIP_WS_LAEMP_GC_2022-09_N	RG_TRIP	WS		2022/09/16	8:55	G	4			1		1	1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Dissolved metals were field filtered and to be lab preserved Total metals to be lab preserved	Jennifer Ings/Minnow	##############	Seema	09-17 1138am 3C

SERVICE REQUEST (rush - subject to availability)					
Regular (default)		Sampler's Name	Jennifer Ings	5195003444	
Priority (2-3 business days) - 50% surcharge	X				
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature	Jennifer Ings	Date/Time	September 16, 2022
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **CG2213024**	Page	: 1 of 7
Amendment	: **2**		
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 22-Sep-2022 08:58
PO	: VPO00816101	Date Analysis Commenced	: 22-Sep-2022
C-O-C number	: GHO_RAEMP_2022-09_ALS	Issue Date	: 12-Oct-2022 16:00
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Metals, Calgary, Alberta
Elke Tabora		Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Metals, Calgary, Alberta
Kevin Baxter		Metals, Calgary, Alberta
Mackenzie Lamoureux	Laboratory Analyst	Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Sara Niroomand		Metals, Calgary, Alberta
Sheida Aria	Lab Assistant	Metals, Calgary, Alberta
Shirley Li		Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Inorganics, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
DTSE	*Dissolved Se concentration exceeds total. Positive bias on D-Se suspected due to signal enhancement from volatile selenium species. Contact ALS if an alternative test to address this interference is needed.*
HTA	*Analytical holding time was exceeded.*

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHP_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	19-Sep-2022 09:15	----	----	----	----
					CG2213024-001	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	----	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	243	----	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	296	----	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	10.2	----	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	6.1	----	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	253	----	----	----	----
conductivity	----	E100	2.0	µS/cm	1580	----	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	1190	----	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	363	----	----	----	----
pH	----	E108	0.10	pH units	8.32	----	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	1320	----	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	3.4	----	----	----	----
turbidity	----	E121	0.10	NTU	1.22	----	----	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0088	----	----	----	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.250 DLDS	----	----	----	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	1.51	----	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.146	----	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	<0.500 DLM	----	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	4.65	----	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0110	----	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0018 HTA	----	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0063	----	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	846	----	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.44	----	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.47	----	----	----	----

Analytical Results

Sub-Matrix: Water

(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	RG_GHP_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	19-Sep-2022 09:15	----	----	----	----
					CG2213024-001	--------	--------	--------	--------
					Result	----	----	----	----
Metals									
selenium, dissolved	7782-49-2	E423ASe	0.050	µg/L	159	----	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	23.0	----	----	----	----
cation sum	----	EC101	0.10	meq/L	24.0	----	----	----	----
ion balance (cations/anions)	----	EC101	0.010	%	104	----	----	----	----
ion balance (APHA)	----	EC101	0.010	%	2.13	----	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0136	----	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00048	----	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00029	----	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0460	----	----	----	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	----	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	----	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L	0.012	----	----	----	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.0120	----	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	166	----	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00011	----	----	----	----
cobalt, total	7440-48-4	E420	0.10	µg/L	<0.10	----	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	0.00051	----	----	----	----
iron, total	7439-89-6	E420	0.010	mg/L	0.010	----	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	----	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0199	----	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	168	----	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.00331	----	----	----	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00165	----	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00900	----	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	2.56	----	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	156 DTSE	----	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	3.57	----	----	----	----

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	RG_GHP_WS_LAEMP_GC_2022-09_N	----	----	----	----
				Client sampling date / time	19-Sep-2022 09:15	----	----	----	----
					CG2213024-001	--------	--------	--------	--------
					Result	----	----	----	----
Total Metals									
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	----	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L	2.74	----	----	----	----
strontium, total	7440-24-6	E420	0.00020	mg/L	0.202	----	----	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	265	----	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	----	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	----	----	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	0.00047	----	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.00835	----	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	----	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	----	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	----	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00052	----	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00025	----	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0477	----	----	----	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.020	----	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	----	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	0.011	----	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	0.0109	----	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	178	----	----	----	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	----	----	----	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.10	----	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00038	----	----	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	----	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	----	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0194	----	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	181	----	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00106	----	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00162	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit					
				Client sample ID	**RG_GHP_WS_LAEMP_GC_2022-09_N**	----	----	----	----
				Client sampling date / time	19-Sep-2022 09:15	----	----	----	----
					CG2213024-001	--------	--------	--------	--------
					Result	----	----	----	----
Dissolved Metals									
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00977	----	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	2.70	----	----	----	----
selenium, dissolved	7782-49-2	E421	0.050	µg/L	215 DTSE	----	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	4.41	----	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	----	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	2.72	----	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.197	----	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	257	----	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.000010	----	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	----	----	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	----	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00840	----	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	----	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	----	----	----	----
dissolved mercury filtration location	----	EP509	-	-	Field	----	----	----	----
dissolved metals filtration location	----	EP423	-	-	Field	----	----	----	----
dissolved metals filtration location	----	EP421	-	-	Field	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2213024**	Page	: 1 of 13
Amendment	: 2		
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 22-Sep-2022 08:58
PO	: VPO00816101	Issue Date	: 12-Oct-2022 16:00
C-O-C number	: GHO_RAEMP_2022-09_ALS		
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: ✘ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_GHP_WS_LAEMP_GC_2022-09_N	E298	19-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E235.Br-L	19-Sep-2022	22-Sep-2022	----	----		22-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E235.Cl-L	19-Sep-2022	22-Sep-2022	----	----		22-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E378-U	19-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	4 days	✘ EHTL
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E235.F	19-Sep-2022	22-Sep-2022	----	----		22-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E235.NO3-L	19-Sep-2022	22-Sep-2022	3 days	4 days	✘ EHTL	22-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E235.NO2-L	19-Sep-2022	22-Sep-2022	----	----		22-Sep-2022	3 days	4 days	✘ EHTL

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E235.SO4	19-Sep-2022	22-Sep-2022	----	----		22-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_GHP_WS_LAEMP_GC_2022-09_N	E318	19-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) RG_GHP_WS_LAEMP_GC_2022-09_N	E372-U	19-Sep-2022	23-Sep-2022	----	----		24-Sep-2022	28 days	5 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) RG_GHP_WS_LAEMP_GC_2022-09_N	E421.Cr-L	19-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GHP_WS_LAEMP_GC_2022-09_N	E509	19-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) RG_GHP_WS_LAEMP_GC_2022-09_N	E421	19-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	5 days	✓
Metals : Digested Dissolved Selenium in Water by CRC ICPMS										
Amber glass vial dissolved (nitric acid) RG_GHP_WS_LAEMP_GC_2022-09_N	E423ASe	19-Sep-2022	12-Oct-2022	----	----		12-Oct-2022	180 days	23 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GHP_WS_LAEMP_GC_2022-09_N	E358-L	19-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	28 days	4 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GHP_WS_LAEMP_GC_2022-09_N	E355-L	19-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	28 days	4 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Physical Tests : Acidity by Titration										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E283	19-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	14 days	4 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E290	19-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	14 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E100	19-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	4 days	✓
Physical Tests : ORP by Electrode										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E125	19-Sep-2022	----	----	----		24-Sep-2022	0.25 hrs	121 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E108	19-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E162	19-Sep-2022	----	----	----		24-Sep-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE [TSS-WB] RG_GHP_WS_LAEMP_GC_2022-09_N	E160-L	19-Sep-2022	----	----	----		24-Sep-2022	7 days	5 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE RG_GHP_WS_LAEMP_GC_2022-09_N	E121	19-Sep-2022	----	----	----		22-Sep-2022	3 days	4 days	× EHTL
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) RG_GHP_WS_LAEMP_GC_2022-09_N	E420.Cr-L	19-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	5 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) RG_GHP_WS_LAEMP_GC_2022-09_N	E508	19-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	5 days	✓
Total Metals : Total metals in Water by CRC ICPMS										
HDPE total (nitric acid) RG_GHP_WS_LAEMP_GC_2022-09_N	E420	19-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	5 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	662100	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	662108	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	662439	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	661254	1	15	6.6	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	661255	1	15	6.6	5.0	✓
Conductivity in Water	E100	662106	1	20	5.0	5.0	✓
Digested Dissolved Selenium in Water by CRC ICPMS	E423ASe	691197	1	1	100.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	661916	1	9	11.1	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	662251	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	661917	1	9	11.1	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	661300	1	8	12.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	662043	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	661253	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	661252	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	661251	1	19	5.2	5.0	✓
ORP by Electrode	E125	662920	1	14	7.1	5.0	✓
pH by Meter	E108	662107	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	661256	1	15	6.6	5.0	✓
TDS by Gravimetry	E162	664427	1	13	7.6	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	662944	1	15	6.6	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	662438	1	19	5.2	5.0	✓
Total Mercury in Water by CVAAS	E508	662245	1	14	7.1	5.0	✓
Total metals in Water by CRC ICPMS	E420	662945	1	15	6.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	661301	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	661974	1	14	7.1	5.0	✓
Turbidity by Nephelometry	E121	661264	1	4	25.0	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	662100	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	662108	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	662439	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	661254	1	15	6.6	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	661255	1	15	6.6	5.0	✓
Conductivity in Water	E100	662106	1	20	5.0	5.0	✓
Digested Dissolved Selenium in Water by CRC ICPMS	E423ASe	691197	1	1	100.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	661916	1	9	11.1	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	662251	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	661917	1	9	11.1	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	661300	1	8	12.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	662043	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	661253	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	661252	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	661251	1	19	5.2	5.0	✓
ORP by Electrode	E125	662920	1	14	7.1	5.0	✓
pH by Meter	E108	662107	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	661256	1	15	6.6	5.0	✓
TDS by Gravimetry	E162	664427	1	13	7.6	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	662944	1	15	6.6	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	662438	1	19	5.2	5.0	✓
Total Mercury in Water by CVAAS	E508	662245	1	14	7.1	5.0	✓
Total metals in Water by CRC ICPMS	E420	662945	1	15	6.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	661301	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	661974	1	14	7.1	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	664426	1	17	5.8	5.0	✓
Turbidity by Nephelometry	E121	661264	1	4	25.0	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	662100	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	662108	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	662439	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	661254	1	15	6.6	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	661255	1	15	6.6	5.0	✓
Conductivity in Water	E100	662106	1	20	5.0	5.0	✓
Digested Dissolved Selenium in Water by CRC ICPMS	E423ASe	691197	1	1	100.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	661916	1	9	11.1	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	662251	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	661917	1	9	11.1	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	661300	1	8	12.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	662043	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	661253	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	661252	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	661251	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	661256	1	15	6.6	5.0	✓
TDS by Gravimetry	E162	664427	1	13	7.6	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	662944	1	15	6.6	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	662438	1	19	5.2	5.0	✓
Total Mercury in Water by CVAAS	E508	662245	1	14	7.1	5.0	✓
Total metals in Water by CRC ICPMS	E420	662945	1	15	6.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	661301	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	661974	1	14	7.1	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
TSS by Gravimetry (Low Level)	E160-L	664426	1	17	5.8	5.0	✓
Turbidity by Nephelometry	E121	661264	1	4	25.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	662439	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	661254	1	15	6.6	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	661255	1	15	6.6	5.0	✓
Digested Dissolved Selenium in Water by CRC ICPMS	E423ASe	691197	1	1	100.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	661916	1	9	11.1	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	662251	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	661917	1	9	11.1	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	661300	1	8	12.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	662043	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	661253	1	15	6.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	661252	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	661251	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	661256	1	15	6.6	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	662944	1	15	6.6	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	662438	1	19	5.2	5.0	✓
Total Mercury in Water by CVAAS	E508	662245	1	14	7.1	5.0	✓
Total metals in Water by CRC ICPMS	E420	662945	1	15	6.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	661301	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	661974	1	14	7.1	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total metals in Water by CRC ICPMS	E420 Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Calgary - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Digested Dissolved Selenium in Water by CRC ICPMS	E423ASe Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45um), digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Total Mercury in Water by CVAAS	E508 Calgary - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as $CaCO_3$), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO_3.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Metals Water Digestion and Filtration	EP423 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um) and digested with nitric and hydrochloric acids.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

QUALITY CONTROL REPORT

Work Order	: **CG2213024**		
Amendment	: **2**		
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 22-Sep-2022 08:58
PO	: VPO00816101	Date Analysis Commenced	: 22-Sep-2022
C-O-C number	: GHO_RAEMP_2022-09_ALS	Issue Date	: 12-Oct-2022 16:00
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Calgary Metals, Calgary, Alberta
Elke Tabora		Calgary Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Metals, Calgary, Alberta
Kevin Baxter		Calgary Metals, Calgary, Alberta
Mackenzie Lamoureux	Laboratory Analyst	Calgary Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Calgary Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Calgary Inorganics, Calgary, Alberta
Sara Niroomand		Calgary Inorganics, Calgary, Alberta
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Sheida Aria	Lab Assistant	Calgary Metals, Calgary, Alberta
Shirley Li		Calgary Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Calgary Inorganics, Calgary, Alberta

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Physical Tests (QC Lot: 661264)											
CG2213024-001	RG_GHP_WS_LAEMP_GC_2022-09_N	turbidity	----	E121	0.10	NTU	1.22	1.31	0.08	Diff <2x LOR	----
Physical Tests (QC Lot: 662100)											
CG2212785-004	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 662106)											
CG2212785-004	Anonymous	conductivity	----	E100	2.0	µS/cm	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 662107)											
CG2212785-004	Anonymous	pH	----	E108	0.10	pH units	5.15	5.11	0.780%	4%	----
Physical Tests (QC Lot: 662108)											
CG2212785-004	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 662920)											
CG2212931-001	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	336	337	0.297%	15%	----
Physical Tests (QC Lot: 664427)											
CG2213024-001	RG_GHP_WS_LAEMP_GC_2022-09_N	solids, total dissolved [TDS]	----	E162	20	mg/L	1320	1320	0.416%	20%	----
Anions and Nutrients (QC Lot: 661251)											
CG2213023-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0050	mg/L	0.0082	0.0081	0.0001	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 661252)											
CG2213023-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0250	mg/L	46.9	47.4	0.920%	20%	----
Anions and Nutrients (QC Lot: 661253)											
CG2213023-001	Anonymous	fluoride	16984-48-8	E235.F	0.100	mg/L	0.139	0.143	0.004	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 661254)											
CG2213023-001	Anonymous	bromide	24959-67-9	E235.Br-L	0.250	mg/L	<0.250	<0.250	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 661255)											
CG2213023-001	Anonymous	chloride	16887-00-6	E235.Cl-L	0.50	mg/L	13.5	13.0	3.42%	20%	----
Anions and Nutrients (QC Lot: 661256)											
CG2213023-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	1.50	mg/L	1860	1880	0.911%	20%	----
Anions and Nutrients (QC Lot: 661974)											
CG2212931-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0051	0.0047	0.0004	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Anions and Nutrients (QC Lot: 662043)											
CG2213003-025	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 662438)											
CG2213021-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.500	mg/L	3.54	3.58	0.039	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 662439)											
CG2213021-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.456	0.435	4.67%	20%	----
Organic / Inorganic Carbon (QC Lot: 661300)											
CG2213024-001	RG_GHP_WS_LAEMP_GC_2022-09_N	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.44	1.54	0.09	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 661301)											
CG2213024-001	RG_GHP_WS_LAEMP_GC_2022-09_N	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.47	1.49	0.02	Diff <2x LOR	----
Metals (QC Lot: 691197)											
CG2213024-001	RG_GHP_WS_LAEMP_GC_2022-09_N	selenium, dissolved	7782-49-2	E423ASe	0.000050	mg/L	159 µg/L	0.161	1.25%	20%	----
Total Metals (QC Lot: 662245)											
CG2212931-001	Anonymous	mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Total Metals (QC Lot: 662944)											
CG2212812-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00025	0.00023	0.00002	Diff <2x LOR	----
Total Metals (QC Lot: 662945)											
CG2212812-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0182	0.0179	0.0002	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00015	0.00016	0.00002	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0476	0.0477	0.283%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0121 µg/L	0.0000122	0.00000007	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	43.1	43.1	0.131%	20%	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	0.016	0.017	0.00008	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	0.0020	0.0021	0.00010	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	11.2	11.0	1.08%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00340	0.00344	1.23%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00106	0.00108	1.31%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Total Metals (QC Lot: 662945) - continued											
CG2212812-001	Anonymous	potassium, total	7440-09-7	E420	0.050	mg/L	0.384	0.386	0.002	Diff <2x LOR	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	0.730 µg/L	0.000737	0.973%	20%	----
		silicon, total	7440-21-3	E420	0.10	mg/L	1.77	1.77	0.161%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	0.668	0.672	0.627%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.209	0.214	2.15%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	6.52	6.41	1.77%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.000685	0.000700	2.11%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 661916)											
CG2213024-001	RG_GHP_WS_LAEMP_GC_2022-09_N	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 661917)											
CG2213024-001	RG_GHP_WS_LAEMP_GC_2022-09_N	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00052	0.00050	0.00002	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00025	0.00024	0.00001	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0477	0.0454	4.94%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.011	0.011	0.00006	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0109 µg/L	0.0000089	0.0000020	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	178	177	0.566%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00038	0.00034	0.00004	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0194	0.0189	2.31%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	181	173	4.43%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00106	0.00104	1.68%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00162	0.00160	0.977%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00977	0.00931	4.82%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Dissolved Metals (QC Lot: 661917) - continued											
CG2213024-001	RG_GHP_WS_LAEMP_GC_2022-09_N	potassium, dissolved	7440-09-7	E421	0.050	mg/L	2.70	2.63	2.70%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	215 µg/L	0.208	3.17%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	4.41	4.19	5.16%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	2.72	2.61	4.00%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.197	0.199	0.834%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	257	247	3.91%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.000010	0.000010	0.00000003	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00840	0.00842	0.284%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 662251)											
CG2212715-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 661264)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 662100)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 662106)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 662108)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 664426)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 664427)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 661251)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 661252)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 661253)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 661254)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 661255)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 661256)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 661974)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 662043)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 662438)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 662439)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 662439) - continued						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Organic / Inorganic Carbon (QCLot: 661300)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 661301)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Metals (QCLot: 691197)						
selenium, dissolved	7782-49-2	E423ASe	0.00005	mg/L	<0.000050	----
Total Metals (QCLot: 662245)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Total Metals (QCLot: 662944)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 662945)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 662945) - continued						
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Dissolved Metals (QCLot: 661916)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 661917)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 661917) - continued						
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Dissolved Metals (QCLot: 662251)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 661264)									
turbidity	----	E121	0.1	NTU	200 NTU	106	85.0	115	----
Physical Tests (QCLot: 662100)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	106	85.0	115	----
Physical Tests (QCLot: 662106)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	95.9	90.0	110	----
Physical Tests (QCLot: 662107)									
pH	----	E108	----	pH units	7 pH units	101	98.6	101	----
Physical Tests (QCLot: 662108)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	105	85.0	115	----
Physical Tests (QCLot: 662920)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	102	95.4	104	----
Physical Tests (QCLot: 664426)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	102	85.0	115	----
Physical Tests (QCLot: 664427)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	93.0	85.0	115	----
Anions and Nutrients (QCLot: 661251)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	95.9	90.0	110	----
Anions and Nutrients (QCLot: 661252)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 661253)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 661254)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	100	85.0	115	----
Anions and Nutrients (QCLot: 661255)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	99.9	90.0	110	----
Anions and Nutrients (QCLot: 661256)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 661974)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.03 mg/L	91.3	80.0	120	----
Anions and Nutrients (QCLot: 662043)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	91.9	80.0	120	----
Anions and Nutrients (QCLot: 662438)									

Sub-Matrix: **Water**

Laboratory Control Sample (LCS) Report

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Anions and Nutrients (QCLot: 662438) - continued									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	104	75.0	125	----
Anions and Nutrients (QCLot: 662439)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	96.0	85.0	115	----
Organic / Inorganic Carbon (QCLot: 661300)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	99.9	80.0	120	----
Organic / Inorganic Carbon (QCLot: 661301)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	101	80.0	120	----
Metals (QCLot: 691197)									
selenium, dissolved	7782-49-2	E423ASe	0.00005	mg/L	1 mg/L	91.2	80.0	120	----
Total Metals (QCLot: 662245)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	103	80.0	120	----
Total Metals (QCLot: 662944)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	96.3	80.0	120	----
Total Metals (QCLot: 662945)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	101	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	101	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	97.5	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	98.1	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	102	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	95.5	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	96.9	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	95.4	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	95.9	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	96.2	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	94.6	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	104	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	94.8	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	104	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	97.8	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	97.9	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	98.4	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	95.5	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	100	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	92.3	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 662945) - continued									
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	93.0	60.0	140	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	94.5	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	101	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	98.6	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	104	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	93.4	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	95.7	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	99.2	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	95.3	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	98.0	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	92.4	80.0	120	----
Dissolved Metals (QCLot: 661916)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	99.5	80.0	120	----
Dissolved Metals (QCLot: 661917)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	105	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	108	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	101	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	102	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	99.1	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	100	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	99.6	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	99.1	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	100	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	112	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	100	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	94.5	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	105	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	103	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	101	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	104	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	95.7	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	106	60.0	140	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	90.1	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Dissolved Metals (QCLot: 661917) - continued									
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	102	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	103	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	107	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	99.5	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	103	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	103	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	95.0	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	101	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	95.8	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	91.5	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 661251)										
CG2213023-007	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.510 mg/L	0.5 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 661252)										
CG2213023-007	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	2.51 mg/L	2.5 mg/L	100	75.0	125	----
Anions and Nutrients (QCLot: 661253)										
CG2213023-007	Anonymous	fluoride	16984-48-8	E235.F	1.02 mg/L	1 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 661254)										
CG2213023-007	Anonymous	bromide	24959-67-9	E235.Br-L	0.474 mg/L	0.5 mg/L	94.7	75.0	125	----
Anions and Nutrients (QCLot: 661255)										
CG2213023-007	Anonymous	chloride	16887-00-6	E235.Cl-L	101 mg/L	100 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 661256)										
CG2213023-007	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	103 mg/L	100 mg/L	103	75.0	125	----
Anions and Nutrients (QCLot: 661974)										
CG2212931-002	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0457 mg/L	0.05 mg/L	91.4	70.0	130	----
Anions and Nutrients (QCLot: 662043)										
CG2213003-026	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0408 mg/L	0.05 mg/L	81.7	70.0	130	----
Anions and Nutrients (QCLot: 662438)										
CG2213021-002	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.62 mg/L	2.5 mg/L	105	70.0	130	----
Anions and Nutrients (QCLot: 662439)										
CG2213021-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0974 mg/L	0.1 mg/L	97.4	75.0	125	----
Organic / Inorganic Carbon (QCLot: 661300)										
CG2213024-001	RG_GHP_WS_LAEMP_GC_2022-09_N	carbon, dissolved organic [DOC]	----	E358-L	5.51 mg/L	5 mg/L	110	70.0	130	----
Organic / Inorganic Carbon (QCLot: 661301)										
CG2213024-001	RG_GHP_WS_LAEMP_GC_2022-09_N	carbon, total organic [TOC]	----	E355-L	5.30 mg/L	5 mg/L	106	70.0	130	----
Metals (QCLot: 691197)										
CG2213024-001	RG_GHP_WS_LAEMP_GC_2022-09_N	selenium, dissolved	7782-49-2	E423ASe	0.378 mg/L	0.4 mg/L	94.4	70.0	130	----
Total Metals (QCLot: 662245)										
CG2212931-002	Anonymous	mercury, total	7439-97-6	E508	0.0000976 mg/L	0.0001 mg/L	97.6	70.0	130	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Spike Concentration	Spike Target	Recovery (%) MS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Total Metals (QCLot: 662944)										
CG2212931-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.409 mg/L	0.4 mg/L	102	70.0	130	----
Total Metals (QCLot: 662945)										
CG2212931-001	Anonymous	aluminum, total	7429-90-5	E420	2.05 mg/L	2 mg/L	102	70.0	130	----
		antimony, total	7440-36-0	E420	0.209 mg/L	0.2 mg/L	104	70.0	130	----
		arsenic, total	7440-38-2	E420	0.205 mg/L	0.2 mg/L	102	70.0	130	----
		barium, total	7440-39-3	E420	0.208 mg/L	0.2 mg/L	104	70.0	130	----
		beryllium, total	7440-41-7	E420	0.412 mg/L	0.4 mg/L	103	70.0	130	----
		bismuth, total	7440-69-9	E420	0.103 mg/L	0.1 mg/L	103	70.0	130	----
		boron, total	7440-42-8	E420	1.05 mg/L	1 mg/L	105	70.0	130	----
		cadmium, total	7440-43-9	E420	0.0424 mg/L	0.04 mg/L	106	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	0.207 mg/L	0.2 mg/L	103	70.0	130	----
		copper, total	7440-50-8	E420	0.205 mg/L	0.2 mg/L	102	70.0	130	----
		iron, total	7439-89-6	E420	20.5 mg/L	20 mg/L	103	70.0	130	----
		lead, total	7439-92-1	E420	0.204 mg/L	0.2 mg/L	102	70.0	130	----
		lithium, total	7439-93-2	E420	1.02 mg/L	1 mg/L	102	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.209 mg/L	0.2 mg/L	104	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.208 mg/L	0.2 mg/L	104	70.0	130	----
		nickel, total	7440-02-0	E420	0.409 mg/L	0.4 mg/L	102	70.0	130	----
		potassium, total	7440-09-7	E420	40.9 mg/L	40 mg/L	102	70.0	130	----
		selenium, total	7782-49-2	E420	0.392 mg/L	0.4 mg/L	98.0	70.0	130	----
		silicon, total	7440-21-3	E420	86.9 mg/L	100 mg/L	86.9	70.0	130	----
		silver, total	7440-22-4	E420	0.0456 mg/L	0.04 mg/L	114	70.0	130	----
		sodium, total	7440-23-5	E420	21.3 mg/L	20 mg/L	107	70.0	130	----
		strontium, total	7440-24-6	E420	0.216 mg/L	0.2 mg/L	108	70.0	130	----
		sulfur, total	7704-34-9	E420	173 mg/L	200 mg/L	86.7	70.0	130	----
		thallium, total	7440-28-0	E420	0.0389 mg/L	0.04 mg/L	97.3	70.0	130	----
		tin, total	7440-31-5	E420	0.206 mg/L	0.2 mg/L	103	70.0	130	----
		titanium, total	7440-32-6	E420	0.416 mg/L	0.4 mg/L	104	70.0	130	----
		uranium, total	7440-61-1	E420	0.0400 mg/L	0.04 mg/L	100	70.0	130	----
		vanadium, total	7440-62-2	E420	1.02 mg/L	1 mg/L	102	70.0	130	----
		zinc, total	7440-66-6	E420	4.02 mg/L	4 mg/L	100	70.0	130	----
Dissolved Metals (QCLot: 661916)										
CG2213025-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.382 mg/L	0.4 mg/L	95.4	70.0	130	----
Dissolved Metals (QCLot: 661917)										

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 661917) - continued										
CG2213025-001	Anonymous	aluminum, dissolved	7429-90-5	E421	1.99 mg/L	2 mg/L	99.3	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.199 mg/L	0.2 mg/L	99.6	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.190 mg/L	0.2 mg/L	95.3	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.187 mg/L	0.2 mg/L	93.6	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.385 mg/L	0.4 mg/L	96.4	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0905 mg/L	0.1 mg/L	90.5	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.979 mg/L	1 mg/L	97.9	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0389 mg/L	0.04 mg/L	97.2	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.192 mg/L	0.2 mg/L	96.1	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.193 mg/L	0.2 mg/L	96.7	70.0	130	----
		iron, dissolved	7439-89-6	E421	19.4 mg/L	20 mg/L	96.9	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.188 mg/L	0.2 mg/L	93.9	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.860 mg/L	1 mg/L	86.0	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.195 mg/L	0.2 mg/L	97.6	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.195 mg/L	0.2 mg/L	97.5	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.384 mg/L	0.4 mg/L	96.0	70.0	130	----
		potassium, dissolved	7440-09-7	E421	37.7 mg/L	40 mg/L	94.2	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.322 mg/L	0.4 mg/L	80.6	70.0	130	----
		silicon, dissolved	7440-21-3	E421	75.8 mg/L	100 mg/L	75.8	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0389 mg/L	0.04 mg/L	97.3	70.0	130	----
		sodium, dissolved	7440-23-5	E421	18.7 mg/L	20 mg/L	93.4	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.2 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	ND mg/L	200 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.0362 mg/L	0.04 mg/L	90.4	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.192 mg/L	0.2 mg/L	96.2	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.392 mg/L	0.4 mg/L	98.1	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.0369 mg/L	0.04 mg/L	92.2	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.958 mg/L	1 mg/L	95.8	70.0	130	----
		zinc, dissolved	7440-66-6	E421	3.75 mg/L	4 mg/L	93.7	70.0	130	----
Dissolved Metals (QCLot: 662251)										
CG2212715-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.000104 mg/L	0.0001 mg/L	104	70.0	130	----

Teck

COC ID:	GHO_RAEMP_2022-09_ALS	TURNAROUND TIME:	2-3 Business Days	RUSH:	Priorty

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Greenhills Operations			Lab Name	ALS Calgary			Report Format / Distribution	Excel	PDF	EDD
Project Manager	Giovanna Diaz			Lab Contact	Lyudmyla Shvets			Email 1: AquaSciLab@Teck.com	X	X	X
Email	Giovanna.Diaz@Teck.com			Email	Lyudmyla.Shvets@ALSGlobal.com			Email 2: teckcoal@equisonline.com			X
Address	421 Pine Avenue			Address	2559 29 Street NE			Email 3: Teck.Lab.Results@teck.com	X	X	X
								Email 4: Lisa.Bowron@minnow.ca	X	X	X
City	Sparwood	Provinc	BC	City	Calgary	Provinc	AB	Email 5: Clare.Nelligan@minnow.ca	X	X	X
Postal Code	V0B 2G0	Country	Canada	Postal Code	T1Y 7B5	Country	Canada	Email 6: Giovanna.Diaz@Teck.com	X	X	X
Phone Number	1-250-865-3048			Phone Number	403 407 1794			PO number	VPO00816101		

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	DOC	Mercury_Dissolved	Mercury_Total	TECKCOAL_METNHG_D	TECKCOAL_METNHG_T	TECKCOAL_ROUTINE	TOC_TKN_PT
Filt.								F	F	N	F	N	N	N
PRESERV.								H2SO4	HCL	HCL				H2SO4
RG_GHP_WS_LAEMP_GC_2022-09_N	RG_GHP	WS	N	2022-09-19	9:15	G	7	1	1	1	1	1	1	1

Environmental Division
Calgary
Work Order Reference
CG2213024

Telephone : +1 403 407 1800

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Dissolved metals were field filtered and to be lab preserved Total metals to be lab preserved	Jennifer Ings	#############	NR	22/09/22 0858
			8°C	

SERVICE REQUEST (rush - subject to availability)					
Regular (default)		Sampler's Name	Jennifer Ings	Mobile #	5195003444
Priority (2-3 business days) - 50% surcharge	X				
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature	J. Ings	Date/Time	September 16, 2022
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Environmental Division
Calgary
Work Order Reference
CG2213024

ALS - SEDIMENT

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **CG2212702**	Page	: 1 of 19
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 15-Sep-2022 08:50
PO	: VPO00816101	Date Analysis Commenced	: 19-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 17-Oct-2022 14:39
Sampler	: JI		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Amber Sheikh	Laboratory Assistant	Organics, Calgary, Alberta
Dwayne Bennett	Technical Specialist	Metals, Calgary, Alberta
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Sask Soils, Saskatoon, Saskatchewan
Kuljeet Chawla		Inorganics, Calgary, Alberta
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Sorina Motea	Laboratory Analyst	Organics, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	Description
-	No Unit
%	percent
mg/kg	milligrams per kilogram
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Sample Comments

Sample	Client Id	Comment
CG2212702-001	RG_GHBP_SE-1_2022-09-12_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
CG2212702-002	RG_GHBP_SE-2_2022-09-12_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
CG2212702-003	RG_GHBP_SE-3_2022-09-12_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
CG2212702-004	RG_GHBP_SE-4_2022-09-12_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
CG2212702-005	RG_GHBP_SE-5_2022-09-12_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
CG2212702-006	RG_GANF_SE-1_2022-09-13_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
CG2212702-007	RG_GANF_SE-2_2022-09-13_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
CG2212702-008	RG_GANF_SE-3_2022-09-13_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.

CG2212702-009	RG_GANF_SE-4_2022-09-13_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
CG2212702-010	RG_GANF_SE-5_2022-09-13_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid)**

Analyte	CAS Number	Method	LOR	Unit	RG_GHBP_SE-1_2022-09-12_N	RG_GHBP_SE-2_2022-09-12_N	RG_GHBP_SE-3_2022-09-12_N	RG_GHBP_SE-4_2022-09-12_N	RG_GHBP_SE-5_2022-09-12_N
				Client sampling date / time	12-Sep-2022 08:37	12-Sep-2022 09:55	12-Sep-2022 11:16	12-Sep-2022 12:00	12-Sep-2022 13:45
					CG2212702-001	CG2212702-002	CG2212702-003	CG2212702-004	CG2212702-005
					Result	Result	Result	Result	Result
Physical Tests									
moisture	----	E144	0.25	%	40.5	57.6	44.1	53.3	60.8
pH (1:2 soil:water)	----	E108	0.10	pH units	8.40	8.26	8.31	8.21	8.34
Particle Size									
grain size curve	----	E185A	-	-	See Attached	See Attached	See Attached	See Attached	See Attached
clay (<0.004mm)	----	EC184A	1.0	%	14.9	24.0	30.5	17.1	15.0
silt (0.063mm - 0.0312mm)	----	EC184A	1.0	%	10.5	10.6	18.6	14.7	6.8
silt (0.0312mm - 0.004mm)	----	EC184A	1.0	%	21.4	25.5	37.9	27.1	15.9
sand (0.125mm - 0.063mm)	----	EC184A	1.0	%	5.3	4.3	5.4	6.3	4.6
sand (0.25mm - 0.125mm)	----	EC184A	1.0	%	13.4	9.9	5.6	12.3	9.6
sand (0.5mm - 0.25mm)	----	EC184A	1.0	%	21.3	15.0	1.8	7.4	13.3
sand (1.0mm - 0.50mm)	----	EC184A	1.0	%	11.2	8.3	<1.0	5.9	17.0
sand (2.0mm - 1.0mm)	----	EC184A	1.0	%	2.0	2.4	<1.0	7.1	12.8
gravel (>2mm)	----	EC184A	1.0	%	<1.0	<1.0	<1.0	2.1	5.0
Organic / Inorganic Carbon									
carbon, total [TC]	----	E351	0.050	%	10.3	14.0	18.6	12.7	13.4
carbon, inorganic [IC]	----	E354	0.050	%	1.51	1.69	2.22	2.34	4.44
carbon, inorganic [IC], (as CaCO3 equivalent)	----	E354	0.40	%	12.6	14.1	18.5	19.5	37.0
carbon, total organic [TOC]	----	EC356	0.050	%	8.79	12.3	16.4	10.4	8.96
Metals									
aluminum	7429-90-5	E440	50	mg/kg	9390	6480	7440	6190	4100
antimony	7440-36-0	E440	0.10	mg/kg	0.83	0.83	0.78	0.62	0.33
arsenic	7440-38-2	E440	0.10	mg/kg	6.95	6.26	7.36	4.45	2.86
barium	7440-39-3	E440	0.50	mg/kg	196	173	223	232	136
beryllium	7440-41-7	E440	0.10	mg/kg	0.79	0.68	0.68	0.58	0.36
bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg	10.0	5.8	5.8	6.3	6.2
cadmium	7440-43-9	E440	0.020	mg/kg	1.01	1.20	1.40	1.23	1.10
calcium	7440-70-2	E440	50	mg/kg	41500	50400	62700	71300	107000
chromium	7440-47-3	E440	0.50	mg/kg	14.1	10.8	12.4	9.85	6.25

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid)**

				Client sample ID	RG_GHBP_SE-1 _2022-09-12_N	RG_GHBP_SE-2 _2022-09-12_N	RG_GHBP_SE-3 _2022-09-12_N	RG_GHBP_SE-4 _2022-09-12_N	RG_GHBP_SE-5 _2022-09-12_N
				Client sampling date / time	12-Sep-2022 08:37	12-Sep-2022 09:55	12-Sep-2022 11:16	12-Sep-2022 12:00	12-Sep-2022 13:45
Analyte	CAS Number	Method	LOR	Unit	CG2212702-001	CG2212702-002	CG2212702-003	CG2212702-004	CG2212702-005
					Result	Result	Result	Result	Result
Metals									
cobalt	7440-48-4	E440	0.10	mg/kg	8.55	7.62	9.61	7.51	5.08
copper	7440-50-8	E440	0.50	mg/kg	17.0	16.7	19.0	16.0	10.1
iron	7439-89-6	E440	50	mg/kg	20400	17900	21800	12900	9010
lead	7439-92-1	E440	0.50	mg/kg	13.2	12.6	11.7	10.3	6.32
lithium	7439-93-2	E440	2.0	mg/kg	13.9	11.7	12.0	9.2	6.4
magnesium	7439-95-4	E440	20	mg/kg	6020	5310	6010	5530	5010
manganese	7439-96-5	E440	1.0	mg/kg	520	433	701	435	281
mercury	7439-97-6	E510	0.0050	mg/kg	0.0408	0.0491	0.0422	0.0545	0.0305
molybdenum	7439-98-7	E440	0.10	mg/kg	1.66	1.84	1.52	1.22	0.72
nickel	7440-02-0	E440	0.50	mg/kg	63.5	51.6	68.9	65.3	46.3
phosphorus	7723-14-0	E440	50	mg/kg	1290	1240	1190	1080	725
potassium	7440-09-7	E440	100	mg/kg	2050	1300	1990	1390	1020
selenium	7782-49-2	E440	0.20	mg/kg	6.85	5.54	6.14	8.40	7.66
silver	7440-22-4	E440	0.10	mg/kg	0.20	0.24	0.20	0.24	0.13
sodium	7440-23-5	E440	50	mg/kg	76	59	104	72	69
strontium	7440-24-6	E440	0.50	mg/kg	49.4	50.4	55.6	58.7	60.8
sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	<1000	1400	1700
thallium	7440-28-0	E440	0.050	mg/kg	0.237	0.192	0.192	0.180	0.107
tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg	15.8	10.3	11.4	9.8	9.1
tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg	1.04	1.13	1.06	1.36	0.959
vanadium	7440-62-2	E440	0.20	mg/kg	30.4	23.0	26.2	21.8	14.0
zinc	7440-66-6	E440	2.0	mg/kg	132	136	149	124	103
zirconium	7440-67-7	E440	1.0	mg/kg	1.2	1.1	1.0	1.1	<1.0
Polycyclic Aromatic Hydrocarbons									
acenaphthene	83-32-9	E641A	0.050	mg/kg	0.067	0.133	0.178	0.088	0.175
acenaphthylene	208-96-8	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
acridine	260-94-6	E641A	0.050	mg/kg	0.094	0.270	0.356	0.176	0.360
anthracene	120-12-7	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
benz(a)anthracene	56-55-3	E641A	0.050	mg/kg	<0.050	0.085	0.102	0.056	0.105

Analytical Results

Sub-Matrix: Soil
(Matrix: Soil/Solid)

Analyte	CAS Number	Method	LOR	Unit	RG_GHBP_SE-1_2022-09-12_N	RG_GHBP_SE-2_2022-09-12_N	RG_GHBP_SE-3_2022-09-12_N	RG_GHBP_SE-4_2022-09-12_N	RG_GHBP_SE-5_2022-09-12_N
Client sampling date / time					12-Sep-2022 08:37	12-Sep-2022 09:55	12-Sep-2022 11:16	12-Sep-2022 12:00	12-Sep-2022 13:45
					CG2212702-001	CG2212702-002	CG2212702-003	CG2212702-004	CG2212702-005
					Result	Result	Result	Result	Result
Polycyclic Aromatic Hydrocarbons									
benzo(a)pyrene	50-32-8	E641A	0.050	mg/kg	<0.050	<0.050	0.055	<0.050	0.056
benzo(b+j)fluoranthene	n/a	E641A	0.050	mg/kg	0.076	0.191	0.218	0.115	0.231
benzo(b+j+k)fluoranthene	n/a	E641A	0.075	mg/kg	0.076	0.191	0.218	0.115	0.231
benzo(g,h,i)perylene	191-24-2	E641A	0.050	mg/kg	<0.050	0.076	0.090	0.054	0.096
benzo(k)fluoranthene	207-08-9	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
chrysene	218-01-9	E641A	0.050	mg/kg	0.208	0.442	0.530	0.286	0.488
dibenz(a,h)anthracene	53-70-3	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	0.050
fluoranthene	206-44-0	E641A	0.050	mg/kg	<0.050	0.081	0.094	0.051	0.103
fluorene	86-73-7	E641A	0.050	mg/kg	0.144	0.319	0.430	0.213	0.438
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
methylnaphthalene, 1-	90-12-0	E641A	0.030	mg/kg	0.847	1.59	2.14	1.09	2.19
methylnaphthalene, 1+2-	----	E641A	0.050	mg/kg	2.30	4.36	5.94	2.93	6.13
methylnaphthalene, 2-	91-57-6	E641A	0.030	mg/kg	1.45	2.77	3.80	1.84	3.94
naphthalene	91-20-3	E641A	0.010	mg/kg	0.426	0.755	1.07	0.509	1.16
phenanthrene	85-01-8	E641A	0.050	mg/kg	0.650	1.73	2.17	1.22	2.03
pyrene	129-00-0	E641A	0.050	mg/kg	0.064	0.134	0.161	0.088	0.159
quinoline	91-22-5	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.065	mg/kg	0.067	0.088	0.123	0.076	0.150
IACR (CCME)	----	E641A	0.60	-	1.00	2.01	2.36	1.37	2.54
IACR AB (coarse)	----	E641A	0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10
IACR AB (fine)	----	E641A	0.10	-	<0.10	0.14	0.16	0.10	0.16
PAHs, total (BC Sched 3.4)	n/a	E641A	0.20	mg/kg	3.01	6.45	8.59	4.35	8.70
PAHs, total (EPA 16)	n/a	E641A	0.20	mg/kg	1.64	3.95	5.10	2.68	5.09
Polycyclic Aromatic Hydrocarbons Surrogates									
acridine-d9	34749-75-2	E641A	0.1	%	78.9	91.3	84.4	118	94.6
chrysene-d12	1719-03-5	E641A	0.1	%	82.2	80.7	75.5	97.2	82.6
naphthalene-d8	1146-65-2	E641A	0.1	%	83.6	78.0	74.0	94.3	79.6
phenanthrene-d10	1517-22-2	E641A	0.1	%	88.8	99.2	93.0	124	101
Exchangeable & Adsorbed Metals									
aluminum, leachable	7429-90-5	E450	50	mg/kg	<50	<50	<50	<50	<50
antimony, leachable	7440-36-0	E450	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid)**

				Client sample ID	RG_GHBP_SE-1_2022-09-12_N	RG_GHBP_SE-2_2022-09-12_N	RG_GHBP_SE-3_2022-09-12_N	RG_GHBP_SE-4_2022-09-12_N	RG_GHBP_SE-5_2022-09-12_N
				Client sampling date / time	12-Sep-2022 08:37	12-Sep-2022 09:55	12-Sep-2022 11:16	12-Sep-2022 12:00	12-Sep-2022 13:45
Analyte	CAS Number	Method	LOR	Unit	CG2212702-001	CG2212702-002	CG2212702-003	CG2212702-004	CG2212702-005
					Result	Result	Result	Result	Result
Exchangeable & Adsorbed Metals									
arsenic, leachable	7440-38-2	E450	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	0.060
barium, leachable	7440-39-3	E450	0.50	mg/kg	9.20	12.3	10.9	17.6	10.8
beryllium, leachable	7440-41-7	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
bismuth, leachable	7440-69-9	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450	0.050	mg/kg	0.168	0.250	0.185	0.175	<0.050
calcium, leachable	7440-70-2	E450	50	mg/kg	5800	4290	5030	4320	3270
chromium, leachable	7440-47-3	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
cobalt, leachable	7440-48-4	E450	0.10	mg/kg	0.14	0.20	0.28	<0.10	0.23
copper, leachable	7440-50-8	E450	0.50	mg/kg	0.92	<0.50	1.23	1.29	1.35
iron, leachable	7439-89-6	E450	50	mg/kg	<50	<50	<50	<50	<50
lead, leachable	7439-92-1	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
lithium, leachable	7439-93-2	E450	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450	1.0	mg/kg	20.6	61.8	85.7	10.5	51.3
molybdenum, leachable	7439-98-7	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450	0.50	mg/kg	2.45	1.96	3.36	1.82	2.76
phosphorus, leachable	7723-14-0	E450	50	mg/kg	<50	<50	<50	<50	<50
potassium, leachable	7440-09-7	E450	100	mg/kg	140	<100	150	130	160
selenium, leachable	7782-49-2	E450	0.20	mg/kg	0.45	0.27	0.28	<0.20	0.46
silver, leachable	7440-22-4	E450	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
sodium, leachable	7440-23-5	E450	100	mg/kg	<100	<100	<100	<100	<100
strontium, leachable	7440-24-6	E450	0.50	mg/kg	7.02	5.07	6.25	5.82	4.60
thallium, leachable	7440-28-0	E450	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
uranium, leachable	7440-61-1	E450	0.050	mg/kg	0.058	<0.050	0.059	0.050	0.063
vanadium, leachable	7440-62-2	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
zinc, leachable	7440-66-6	E450	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Carbonate Metals									
aluminum, leachable	7429-90-5	E450A	50	mg/kg	<50	<50	<50	<50	<50
antimony, leachable	7440-36-0	E450A	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450A	0.050	mg/kg	0.053	<0.050	<0.050	<0.050	0.070

Analytical Results

Sub-Matrix: Soil
(Matrix: Soil/Solid)

Analyte	CAS Number	Method	LOR	Unit	RG_GHBP_SE-1 _2022-09-12_N	RG_GHBP_SE-2 _2022-09-12_N	RG_GHBP_SE-3 _2022-09-12_N	RG_GHBP_SE-4 _2022-09-12_N	RG_GHBP_SE-5 _2022-09-12_N
				Client sampling date / time	12-Sep-2022 08:37	12-Sep-2022 09:55	12-Sep-2022 11:16	12-Sep-2022 12:00	12-Sep-2022 13:45
					CG2212702-001	CG2212702-002	CG2212702-003	CG2212702-004	CG2212702-005
					Result	Result	Result	Result	Result
Carbonate Metals									
barium, leachable	7440-39-3	E450A	2.0	mg/kg	33.2	38.0	38.5	46.1	34.4
beryllium, leachable	7440-41-7	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
bismuth, leachable	7440-69-9	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450A	0.050	mg/kg	0.596	0.625	0.681	0.529	0.491
calcium, leachable	7440-70-2	E450A	50	mg/kg	35300	40700	42500	45900	45300
chromium, leachable	7440-47-3	E450A	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
cobalt, leachable	7440-48-4	E450A	0.10	mg/kg	0.64	0.77	0.90	0.38	0.81
copper, leachable	7440-50-8	E450A	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
iron, leachable	7439-89-6	E450A	50	mg/kg	<50	<50	<50	<50	<50
lead, leachable	7439-92-1	E450A	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
lithium, leachable	7439-93-2	E450A	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450A	5.0	mg/kg	113	108	136	80.7	116
molybdenum, leachable	7439-98-7	E450A	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450A	2.0	mg/kg	12.6	9.8	12.2	9.2	11.5
phosphorus, leachable	7723-14-0	E450A	50	mg/kg	<50	<50	<50	<50	<50
selenium, leachable	7782-49-2	E450A	0.20	mg/kg	0.26	<0.20	0.22	0.21	0.37
silver, leachable	7440-22-4	E450A	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
strontium, leachable	7440-24-6	E450A	5.0	mg/kg	15.6	17.8	18.4	20.4	19.4
thallium, leachable	7440-28-0	E450A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450A	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450A	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
uranium, leachable	7440-61-1	E450A	0.050	mg/kg	0.281	0.358	0.347	0.376	0.377
vanadium, leachable	7440-62-2	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
zinc, leachable	7440-66-6	E450A	1.0	mg/kg	19.8	22.7	24.3	17.5	23.2
Easily Reducible Metals and Iron Oxides									
aluminum, leachable	7429-90-5	E450B	50	mg/kg	453	446	410	342	252
antimony, leachable	7440-36-0	E450B	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450B	0.050	mg/kg	0.414	0.372	0.326	0.260	0.329
barium, leachable	7440-39-3	E450B	0.50	mg/kg	35.7	33.3	30.5	36.1	51.9
beryllium, leachable	7440-41-7	E450B	0.20	mg/kg	0.27	0.26	0.23	0.27	0.21
bismuth, leachable	7440-69-9	E450B	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid)**

				Client sample ID	RG_GHBP_SE-1 _2022-09-12_N	RG_GHBP_SE-2 _2022-09-12_N	RG_GHBP_SE-3 _2022-09-12_N	RG_GHBP_SE-4 _2022-09-12_N	RG_GHBP_SE-5 _2022-09-12_N
				Client sampling date / time	12-Sep-2022 08:37	12-Sep-2022 09:55	12-Sep-2022 11:16	12-Sep-2022 12:00	12-Sep-2022 13:45
Analyte	CAS Number	Method	LOR	Unit	CG2212702-001	CG2212702-002	CG2212702-003	CG2212702-004	CG2212702-005
					Result	Result	Result	Result	Result
Easily Reducible Metals and Iron Oxides									
cadmium, leachable	7440-43-9	E450B	0.050	mg/kg	0.756	0.590	0.710	0.491	0.956
calcium, leachable	7440-70-2	E450B	50	mg/kg	8090	8500	15800	24300	90200
chromium, leachable	7440-47-3	E450B	0.50	mg/kg	0.57	0.71	0.64	0.60	0.51
cobalt, leachable	7440-48-4	E450B	0.10	mg/kg	3.39	3.09	3.08	3.62	1.95
copper, leachable	7440-50-8	E450B	0.50	mg/kg	0.53	<0.50	<0.50	<0.50	<0.50
iron, leachable	7439-89-6	E450B	50	mg/kg	3150	2760	2610	2260	1550
lead, leachable	7439-92-1	E450B	0.50	mg/kg	3.29	3.44	3.45	3.91	3.82
lithium, leachable	7439-93-2	E450B	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450B	1.0	mg/kg	172	208	161	261	128
molybdenum, leachable	7439-98-7	E450B	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450B	0.50	mg/kg	45.7	29.2	42.1	30.9	27.8
phosphorus, leachable	7723-14-0	E450B	50	mg/kg	150	141	122	68	136
selenium, leachable	7782-49-2	E450B	0.20	mg/kg	2.13	1.17	1.56	1.21	2.68
silver, leachable	7440-22-4	E450B	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
strontium, leachable	7440-24-6	E450B	0.50	mg/kg	6.44	7.23	9.06	11.9	37.2
thallium, leachable	7440-28-0	E450B	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450B	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450B	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
uranium, leachable	7440-61-1	E450B	0.050	mg/kg	0.434	0.410	0.408	0.448	0.586
vanadium, leachable	7440-62-2	E450B	0.20	mg/kg	2.04	2.24	2.03	2.00	1.65
zinc, leachable	7440-66-6	E450B	1.0	mg/kg	64.2	57.0	74.5	50.2	67.2
Organic Bound Metals									
aluminum, leachable	7429-90-5	E450C	50	mg/kg	2160	1670	1850	1400	872
antimony, leachable	7440-36-0	E450C	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450C	0.050	mg/kg	0.718	0.416	0.642	0.450	0.322
barium, leachable	7440-39-3	E450C	0.50	mg/kg	30.5	23.2	38.0	30.5	26.1
beryllium, leachable	7440-41-7	E450C	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
bismuth, leachable	7440-69-9	E450C	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450C	0.050	mg/kg	0.127	0.082	0.117	0.081	0.084
calcium, leachable	7440-70-2	E450C	50	mg/kg	1630	1500	2020	2110	2530
chromium, leachable	7440-47-3	E450C	0.50	mg/kg	5.19	4.00	4.20	3.55	2.33

Analytical Results

Sub-Matrix: Soil
(Matrix: Soil/Solid)

Analyte	CAS Number	Method	LOR	Unit	RG_GHBP_SE-1 _2022-09-12_N	RG_GHBP_SE-2 _2022-09-12_N	RG_GHBP_SE-3 _2022-09-12_N	RG_GHBP_SE-4 _2022-09-12_N	RG_GHBP_SE-5 _2022-09-12_N
				Client sampling date / time	12-Sep-2022 08:37	12-Sep-2022 09:55	12-Sep-2022 11:16	12-Sep-2022 12:00	12-Sep-2022 13:45
					CG2212702-001	CG2212702-002	CG2212702-003	CG2212702-004	CG2212702-005
					Result	Result	Result	Result	Result
Organic Bound Metals									
cobalt, leachable	7440-48-4	E450C	0.10	mg/kg	1.98	1.33	1.78	1.47	1.28
copper, leachable	7440-50-8	E450C	0.50	mg/kg	11.4	6.79	9.62	7.14	6.92
iron, leachable	7439-89-6	E450C	50	mg/kg	3350	2280	2800	2080	1440
lead, leachable	7439-92-1	E450C	0.50	mg/kg	2.05	1.00	1.67	0.74	<0.50
lithium, leachable	7439-93-2	E450C	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450C	1.0	mg/kg	18.1	16.2	13.9	14.3	6.7
molybdenum, leachable	7439-98-7	E450C	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450C	0.50	mg/kg	35.6	16.6	30.0	21.3	17.5
selenium, leachable	7782-49-2	E450C	0.20	mg/kg	20.3	8.53	12.9	8.40	11.9
silver, leachable	7440-22-4	E450C	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
strontium, leachable	7440-24-6	E450C	0.50	mg/kg	4.82	4.90	5.61	5.42	4.05
thallium, leachable	7440-28-0	E450C	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450C	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450C	1.0	mg/kg	8.7	18.7	23.4	17.7	13.8
uranium, leachable	7440-61-1	E450C	0.050	mg/kg	0.545	0.395	0.407	0.324	0.192
vanadium, leachable	7440-62-2	E450C	0.20	mg/kg	6.84	5.56	6.02	5.10	3.35
zinc, leachable	7440-66-6	E450C	1.0	mg/kg	17.8	9.1	14.3	8.0	7.0
Residual Metals									
aluminum, leachable	7429-90-5	E450D	50	mg/kg	6660	8330	6440	6640	5550
antimony, leachable	7440-36-0	E450D	0.10	mg/kg	0.72	0.70	0.68	0.64	0.56
arsenic, leachable	7440-38-2	E450D	5.00	mg/kg	<5.00	5.16	<5.00	<5.00	<5.00
barium, leachable	7440-39-3	E450D	2.0	mg/kg	133	134	143	140	86.7
beryllium, leachable	7440-41-7	E450D	0.20	mg/kg	0.32	0.38	0.28	0.32	0.24
bismuth, leachable	7440-69-9	E450D	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450D	0.050	mg/kg	0.069	0.099	0.063	0.091	0.069
calcium, leachable	7440-70-2	E450D	50	mg/kg	239	732	321	730	721
chromium, leachable	7440-47-3	E450D	5.0	mg/kg	9.9	12.1	9.4	9.7	7.8
cobalt, leachable	7440-48-4	E450D	0.10	mg/kg	2.18	2.89	2.21	2.58	1.99
copper, leachable	7440-50-8	E450D	0.50	mg/kg	11.7	14.4	11.0	11.9	8.60
iron, leachable	7439-89-6	E450D	50	mg/kg	7770	12200	7930	9990	7510
lead, leachable	7439-92-1	E450D	0.50	mg/kg	5.91	6.82	5.40	5.64	3.21

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid)**

				Client sample ID	RG_GHBP_SE-1_2022-09-12_N	RG_GHBP_SE-2_2022-09-12_N	RG_GHBP_SE-3_2022-09-12_N	RG_GHBP_SE-4_2022-09-12_N	RG_GHBP_SE-5_2022-09-12_N
				Client sampling date / time	12-Sep-2022 08:37	12-Sep-2022 09:55	12-Sep-2022 11:16	12-Sep-2022 12:00	12-Sep-2022 13:45
Analyte	CAS Number	Method	LOR	Unit	CG2212702-001	CG2212702-002	CG2212702-003	CG2212702-004	CG2212702-005
					Result	Result	Result	Result	Result
Residual Metals									
lithium, leachable	7439-93-2	E450D	5.0	mg/kg	<5.0	6.7	<5.0	5.5	<5.0
manganese, leachable	7439-96-5	E450D	5.0	mg/kg	31.7	46.6	31.0	38.5	31.8
molybdenum, leachable	7439-98-7	E450D	0.50	mg/kg	0.89	1.12	0.79	0.88	0.64
nickel, leachable	7440-02-0	E450D	2.0	mg/kg	9.6	12.0	9.4	10.4	8.0
selenium, leachable	7782-49-2	E450D	0.20	mg/kg	3.09	1.80	2.03	1.36	2.01
silver, leachable	7440-22-4	E450D	0.10	mg/kg	0.24	0.16	0.20	0.15	0.11
strontium, leachable	7440-24-6	E450D	5.0	mg/kg	19.4	22.0	18.8	20.5	17.0
thallium, leachable	7440-28-0	E450D	0.050	mg/kg	0.174	0.185	0.153	0.157	0.123
tin, leachable	7440-31-5	E450D	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450D	5.0	mg/kg	14.9	13.3	11.1	11.2	10.2
uranium, leachable	7440-61-1	E450D	0.050	mg/kg	0.277	0.348	0.256	0.336	0.251
vanadium, leachable	7440-62-2	E450D	0.20	mg/kg	22.9	27.3	22.0	22.4	17.9
zinc, leachable	7440-66-6	E450D	1.0	mg/kg	50.9	69.2	52.7	58.0	44.7

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: Soil
(Matrix: Soil/Solid)

Analyte	CAS Number	Method	LOR	Unit	RG_GANF_SE-1_2022-09-13_N	RG_GANF_SE-2_2022-09-13_N	RG_GANF_SE-3_2022-09-13_N	RG_GANF_SE-4_2022-09-13_N	RG_GANF_SE-5_2022-09-13_N
				Client sampling date / time	13-Sep-2022 10:20	13-Sep-2022 10:45	13-Sep-2022 11:45	13-Sep-2022 12:30	13-Sep-2022 13:08
					CG2212702-006	CG2212702-007	CG2212702-008	CG2212702-009	CG2212702-010
					Result	Result	Result	Result	Result
Physical Tests									
moisture	----	E144	0.25	%	42.6	46.9	39.0	48.5	49.8
pH (1:2 soil:water)	----	E108	0.10	pH units	8.15	8.20	8.16	8.24	8.16
Particle Size									
grain size curve	----	E185A	-	-	See Attached	See Attached	See Attached	See Attached	See Attached
clay (<0.004mm)	----	EC184A	1.0	%	19.7	12.4	14.3	28.2	16.0
silt (0.063mm - 0.0312mm)	----	EC184A	1.0	%	12.5	14.3	9.0	11.4	11.9
silt (0.0312mm - 0.004mm)	----	EC184A	1.0	%	32.0	27.3	22.6	42.2	28.6
sand (0.125mm - 0.063mm)	----	EC184A	1.0	%	7.5	10.7	6.2	4.8	5.9
sand (0.25mm - 0.125mm)	----	EC184A	1.0	%	12.0	17.3	11.2	6.6	11.4
sand (0.5mm - 0.25mm)	----	EC184A	1.0	%	9.1	11.5	9.3	3.1	10.3
sand (1.0mm - 0.50mm)	----	EC184A	1.0	%	5.6	3.8	10.6	2.3	9.4
sand (2.0mm - 1.0mm)	----	EC184A	1.0	%	1.6	2.2	11.9	1.0	5.4
gravel (>2mm)	----	EC184A	1.0	%	<1.0	<1.0	4.9	<1.0	1.1
Organic / Inorganic Carbon									
carbon, total [TC]	----	E351	0.050	%	18.3	15.4	14.0	26.2	20.2
carbon, inorganic [IC]	----	E354	0.050	%	1.80	2.10	2.47	2.42	2.41
carbon, inorganic [IC], (as CaCO3 equivalent)	----	E354	0.40	%	15.0	17.5	20.6	20.1	20.1
carbon, total organic [TOC]	----	EC356	0.050	%	16.5	13.3	11.5	23.8	17.8
Metals									
aluminum	7429-90-5	E440	50	mg/kg	8260	8980	6830	5980	6680
antimony	7440-36-0	E440	0.10	mg/kg	0.75	0.58	0.63	0.68	0.67
arsenic	7440-38-2	E440	0.10	mg/kg	5.56	5.28	4.55	4.24	5.46
barium	7440-39-3	E440	0.50	mg/kg	225	229	212	216	206
beryllium	7440-41-7	E440	0.10	mg/kg	0.70	0.74	0.59	0.59	0.66
bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg	8.7	9.0	6.0	<5.0	<5.0
cadmium	7440-43-9	E440	0.020	mg/kg	0.727	0.689	0.681	0.711	0.714
calcium	7440-70-2	E440	50	mg/kg	59300	58600	82100	83100	65600
chromium	7440-47-3	E440	0.50	mg/kg	11.9	12.4	9.78	8.86	9.80
cobalt	7440-48-4	E440	0.10	mg/kg	7.31	7.68	7.02	6.79	8.27

Analytical Results

Sub-Matrix: Soil
(Matrix: Soil/Solid)

				Client sample ID	RG_GANF_SE-1 _2022-09-13_N	RG_GANF_SE-2 _2022-09-13_N	RG_GANF_SE-3 _2022-09-13_N	RG_GANF_SE-4 _2022-09-13_N	RG_GANF_SE-5 _2022-09-13_N
				Client sampling date / time	13-Sep-2022 10:20	13-Sep-2022 10:45	13-Sep-2022 11:45	13-Sep-2022 12:30	13-Sep-2022 13:08
Analyte	CAS Number	Method	LOR	Unit	CG2212702-006	CG2212702-007	CG2212702-008	CG2212702-009	CG2212702-010
					Result	Result	Result	Result	Result
Metals									
copper	7440-50-8	E440	0.50	mg/kg	15.7	14.7	14.4	14.9	16.0
iron	7439-89-6	E440	50	mg/kg	14500	16300	12700	10800	15600
lead	7439-92-1	E440	0.50	mg/kg	10.7	10.7	9.64	9.43	11.1
lithium	7439-93-2	E440	2.0	mg/kg	11.6	12.6	10.5	9.4	11.3
magnesium	7439-95-4	E440	20	mg/kg	3620	3750	3830	3580	3930
manganese	7439-96-5	E440	1.0	mg/kg	380	478	402	346	516
mercury	7439-97-6	E510	0.0050	mg/kg	0.0509	0.0391	0.0448	0.0610	0.0532
molybdenum	7439-98-7	E440	0.10	mg/kg	1.24	1.09	1.09	1.18	1.23
nickel	7440-02-0	E440	0.50	mg/kg	25.4	24.7	23.1	21.9	25.8
phosphorus	7723-14-0	E440	50	mg/kg	976	1010	846	831	1000
potassium	7440-09-7	E440	100	mg/kg	2030	2090	1590	1390	1360
selenium	7782-49-2	E440	0.20	mg/kg	1.54	1.21	1.21	1.31	1.19
silver	7440-22-4	E440	0.10	mg/kg	0.30	0.21	0.24	0.25	0.22
sodium	7440-23-5	E440	50	mg/kg	69	74	70	66	67
strontium	7440-24-6	E440	0.50	mg/kg	64.0	64.9	70.1	72.0	62.9
sulfur	7704-34-9	E440	1000	mg/kg	1100	1100	1500	1600	1200
thallium	7440-28-0	E440	0.050	mg/kg	0.154	0.159	0.131	0.112	0.124
tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg	15.0	14.2	11.6	10.8	11.8
tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg	0.815	0.763	0.747	0.751	0.792
vanadium	7440-62-2	E440	0.20	mg/kg	27.5	28.2	22.5	21.2	22.3
zinc	7440-66-6	E440	2.0	mg/kg	90.7	88.5	79.2	78.0	91.8
zirconium	7440-67-7	E440	1.0	mg/kg	<1.0	<1.0	1.2	<1.0	1.0
Polycyclic Aromatic Hydrocarbons									
acenaphthene	83-32-9	E641A	0.050	mg/kg	0.256	0.138	0.239	0.580	0.508
acenaphthylene	208-96-8	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	0.095	0.084
acridine	260-94-6	E641A	0.050	mg/kg	0.429	0.207	0.346	0.905	0.829
anthracene	120-12-7	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
benz(a)anthracene	56-55-3	E641A	0.050	mg/kg	0.133	0.051	0.129	0.316	0.299
benzo(a)pyrene	50-32-8	E641A	0.050	mg/kg	0.092	<0.050	0.064	0.178	0.163

Analytical Results

Sub-Matrix: Soil
(Matrix: Soil/Solid)

Analyte	CAS Number	Method	LOR	Unit	RG_GANF_SE-1_2022-09-13_N	RG_GANF_SE-2_2022-09-13_N	RG_GANF_SE-3_2022-09-13_N	RG_GANF_SE-4_2022-09-13_N	RG_GANF_SE-5_2022-09-13_N
				Client sampling date / time	13-Sep-2022 10:20	13-Sep-2022 10:45	13-Sep-2022 11:45	13-Sep-2022 12:30	13-Sep-2022 13:08
					CG2212702-006	CG2212702-007	CG2212702-008	CG2212702-009	CG2212702-010
					Result	Result	Result	Result	Result
Polycyclic Aromatic Hydrocarbons									
benzo(b+j)fluoranthene	n/a	E641A	0.050	mg/kg	0.301	0.118	0.223	0.568	0.541
benzo(b+j+k)fluoranthene	n/a	E641A	0.075	mg/kg	0.366	0.118	0.313	0.682	0.762
benzo(g,h,i)perylene	191-24-2	E641A	0.050	mg/kg	0.060	<0.050	0.066	0.196	0.213
benzo(k)fluoranthene	207-08-9	E641A	0.050	mg/kg	0.065	<0.050	0.090	0.114	0.221
chrysene	218-01-9	E641A	0.050	mg/kg	0.715	0.314	0.552	1.40	1.29
dibenz(a,h)anthracene	53-70-3	E641A	0.050	mg/kg	0.056	<0.050	<0.050	0.111	0.103
fluoranthene	206-44-0	E641A	0.050	mg/kg	0.114	0.053	0.099	0.246	0.222
fluorene	86-73-7	E641A	0.050	mg/kg	0.615	0.338	0.568	1.40	1.25
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	0.074	0.071
methylnaphthalene, 1-	90-12-0	E641A	0.030	mg/kg	3.48	2.13	3.29	7.80	6.97
methylnaphthalene, 1+2-	----	E641A	0.050	mg/kg	9.82	5.93	9.43	22.3	20.0
methylnaphthalene, 2-	91-57-6	E641A	0.030	mg/kg	6.34	3.80	6.14	14.5	13.0
naphthalene	91-20-3	E641A	0.010	mg/kg	2.26	1.50	2.26	5.15	4.66
phenanthrene	85-01-8	E641A	0.050	mg/kg	2.45	1.32	2.24	5.36	4.94
pyrene	129-00-0	E641A	0.050	mg/kg	0.231	0.114	0.200	0.472	0.431
quinoline	91-22-5	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.065	mg/kg	0.208	0.075	0.142	0.412	0.394
IACR (CCME)	----	E641A	0.60	-	3.54	1.39	2.91	6.91	7.23
IACR AB (coarse)	----	E641A	0.10	-	0.14	<0.10	0.14	0.26	0.34
IACR AB (fine)	----	E641A	0.10	-	0.27	0.10	0.26	0.50	0.65
PAHs, total (BC Sched 3.4)	n/a	E641A	0.20	mg/kg	13.3	7.63	12.5	29.8	27.0
PAHs, total (EPA 16)	n/a	E641A	0.20	mg/kg	7.35	3.95	6.73	16.3	15.0
Polycyclic Aromatic Hydrocarbons Surrogates									
acridine-d9	34749-75-2	E641A	0.1	%	72.6	73.8	72.9	69.6	77.5
chrysene-d12	1719-03-5	E641A	0.1	%	81.2	87.8	87.7	77.7	89.2
naphthalene-d8	1146-65-2	E641A	0.1	%	83.5	91.2	93.0	83.2	96.6
phenanthrene-d10	1517-22-2	E641A	0.1	%	80.0	83.8	85.2	78.4	88.0
Exchangeable & Adsorbed Metals									
aluminum, leachable	7429-90-5	E450	50	mg/kg	<50	<50	<50	<50	<50
antimony, leachable	7440-36-0	E450	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050

Analytical Results

Sub-Matrix: Soil
(Matrix: Soil/Solid)

Analyte	CAS Number	Method	LOR	Unit	RG_GANF_SE-1_2022-09-13_N	RG_GANF_SE-2_2022-09-13_N	RG_GANF_SE-3_2022-09-13_N	RG_GANF_SE-4_2022-09-13_N	RG_GANF_SE-5_2022-09-13_N
Client sampling date / time					13-Sep-2022 10:20	13-Sep-2022 10:45	13-Sep-2022 11:45	13-Sep-2022 12:30	13-Sep-2022 13:08
					CG2212702-006	CG2212702-007	CG2212702-008	CG2212702-009	CG2212702-010
					Result	Result	Result	Result	Result
Exchangeable & Adsorbed Metals									
barium, leachable	7440-39-3	E450	0.50	mg/kg	22.9	25.9	16.8	20.4	21.0
beryllium, leachable	7440-41-7	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
bismuth, leachable	7440-69-9	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450	0.050	mg/kg	0.109	0.102	0.112	0.143	0.142
calcium, leachable	7440-70-2	E450	50	mg/kg	3750	3620	3170	3580	4010
chromium, leachable	7440-47-3	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
cobalt, leachable	7440-48-4	E450	0.10	mg/kg	0.26	0.27	0.16	0.23	0.20
copper, leachable	7440-50-8	E450	0.50	mg/kg	1.09	1.05	<0.50	1.04	1.02
iron, leachable	7439-89-6	E450	50	mg/kg	<50	<50	<50	<50	<50
lead, leachable	7439-92-1	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
lithium, leachable	7439-93-2	E450	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450	1.0	mg/kg	86.0	94.9	45.3	46.7	53.1
molybdenum, leachable	7439-98-7	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450	0.50	mg/kg	0.50	0.53	<0.50	<0.50	<0.50
phosphorus, leachable	7723-14-0	E450	50	mg/kg	<50	<50	<50	<50	<50
potassium, leachable	7440-09-7	E450	100	mg/kg	160	150	<100	160	150
selenium, leachable	7782-49-2	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
silver, leachable	7440-22-4	E450	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
sodium, leachable	7440-23-5	E450	100	mg/kg	<100	<100	<100	<100	<100
strontium, leachable	7440-24-6	E450	0.50	mg/kg	7.35	7.85	4.94	5.71	6.52
thallium, leachable	7440-28-0	E450	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
uranium, leachable	7440-61-1	E450	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
vanadium, leachable	7440-62-2	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
zinc, leachable	7440-66-6	E450	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Carbonate Metals									
aluminum, leachable	7429-90-5	E450A	50	mg/kg	<50	<50	<50	<50	<50
antimony, leachable	7440-36-0	E450A	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450A	0.050	mg/kg	0.088	0.066	<0.050	<0.050	<0.050
barium, leachable	7440-39-3	E450A	2.0	mg/kg	52.8	52.3	50.7	54.0	51.0

Analytical Results

Sub-Matrix: Soil
(Matrix: Soil/Solid)

Analyte	CAS Number	Method	LOR	Unit	RG_GANF_SE-1_2022-09-13_N	RG_GANF_SE-2_2022-09-13_N	RG_GANF_SE-3_2022-09-13_N	RG_GANF_SE-4_2022-09-13_N	RG_GANF_SE-5_2022-09-13_N
Client sampling date / time					13-Sep-2022 10:20	13-Sep-2022 10:45	13-Sep-2022 11:45	13-Sep-2022 12:30	13-Sep-2022 13:08
					CG2212702-006	CG2212702-007	CG2212702-008	CG2212702-009	CG2212702-010
					Result	Result	Result	Result	Result
Carbonate Metals									
beryllium, leachable	7440-41-7	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
bismuth, leachable	7440-69-9	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450A	0.050	mg/kg	0.295	0.231	0.232	0.272	0.272
calcium, leachable	7440-70-2	E450A	50	mg/kg	41800	43600	47500	45200	43600
chromium, leachable	7440-47-3	E450A	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
cobalt, leachable	7440-48-4	E450A	0.10	mg/kg	0.92	0.75	0.54	0.71	0.59
copper, leachable	7440-50-8	E450A	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
iron, leachable	7439-89-6	E450A	50	mg/kg	<50	<50	<50	<50	<50
lead, leachable	7439-92-1	E450A	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
lithium, leachable	7439-93-2	E450A	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450A	5.0	mg/kg	104	116	87.2	85.3	98.3
molybdenum, leachable	7439-98-7	E450A	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450A	2.0	mg/kg	2.1	2.0	<2.0	<2.0	<2.0
phosphorus, leachable	7723-14-0	E450A	50	mg/kg	<50	<50	<50	<50	<50
selenium, leachable	7782-49-2	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
silver, leachable	7440-22-4	E450A	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
strontium, leachable	7440-24-6	E450A	5.0	mg/kg	24.9	24.8	25.5	24.9	24.3
thallium, leachable	7440-28-0	E450A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450A	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450A	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
uranium, leachable	7440-61-1	E450A	0.050	mg/kg	0.168	0.158	0.152	0.148	0.145
vanadium, leachable	7440-62-2	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
zinc, leachable	7440-66-6	E450A	1.0	mg/kg	6.9	5.3	4.4	4.1	4.5
Easily Reducible Metals and Iron Oxides									
aluminum, leachable	7429-90-5	E450B	50	mg/kg	598	490	431	458	470
antimony, leachable	7440-36-0	E450B	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450B	0.050	mg/kg	0.536	0.450	0.357	0.366	0.382
barium, leachable	7440-39-3	E450B	0.50	mg/kg	39.3	32.0	47.6	45.0	37.0
beryllium, leachable	7440-41-7	E450B	0.20	mg/kg	0.29	0.28	0.27	0.32	0.29
bismuth, leachable	7440-69-9	E450B	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450B	0.050	mg/kg	0.396	0.335	0.306	0.388	0.372

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

				Client sample ID	RG_GANF_SE-1 _2022-09-13_N	RG_GANF_SE-2 _2022-09-13_N	RG_GANF_SE-3 _2022-09-13_N	RG_GANF_SE-4 _2022-09-13_N	RG_GANF_SE-5 _2022-09-13_N
				Client sampling date / time	13-Sep-2022 10:20	13-Sep-2022 10:45	13-Sep-2022 11:45	13-Sep-2022 12:30	13-Sep-2022 13:08
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**CG2212702-006**	**CG2212702-007**	**CG2212702-008**	**CG2212702-009**	**CG2212702-010**
					Result	Result	Result	Result	Result
Easily Reducible Metals and Iron Oxides									
calcium, leachable	7440-70-2	E450B	50	mg/kg	7900	10300	28200	30600	17600
chromium, leachable	7440-47-3	E450B	0.50	mg/kg	0.82	0.74	0.91	0.98	0.80
cobalt, leachable	7440-48-4	E450B	0.10	mg/kg	3.44	3.28	4.14	3.69	3.48
copper, leachable	7440-50-8	E450B	0.50	mg/kg	<0.50	0.52	0.57	0.67	<0.50
iron, leachable	7439-89-6	E450B	50	mg/kg	3580	3220	2990	2980	3020
lead, leachable	7439-92-1	E450B	0.50	mg/kg	3.34	3.30	4.24	4.38	3.57
lithium, leachable	7439-93-2	E450B	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450B	1.0	mg/kg	105	146	292	151	179
molybdenum, leachable	7439-98-7	E450B	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450B	0.50	mg/kg	10.0	9.36	10.2	9.97	9.66
phosphorus, leachable	7723-14-0	E450B	50	mg/kg	180	132	61	53	76
selenium, leachable	7782-49-2	E450B	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
silver, leachable	7440-22-4	E450B	0.10	mg/kg	<0.10	<0.10	<0.10	0.11	0.10
strontium, leachable	7440-24-6	E450B	0.50	mg/kg	7.78	8.12	16.9	18.9	11.7
thallium, leachable	7440-28-0	E450B	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450B	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450B	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
uranium, leachable	7440-61-1	E450B	0.050	mg/kg	0.191	0.152	0.187	0.190	0.181
vanadium, leachable	7440-62-2	E450B	0.20	mg/kg	2.77	2.36	2.45	2.86	2.42
zinc, leachable	7440-66-6	E450B	1.0	mg/kg	31.3	25.8	26.6	30.7	27.7
Organic Bound Metals									
aluminum, leachable	7429-90-5	E450C	50	mg/kg	1630	1630	1310	1400	1520
antimony, leachable	7440-36-0	E450C	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450C	0.050	mg/kg	0.460	0.446	0.319	0.495	0.479
barium, leachable	7440-39-3	E450C	0.50	mg/kg	23.6	23.4	22.2	23.3	22.7
beryllium, leachable	7440-41-7	E450C	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
bismuth, leachable	7440-69-9	E450C	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450C	0.050	mg/kg	0.073	0.067	0.062	0.081	0.077
calcium, leachable	7440-70-2	E450C	50	mg/kg	1220	1410	1840	1990	1740
chromium, leachable	7440-47-3	E450C	0.50	mg/kg	3.62	3.30	2.56	3.12	3.24
cobalt, leachable	7440-48-4	E450C	0.10	mg/kg	1.02	0.92	0.92	0.83	0.97

Analytical Results

Sub-Matrix: Soil
(Matrix: Soil/Solid)

Analyte	CAS Number	Method	LOR	Unit	RG_GANF_SE-1 _2022-09-13_N	RG_GANF_SE-2 _2022-09-13_N	RG_GANF_SE-3 _2022-09-13_N	RG_GANF_SE-4 _2022-09-13_N	RG_GANF_SE-5 _2022-09-13_N
				Client sampling date / time	13-Sep-2022 10:20	13-Sep-2022 10:45	13-Sep-2022 11:45	13-Sep-2022 12:30	13-Sep-2022 13:08
					CG2212702-006	CG2212702-007	CG2212702-008	CG2212702-009	CG2212702-010
					Result	Result	Result	Result	Result
Organic Bound Metals									
copper, leachable	7440-50-8	E450C	0.50	mg/kg	7.33	6.69	5.16	8.19	7.78
iron, leachable	7439-89-6	E450C	50	mg/kg	1970	2030	1520	1560	1860
lead, leachable	7439-92-1	E450C	0.50	mg/kg	1.12	0.88	<0.50	0.64	0.92
lithium, leachable	7439-93-2	E450C	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450C	1.0	mg/kg	10.9	13.6	14.3	9.0	11.8
molybdenum, leachable	7439-98-7	E450C	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450C	0.50	mg/kg	5.95	5.73	5.20	5.53	5.96
selenium, leachable	7782-49-2	E450C	0.20	mg/kg	1.55	1.19	0.96	1.21	1.25
silver, leachable	7440-22-4	E450C	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
strontium, leachable	7440-24-6	E450C	0.50	mg/kg	4.34	4.67	5.13	5.32	4.84
thallium, leachable	7440-28-0	E450C	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450C	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450C	1.0	mg/kg	17.1	17.4	1.9	16.4	16.5
uranium, leachable	7440-61-1	E450C	0.050	mg/kg	0.255	0.233	0.192	0.232	0.235
vanadium, leachable	7440-62-2	E450C	0.20	mg/kg	4.97	4.38	3.45	4.50	4.32
zinc, leachable	7440-66-6	E450C	1.0	mg/kg	7.9	7.3	5.8	7.4	7.9
Residual Metals									
aluminum, leachable	7429-90-5	E450D	50	mg/kg	6540	6910	6860	5760	5490
antimony, leachable	7440-36-0	E450D	0.10	mg/kg	0.69	0.62	0.63	0.71	0.63
arsenic, leachable	7440-38-2	E450D	5.00	mg/kg	<5.00	<5.00	<5.00	<5.00	<5.00
barium, leachable	7440-39-3	E450D	2.0	mg/kg	132	106	110	114	103
beryllium, leachable	7440-41-7	E450D	0.20	mg/kg	0.31	0.33	0.34	0.31	0.30
bismuth, leachable	7440-69-9	E450D	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450D	0.050	mg/kg	0.075	0.073	0.083	0.064	0.062
calcium, leachable	7440-70-2	E450D	50	mg/kg	423	454	662	313	389
chromium, leachable	7440-47-3	E450D	5.0	mg/kg	9.4	9.7	9.4	8.3	7.8
cobalt, leachable	7440-48-4	E450D	0.10	mg/kg	2.45	2.54	2.68	2.33	2.19
copper, leachable	7440-50-8	E450D	0.50	mg/kg	12.2	11.1	11.7	11.6	10.7
iron, leachable	7439-89-6	E450D	50	mg/kg	8370	8960	11000	7230	7230
lead, leachable	7439-92-1	E450D	0.50	mg/kg	5.93	5.71	5.57	5.08	5.37
lithium, leachable	7439-93-2	E450D	5.0	mg/kg	5.1	6.2	6.5	<5.0	<5.0

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

				Client sample ID	RG_GANF_SE-1 _2022-09-13_N	RG_GANF_SE-2 _2022-09-13_N	RG_GANF_SE-3 _2022-09-13_N	RG_GANF_SE-4 _2022-09-13_N	RG_GANF_SE-5 _2022-09-13_N
				Client sampling date / time	13-Sep-2022 10:20	13-Sep-2022 10:45	13-Sep-2022 11:45	13-Sep-2022 12:30	13-Sep-2022 13:08
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**CG2212702-006**	**CG2212702-007**	**CG2212702-008**	**CG2212702-009**	**CG2212702-010**
					Result	Result	Result	Result	Result
Residual Metals									
manganese, leachable	7439-96-5	E450D	5.0	mg/kg	32.5	35.0	44.8	29.6	29.7
molybdenum, leachable	7439-98-7	E450D	0.50	mg/kg	0.81	0.90	0.88	0.82	0.79
nickel, leachable	7440-02-0	E450D	2.0	mg/kg	9.3	9.6	10.0	8.7	8.3
selenium, leachable	7782-49-2	E450D	0.20	mg/kg	0.45	0.54	0.46	0.34	0.39
silver, leachable	7440-22-4	E450D	0.10	mg/kg	0.19	0.13	0.12	0.16	0.16
strontium, leachable	7440-24-6	E450D	5.0	mg/kg	20.7	19.2	19.1	20.5	18.9
thallium, leachable	7440-28-0	E450D	0.050	mg/kg	0.129	0.128	0.128	0.111	0.102
tin, leachable	7440-31-5	E450D	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450D	5.0	mg/kg	14.3	16.8	15.1	15.6	12.8
uranium, leachable	7440-61-1	E450D	0.050	mg/kg	0.251	0.254	0.302	0.250	0.240
vanadium, leachable	7440-62-2	E450D	0.20	mg/kg	23.3	23.6	23.3	21.5	19.6
zinc, leachable	7440-66-6	E450D	1.0	mg/kg	52.0	52.1	58.4	50.7	47.8

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2212702**	Page	: 1 of 25
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 15-Sep-2022 08:50
PO	: VPO00816101	Issue Date	: 17-Oct-2022 14:40
C-O-C number	: REP_LAEMP_GC_2022-09_ALS		
Sampler	: JI		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Easily Reducible Metals and Iron Oxides	CG2212702-007	RG_GANF_SE-2_2022-09-13_N	calcium, leachable	7440-70-2	E450B	46.9 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Easily Reducible Metals and Iron Oxides	CG2212702-007	RG_GANF_SE-2_2022-09-13_N	strontium, leachable	7440-24-6	E450B	33.4 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
LDPE bag RG_GANF_SE-1_2022-09-13_N	E450A	13-Sep-2022	08-Oct-2022	180 days	25 days	✓	09-Oct-2022	155 days	1 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
LDPE bag RG_GANF_SE-2_2022-09-13_N	E450A	13-Sep-2022	08-Oct-2022	180 days	25 days	✓	09-Oct-2022	155 days	1 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
LDPE bag RG_GANF_SE-3_2022-09-13_N	E450A	13-Sep-2022	08-Oct-2022	180 days	25 days	✓	09-Oct-2022	155 days	1 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
LDPE bag RG_GANF_SE-4_2022-09-13_N	E450A	13-Sep-2022	08-Oct-2022	180 days	25 days	✓	09-Oct-2022	155 days	1 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
LDPE bag RG_GANF_SE-5_2022-09-13_N	E450A	13-Sep-2022	08-Oct-2022	180 days	25 days	✓	09-Oct-2022	155 days	1 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
LDPE bag RG_GHBP_SE-1_2022-09-12_N	E450A	12-Sep-2022	08-Oct-2022	180 days	26 days	✓	09-Oct-2022	154 days	1 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
LDPE bag RG_GHBP_SE-2_2022-09-12_N	E450A	12-Sep-2022	08-Oct-2022	180 days	26 days	✓	09-Oct-2022	154 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
LDPE bag RG_GHBP_SE-3_2022-09-12_N	E450A	12-Sep-2022	08-Oct-2022	180 days	26 days	✓	09-Oct-2022	154 days	1 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
LDPE bag RG_GHBP_SE-4_2022-09-12_N	E450A	12-Sep-2022	08-Oct-2022	180 days	26 days	✓	09-Oct-2022	154 days	1 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
LDPE bag RG_GHBP_SE-5_2022-09-12_N	E450A	12-Sep-2022	08-Oct-2022	180 days	26 days	✓	09-Oct-2022	154 days	1 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
LDPE bag RG_GANF_SE-1_2022-09-13_N	E450B	13-Sep-2022	11-Oct-2022	180 days	28 days	✓	12-Oct-2022	152 days	1 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
LDPE bag RG_GANF_SE-2_2022-09-13_N	E450B	13-Sep-2022	11-Oct-2022	180 days	28 days	✓	12-Oct-2022	152 days	1 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
LDPE bag RG_GANF_SE-3_2022-09-13_N	E450B	13-Sep-2022	11-Oct-2022	180 days	28 days	✓	12-Oct-2022	152 days	1 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
LDPE bag RG_GANF_SE-4_2022-09-13_N	E450B	13-Sep-2022	11-Oct-2022	180 days	28 days	✓	12-Oct-2022	152 days	1 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
LDPE bag RG_GANF_SE-5_2022-09-13_N	E450B	13-Sep-2022	11-Oct-2022	180 days	28 days	✓	12-Oct-2022	152 days	1 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
LDPE bag RG_GHBP_SE-1_2022-09-12_N	E450B	12-Sep-2022	11-Oct-2022	180 days	29 days	✓	12-Oct-2022	151 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
LDPE bag RG_GHBP_SE-2_2022-09-12_N	E450B	12-Sep-2022	11-Oct-2022	180 days	29 days	✓	12-Oct-2022	151 days	1 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
LDPE bag RG_GHBP_SE-3_2022-09-12_N	E450B	12-Sep-2022	11-Oct-2022	180 days	29 days	✓	12-Oct-2022	151 days	1 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
LDPE bag RG_GHBP_SE-4_2022-09-12_N	E450B	12-Sep-2022	11-Oct-2022	180 days	29 days	✓	12-Oct-2022	151 days	1 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
LDPE bag RG_GHBP_SE-5_2022-09-12_N	E450B	12-Sep-2022	11-Oct-2022	180 days	29 days	✓	12-Oct-2022	151 days	1 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
LDPE bag RG_GANF_SE-1_2022-09-13_N	E450	13-Sep-2022	07-Oct-2022	180 days	24 days	✓	10-Oct-2022	156 days	3 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
LDPE bag RG_GANF_SE-2_2022-09-13_N	E450	13-Sep-2022	07-Oct-2022	180 days	24 days	✓	10-Oct-2022	156 days	3 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
LDPE bag RG_GANF_SE-3_2022-09-13_N	E450	13-Sep-2022	07-Oct-2022	180 days	24 days	✓	10-Oct-2022	156 days	3 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
LDPE bag RG_GANF_SE-4_2022-09-13_N	E450	13-Sep-2022	07-Oct-2022	180 days	24 days	✓	10-Oct-2022	156 days	3 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
LDPE bag RG_GANF_SE-5_2022-09-13_N	E450	13-Sep-2022	07-Oct-2022	180 days	24 days	✓	10-Oct-2022	156 days	3 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
LDPE bag RG_GHBP_SE-1_2022-09-12_N	E450	12-Sep-2022	07-Oct-2022	180 days	25 days	✓	10-Oct-2022	155 days	3 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
LDPE bag RG_GHBP_SE-2_2022-09-12_N	E450	12-Sep-2022	07-Oct-2022	180 days	25 days	✓	10-Oct-2022	155 days	3 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
LDPE bag RG_GHBP_SE-3_2022-09-12_N	E450	12-Sep-2022	07-Oct-2022	180 days	25 days	✓	10-Oct-2022	155 days	3 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
LDPE bag RG_GHBP_SE-4_2022-09-12_N	E450	12-Sep-2022	07-Oct-2022	180 days	25 days	✓	10-Oct-2022	155 days	3 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
LDPE bag RG_GHBP_SE-5_2022-09-12_N	E450	12-Sep-2022	07-Oct-2022	180 days	25 days	✓	10-Oct-2022	155 days	3 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag RG_GANF_SE-1_2022-09-13_N	E510	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	7 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag RG_GANF_SE-2_2022-09-13_N	E510	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	7 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag RG_GANF_SE-3_2022-09-13_N	E510	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	7 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag RG_GANF_SE-4_2022-09-13_N	E510	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag RG_GANF_SE-5_2022-09-13_N	E510	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	7 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag RG_GHBP_SE-1_2022-09-12_N	E510	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	8 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag RG_GHBP_SE-2_2022-09-12_N	E510	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	8 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag RG_GHBP_SE-3_2022-09-12_N	E510	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	8 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag RG_GHBP_SE-4_2022-09-12_N	E510	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	8 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
LDPE bag RG_GHBP_SE-5_2022-09-12_N	E510	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	28 days	8 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag RG_GANF_SE-1_2022-09-13_N	E440	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	180 days	7 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag RG_GANF_SE-2_2022-09-13_N	E440	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	180 days	7 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag RG_GANF_SE-3_2022-09-13_N	E440	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	180 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag RG_GANF_SE-4_2022-09-13_N	E440	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	180 days	7 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag RG_GANF_SE-5_2022-09-13_N	E440	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	180 days	7 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag RG_GHBP_SE-1_2022-09-12_N	E440	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	180 days	8 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag RG_GHBP_SE-2_2022-09-12_N	E440	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	180 days	8 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag RG_GHBP_SE-3_2022-09-12_N	E440	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	180 days	8 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag RG_GHBP_SE-4_2022-09-12_N	E440	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	180 days	8 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
LDPE bag RG_GHBP_SE-5_2022-09-12_N	E440	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	180 days	8 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GANF_SE-1_2022-09-13_N	E351	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GANF_SE-2_2022-09-13_N	E351	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GANF_SE-3_2022-09-13_N	E351	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GANF_SE-4_2022-09-13_N	E351	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GANF_SE-5_2022-09-13_N	E351	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GHBP_SE-1_2022-09-12_N	E351	12-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GHBP_SE-2_2022-09-12_N	E351	12-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GHBP_SE-3_2022-09-12_N	E351	12-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GHBP_SE-4_2022-09-12_N	E351	12-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GHBP_SE-5_2022-09-12_N	E351	12-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GANF_SE-1_2022-09-13_N	E354	13-Sep-2022	----	----	----		22-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GANF_SE-2_2022-09-13_N	E354	13-Sep-2022	----	----	----		22-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GANF_SE-3_2022-09-13_N	E354	13-Sep-2022	----	----	----		22-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GANF_SE-4_2022-09-13_N	E354	13-Sep-2022	----	----	----		22-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GANF_SE-5_2022-09-13_N	E354	13-Sep-2022	----	----	----		22-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GHBP_SE-1_2022-09-12_N	E354	12-Sep-2022	----	----	----		22-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GHBP_SE-2_2022-09-12_N	E354	12-Sep-2022	----	----	----		22-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GHBP_SE-3_2022-09-12_N	E354	12-Sep-2022	----	----	----		22-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GHBP_SE-4_2022-09-12_N	E354	12-Sep-2022	----	----	----		22-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GHBP_SE-5_2022-09-12_N	E354	12-Sep-2022	----	----	----		22-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
LDPE bag RG_GANF_SE-1_2022-09-13_N	E450C	13-Sep-2022	12-Oct-2022	180 days	29 days	✓	13-Oct-2022	151 days	1 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
LDPE bag RG_GANF_SE-2_2022-09-13_N	E450C	13-Sep-2022	12-Oct-2022	180 days	29 days	✓	13-Oct-2022	151 days	1 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
LDPE bag RG_GANF_SE-3_2022-09-13_N	E450C	13-Sep-2022	12-Oct-2022	180 days	29 days	✓	13-Oct-2022	151 days	1 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
LDPE bag RG_GANF_SE-4_2022-09-13_N	E450C	13-Sep-2022	12-Oct-2022	180 days	29 days	✓	13-Oct-2022	151 days	1 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
LDPE bag RG_GANF_SE-5_2022-09-13_N	E450C	13-Sep-2022	12-Oct-2022	180 days	29 days	✓	13-Oct-2022	151 days	1 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
LDPE bag RG_GHBP_SE-1_2022-09-12_N	E450C	12-Sep-2022	12-Oct-2022	180 days	30 days	✓	13-Oct-2022	150 days	1 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
LDPE bag RG_GHBP_SE-2_2022-09-12_N	E450C	12-Sep-2022	12-Oct-2022	180 days	30 days	✓	13-Oct-2022	150 days	1 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
LDPE bag RG_GHBP_SE-3_2022-09-12_N	E450C	12-Sep-2022	12-Oct-2022	180 days	30 days	✓	13-Oct-2022	150 days	1 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
LDPE bag RG_GHBP_SE-4_2022-09-12_N	E450C	12-Sep-2022	12-Oct-2022	180 days	30 days	✓	13-Oct-2022	150 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
LDPE bag RG_GHBP_SE-5_2022-09-12_N	E450C	12-Sep-2022	12-Oct-2022	180 days	30 days	✓	13-Oct-2022	150 days	1 days	✓
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GANF_SE-1_2022-09-13_N	E185A	13-Sep-2022	----	----	----		23-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GANF_SE-2_2022-09-13_N	E185A	13-Sep-2022	----	----	----		23-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GANF_SE-3_2022-09-13_N	E185A	13-Sep-2022	----	----	----		23-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GANF_SE-4_2022-09-13_N	E185A	13-Sep-2022	----	----	----		23-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GANF_SE-5_2022-09-13_N	E185A	13-Sep-2022	----	----	----		23-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GHBP_SE-1_2022-09-12_N	E185A	12-Sep-2022	----	----	----		23-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GHBP_SE-2_2022-09-12_N	E185A	12-Sep-2022	----	----	----		23-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GHBP_SE-3_2022-09-12_N	E185A	12-Sep-2022	----	----	----		23-Sep-2022	365 days	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GHBP_SE-4_2022-09-12_N	E185A	12-Sep-2022	----	----	----		23-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GHBP_SE-5_2022-09-12_N	E185A	12-Sep-2022	----	----	----		23-Sep-2022	365 days	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag RG_GANF_SE-1_2022-09-13_N	E144	13-Sep-2022	----	----	----		19-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag RG_GANF_SE-2_2022-09-13_N	E144	13-Sep-2022	----	----	----		19-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag RG_GANF_SE-3_2022-09-13_N	E144	13-Sep-2022	----	----	----		19-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag RG_GANF_SE-4_2022-09-13_N	E144	13-Sep-2022	----	----	----		19-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag RG_GANF_SE-5_2022-09-13_N	E144	13-Sep-2022	----	----	----		19-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag RG_GHBP_SE-1_2022-09-12_N	E144	12-Sep-2022	----	----	----		19-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag RG_GHBP_SE-2_2022-09-12_N	E144	12-Sep-2022	----	----	----		19-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag RG_GHBP_SE-3_2022-09-12_N	E144	12-Sep-2022	----	----	----		19-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag RG_GHBP_SE-4_2022-09-12_N	E144	12-Sep-2022	----	----	----		19-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag RG_GHBP_SE-5_2022-09-12_N	E144	12-Sep-2022	----	----	----		19-Sep-2022	----	----	
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag RG_GANF_SE-1_2022-09-13_N	E108	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	30 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag RG_GANF_SE-2_2022-09-13_N	E108	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	30 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag RG_GANF_SE-3_2022-09-13_N	E108	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	30 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag RG_GANF_SE-4_2022-09-13_N	E108	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	30 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag RG_GANF_SE-5_2022-09-13_N	E108	13-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	30 days	7 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag RG_GHBP_SE-1_2022-09-12_N	E108	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	30 days	8 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag RG_GHBP_SE-2_2022-09-12_N	E108	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	30 days	8 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag RG_GHBP_SE-3_2022-09-12_N	E108	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	30 days	8 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag RG_GHBP_SE-4_2022-09-12_N	E108	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	30 days	8 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
LDPE bag RG_GHBP_SE-5_2022-09-12_N	E108	12-Sep-2022	20-Sep-2022	----	----		20-Sep-2022	30 days	8 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GANF_SE-1_2022-09-13_N	E641A	13-Sep-2022	19-Sep-2022	14 days	6 days	✓	20-Sep-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GANF_SE-2_2022-09-13_N	E641A	13-Sep-2022	19-Sep-2022	14 days	6 days	✓	20-Sep-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GANF_SE-3_2022-09-13_N	E641A	13-Sep-2022	19-Sep-2022	14 days	6 days	✓	20-Sep-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GANF_SE-4_2022-09-13_N	E641A	13-Sep-2022	19-Sep-2022	14 days	6 days	✓	20-Sep-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GANF_SE-5_2022-09-13_N	E641A	13-Sep-2022	19-Sep-2022	14 days	6 days	✓	20-Sep-2022	40 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GHBP_SE-1_2022-09-12_N	E641A	12-Sep-2022	19-Sep-2022	14 days	7 days	✓	20-Sep-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GHBP_SE-2_2022-09-12_N	E641A	12-Sep-2022	19-Sep-2022	14 days	7 days	✓	20-Sep-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GHBP_SE-3_2022-09-12_N	E641A	12-Sep-2022	19-Sep-2022	14 days	7 days	✓	20-Sep-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GHBP_SE-4_2022-09-12_N	E641A	12-Sep-2022	19-Sep-2022	14 days	7 days	✓	20-Sep-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GHBP_SE-5_2022-09-12_N	E641A	12-Sep-2022	19-Sep-2022	14 days	7 days	✓	20-Sep-2022	40 days	1 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
LDPE bag RG_GANF_SE-2_2022-09-13_N	E450D	13-Sep-2022	13-Oct-2022	180 days	30 days	✓	14-Oct-2022	150 days	0 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
LDPE bag RG_GANF_SE-3_2022-09-13_N	E450D	13-Sep-2022	13-Oct-2022	180 days	30 days	✓	14-Oct-2022	150 days	0 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
LDPE bag RG_GANF_SE-4_2022-09-13_N	E450D	13-Sep-2022	13-Oct-2022	180 days	30 days	✓	14-Oct-2022	150 days	0 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
LDPE bag RG_GANF_SE-5_2022-09-13_N	E450D	13-Sep-2022	13-Oct-2022	180 days	30 days	✓	14-Oct-2022	150 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
LDPE bag RG_GHBP_SE-3_2022-09-12_N	E450D	12-Sep-2022	13-Oct-2022	180 days	31 days	✓	14-Oct-2022	149 days	0 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
LDPE bag RG_GHBP_SE-4_2022-09-12_N	E450D	12-Sep-2022	13-Oct-2022	180 days	31 days	✓	14-Oct-2022	149 days	0 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
LDPE bag RG_GHBP_SE-5_2022-09-12_N	E450D	12-Sep-2022	13-Oct-2022	180 days	31 days	✓	14-Oct-2022	149 days	0 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
LDPE bag RG_GANF_SE-1_2022-09-13_N	E450D	13-Sep-2022	13-Oct-2022	180 days	31 days	✓	14-Oct-2022	150 days	0 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
LDPE bag RG_GHBP_SE-1_2022-09-12_N	E450D	12-Sep-2022	13-Oct-2022	180 days	32 days	✓	14-Oct-2022	148 days	0 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
LDPE bag RG_GHBP_SE-2_2022-09-12_N	E450D	12-Sep-2022	13-Oct-2022	180 days	32 days	✓	14-Oct-2022	148 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Soil/Solid by CVAAS	E510	655189	1	16	6.2	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #1)	E450	686843	1	10	10.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #2)	E450A	687058	1	10	10.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #3)	E450B	690795	1	10	10.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #4)	E450C	693060	1	10	10.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction RM)	E450D	695138	1	10	10.0	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	655190	1	16	6.2	5.0	✓
Moisture Content by Gravimetry	E144	653383	1	16	6.2	5.0	✓
PAHs by Hex:Ace GC-MS	E641A	653382	1	16	6.2	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	655392	1	20	5.0	5.0	✓
Total Carbon by Combustion	E351	658653	2	40	5.0	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	659640	3	41	7.3	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Soil/Solid by CVAAS	E510	655189	2	16	12.5	10.0	✓
Metals by CRC ICPMS (Tessier Extraction #1)	E450	686843	1	10	10.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #2)	E450A	687058	1	10	10.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #3)	E450B	690795	1	10	10.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #4)	E450C	693060	1	10	10.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction RM)	E450D	695138	1	10	10.0	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	655190	2	16	12.5	10.0	✓
Moisture Content by Gravimetry	E144	653383	1	16	6.2	5.0	✓
PAHs by Hex:Ace GC-MS	E641A	653382	1	16	6.2	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	655392	2	20	10.0	10.0	✓
Total Carbon by Combustion	E351	658653	4	40	10.0	10.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	659640	6	41	14.6	10.0	✓
Method Blanks (MB)							
Mercury in Soil/Solid by CVAAS	E510	655189	1	16	6.2	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #1)	E450	686843	1	10	10.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #2)	E450A	687058	1	10	10.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #3)	E450B	690795	1	10	10.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #4)	E450C	693060	1	10	10.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction RM)	E450D	695138	1	10	10.0	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	655190	1	16	6.2	5.0	✓
Moisture Content by Gravimetry	E144	653383	1	16	6.2	5.0	✓
PAHs by Hex:Ace GC-MS	E641A	653382	1	16	6.2	5.0	✓
Total Carbon by Combustion	E351	658653	2	40	5.0	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	659640	3	41	7.3	5.0	✓

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS)							
PAHs by Hex:Ace GC-MS	E641A	653382	1	16	6.2	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
pH by Meter (1:2 Soil:Water Extraction)	E108 Calgary - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
Moisture Content by Gravimetry	E144 Calgary - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Grain Size Report (Attachment) Pipet/Sieve Method	E185A Saskatoon - Environmental	Soil/Solid	SSIR-51 Method 3.2.1	A grain size curve is a graphical representation of the particle sizing of a sample representing the percent passing against the effective particle size.
Total Carbon by Combustion	E351 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2 (mod)	Total Carbon is determined by the high temperature combustion method with measurement by an infrared detector.
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 20.2	Total Inorganic Carbon is determined by acetic acid pH standard curve, where a known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.
Metals in Soil/Solid by CRC ICPMS	E440 Calgary - Environmental	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals by CRC ICPMS (Tessier Extraction #1)	E450 Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by Collision/Reaction Cell ICPMS. Note: For Extraction #1, the extraction solution is 1M Magnesium Chloride and is intended to extract the "Exchangeable and Adsorbed" metals.
Metals by CRC ICPMS (Tessier Extraction #2)	E450A Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by collision cell ICPMS. Note: For Extraction #2, the extraction solution is 1M Sodium Acetate adjusted to pH 5 and is intended to extract the "Carbonate" metals.
Metals by CRC ICPMS (Tessier Extraction #3)	E450B Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by CRC ICPMS.Note: For Extraction #3, the extraction solution is 0.1 M Hydroxylamine Hydro- Chloride in 25% v/v Acetic Acid and is intended to extract the Easily Reducible Metals and Iron Oxides.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals by CRC ICPMS (Tessier Extraction #4)	E450C Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by Collision Reaction Cell ICPMS. Note: For Extraction #4, the extraction solution is 0.02 M Nitric Acid followed by 3.2M Ammonium Acetate and is intended to extract the Organic Bound metals.
Metals by CRC ICPMS (Tessier Extraction RM)	E450D Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with up to 6 different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by CRC ICPMS. Note: For the Tessier "RM" Extraction, the extraction solution is 50/50 mix of 1:1 Nitric Acid along with 1:1 Hydrochloric Acid, and is hot block digested as per the BC SALM procedure. This is intended to extract the Residual metals.
Mercury in Soil/Solid by CVAAS	E510 Calgary - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
PAHs by Hex:Ace GC-MS	E641A Calgary - Environmental	Soil/Solid	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are extracted with hexane/acetone and analyzed by GC-MS. If reported, IACR (index of additive cancer risk, unitless) and B(a)P toxic potency equivalent (in soil concentration units) are calculated as per CCME PAH Soil Quality Guidelines fact sheet (2010) or ABT1.
Particle Size Analysis (Pipette) - Wentworth Classification	EC184A Saskatoon - Environmental	Soil/Solid	Modified Wentworth	The particle size determination is performed by various methods to generate a Grain Size curve. The data from the curve is then used to produce particle size ranges based on the Modified Wentworth Classification system.
Total Organic Carbon (Calculated) in soil	EC356 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2	Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon (TIC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Calgary - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Digestion for Metals and Mercury	EP440 Calgary - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available.
Extraction of Metals for CRC ICPMS (Tessier - EA)	EP450 Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by Collision/Reaction Cell ICPMS. Note: For Extraction #1, the extraction solution is 1M Magnesium Chloride and is intended to extract the "Exchangeable and Adsorbed" metals.
Extraction of Metals for CRC ICPMS (Tessier - CM)	EP450A Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by collision cell ICPMS. Note: For Extraction #2, the extraction solution is 1M Sodium Acetate adjusted to pH 5 and is intended to extract the "Carbonate" metals.
Extraction of Metals for CRC ICPMS (Tessier- FEO)	EP450B Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by CRC ICPMS.Note: For Extraction #3, the extraction solution is 0.1 M Hydroxylamine Hydro- Chloride in 25% v/v Acetic Acid and is intended to extract the Easily Reducible Metals and Iron Oxides.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Extraction of Metals for CRC ICPMS (Tessier - OB)	EP450C Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	"This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by Collision Reaction Cell ICPMS. Note: For Extraction #4, the extraction solution is 0.02 M Nitric Acid followed by 3.2M Ammonium Acetate and is intended to extract the □Organic Bound□ metals.
Extraction of Metals for CRC ICPMS (Tessier - RM)	EP450D Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	"This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with up to 6 different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by CRC ICPMS. Note: For the Tessier "RM" Extraction, the extraction solution is 50/50 mix of 1:1 Nitric Acid along with 1:1 Hydrochloric Acid, and is hot block digested as per the BC SALM procedure. This is intended to extract the □Residual□ metals.
PHCs and PAHs Hexane-Acetone Tumbler Extraction	EP601 Calgary - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1 (mod)	Samples are subsampled and Petroleum Hydrocarbons (PHC) and PAHs are extracted with 1:1 hexane:acetone using a rotary extractor.
Dry and Grind in Soil/Solid <60°C	EPP442 Calgary - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

QUALITY CONTROL REPORT

Work Order	: **CG2212702**	Page	: 1 of 24
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 15-Sep-2022 08:50
PO	: VPO00816101	Date Analysis Commenced	: 19-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 17-Oct-2022 14:40
Sampler	: JI		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Amber Sheikh	Laboratory Assistant	Calgary Organics, Calgary, Alberta
Dwayne Bennett	Technical Specialist	Calgary Metals, Calgary, Alberta
Hedy Lai	Team Leader - Inorganics	Saskatoon Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Saskatoon Sask Soils, Saskatoon, Saskatchewan
Kuljeet Chawla		Calgary Inorganics, Calgary, Alberta
Robin Weeks	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia
Sorina Motea	Laboratory Analyst	Calgary Organics, Calgary, Alberta

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 653383)											
CG2212702-001	RG_GHBP_SE-1_2022-09-12_N	moisture	----	E144	0.25	%	40.5	40.8	0.902%	20%	----
Physical Tests (QC Lot: 655392)											
CG2212702-001	RG_GHBP_SE-1_2022-09-12_N	pH (1:2 soil:water)	----	E108	0.10	pH units	8.40	8.35	0.597%	5%	----
Organic / Inorganic Carbon (QC Lot: 658653)											
CG2212684-004	Anonymous	carbon, total [TC]	----	E351	0.050	%	11.4	11.9	4.60%	20%	----
Organic / Inorganic Carbon (QC Lot: 658655)											
CG2212740-001	Anonymous	carbon, total [TC]	----	E351	0.050	%	4.94	4.69	5.13%	20%	----
Organic / Inorganic Carbon (QC Lot: 659640)											
CG2212675-001	Anonymous	carbon, inorganic [IC]	----	E354	0.050	%	0.170	0.172	0.002	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 659648)											
CG2212684-008	Anonymous	carbon, inorganic [IC]	----	E354	0.050	%	6.03	5.83	3.37%	20%	----
Organic / Inorganic Carbon (QC Lot: 659916)											
CG2212683-011	Anonymous	carbon, inorganic [IC]	----	E354	0.050	%	2.91	2.89	0.697%	20%	----
Metals (QC Lot: 655189)											
CG2212702-001	RG_GHBP_SE-1_2022-09-12_N	mercury	7439-97-6	E510	0.0050	mg/kg	0.0408	0.0393	3.80%	40%	----
Metals (QC Lot: 655190)											
CG2212702-001	RG_GHBP_SE-1_2022-09-12_N	aluminum	7429-90-5	E440	50	mg/kg	9390	7910	17.2%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	0.83	0.82	1.09%	30%	----
		arsenic	7440-38-2	E440	0.10	mg/kg	6.95	7.09	1.98%	30%	----
		barium	7440-39-3	E440	0.50	mg/kg	196	172	12.8%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.79	0.77	3.12%	30%	----
		bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	10.0	7.1	2.8	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	1.01	1.00	0.785%	30%	----
		calcium	7440-70-2	E440	50	mg/kg	41500	39400	5.35%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	14.1	12.6	11.2%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	8.55	8.55	0.0451%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	17.0	17.9	5.36%	30%	----
		iron	7439-89-6	E440	50	mg/kg	20400	19700	3.69%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	13.2	13.5	2.29%	40%	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Metals (QC Lot: 655190) - continued											
CG2212702-001	RG_GHBP_SE-1_2022-09-12_N	lithium	7439-93-2	E440	2.0	mg/kg	13.9	12.6	1.3	Diff <2x LOR	----
		magnesium	7439-95-4	E440	20	mg/kg	6020	5890	2.24%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	520	517	0.562%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	1.66	1.62	2.08%	40%	----
		nickel	7440-02-0	E440	0.50	mg/kg	63.5	63.1	0.660%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	1290	1220	6.02%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	2050	1660	21.0%	40%	----
		selenium	7782-49-2	E440	0.20	mg/kg	6.85	7.15	4.32%	30%	----
		silver	7440-22-4	E440	0.10	mg/kg	0.20	0.22	0.02	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	76	67	9	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.50	mg/kg	49.4	48.8	1.10%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	0.237	0.229	0.008	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	15.8	13.2	17.6%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	1.04	1.06	1.29%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	30.4	27.1	11.5%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	132	134	1.81%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	1.2	1.3	0.1	Diff <2x LOR	----
Polycyclic Aromatic Hydrocarbons (QC Lot: 653382)											
CG2212702-001	RG_GHBP_SE-1_2022-09-12_N	acenaphthene	83-32-9	E641A	0.050	mg/kg	0.067	0.063	0.004	Diff <2x LOR	----
		acenaphthylene	208-96-8	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		acridine	260-94-6	E641A	0.050	mg/kg	0.094	0.124	0.030	Diff <2x LOR	----
		anthracene	120-12-7	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		benz(a)anthracene	56-55-3	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		benzo(a)pyrene	50-32-8	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		benzo(b+j)fluoranthene	n/a	E641A	0.050	mg/kg	0.076	0.085	0.009	Diff <2x LOR	----
		benzo(g,h,i)perylene	191-24-2	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		benzo(k)fluoranthene	207-08-9	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		chrysene	218-01-9	E641A	0.050	mg/kg	0.208	0.215	3.28%	50%	----
		dibenz(a,h)anthracene	53-70-3	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		fluoranthene	206-44-0	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		fluorene	86-73-7	E641A	0.050	mg/kg	0.144	0.187	0.043	Diff <2x LOR	----
		indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Polycyclic Aromatic Hydrocarbons (QC Lot: 653382) - continued											
CG2212702-001	RG_GHBP_SE-1_2022-09-12_N	methylnaphthalene, 1-	90-12-0	E641A	0.030	mg/kg	0.847	0.780	8.21%	50%	----
		methylnaphthalene, 2-	91-57-6	E641A	0.030	mg/kg	1.45	1.36	6.65%	50%	----
		naphthalene	91-20-3	E641A	0.015	mg/kg	0.426	0.391	8.47%	50%	----
		phenanthrene	85-01-8	E641A	0.050	mg/kg	0.650	0.860	27.8%	50%	----
		pyrene	129-00-0	E641A	0.050	mg/kg	0.064	0.063	0.0008	Diff <2x LOR	----
		quinoline	91-22-5	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
Exchangeable & Adsorbed Metals (QC Lot: 686843)											
CG2212702-007	RG_GANF_SE-2_2022-09-13_N	aluminum, leachable	7429-90-5	E450	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		antimony, leachable	7440-36-0	E450	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		arsenic, leachable	7440-38-2	E450	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		barium, leachable	7440-39-3	E450	0.50	mg/kg	25.9	26.6	2.98%	30%	----
		beryllium, leachable	7440-41-7	E450	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450	0.050	mg/kg	0.102	0.109	0.006	Diff <2x LOR	----
		calcium, leachable	7440-70-2	E450	50	mg/kg	3620	3950	8.68%	30%	----
		chromium, leachable	7440-47-3	E450	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		cobalt, leachable	7440-48-4	E450	0.10	mg/kg	0.27	0.27	0.002	Diff <2x LOR	----
		copper, leachable	7440-50-8	E450	0.50	mg/kg	1.05	1.18	0.13	Diff <2x LOR	----
		iron, leachable	7439-89-6	E450	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		lead, leachable	7439-92-1	E450	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		lithium, leachable	7439-93-2	E450	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450	1.0	mg/kg	94.9	102	7.30%	30%	----
		molybdenum, leachable	7439-98-7	E450	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450	0.50	mg/kg	0.53	0.58	0.05	Diff <2x LOR	----
		phosphorus, leachable	7723-14-0	E450	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		potassium, leachable	7440-09-7	E450	100	mg/kg	150	120	30	Diff <2x LOR	----
		selenium, leachable	7782-49-2	E450	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		sodium, leachable	7440-23-5	E450	100	mg/kg	<100	<100	0	Diff <2x LOR	----
		strontium, leachable	7440-24-6	E450	0.50	mg/kg	7.85	8.18	4.06%	30%	----
		thallium, leachable	7440-28-0	E450	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		vanadium, leachable	7440-62-2	E450	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Exchangeable & Adsorbed Metals (QC Lot: 686843) - continued											
CG2212702-007	RG_GANF_SE-2_2022-09-13_N	zinc, leachable	7440-66-6	E450	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
Carbonate Metals (QC Lot: 687058)											
CG2212702-007	RG_GANF_SE-2_2022-09-13_N	aluminum, leachable	7429-90-5	E450A	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		antimony, leachable	7440-36-0	E450A	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		arsenic, leachable	7440-38-2	E450A	0.050	mg/kg	0.066	0.067	0.0006	Diff <2x LOR	----
		barium, leachable	7440-39-3	E450A	2.0	mg/kg	52.3	51.6	1.27%	30%	----
		beryllium, leachable	7440-41-7	E450A	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450A	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450A	0.050	mg/kg	0.231	0.246	0.014	Diff <2x LOR	----
		calcium, leachable	7440-70-2	E450A	50	mg/kg	43600	43100	1.31%	30%	----
		chromium, leachable	7440-47-3	E450A	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		cobalt, leachable	7440-48-4	E450A	0.10	mg/kg	0.75	0.78	3.80%	30%	----
		copper, leachable	7440-50-8	E450A	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		iron, leachable	7439-89-6	E450A	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		lead, leachable	7439-92-1	E450A	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		lithium, leachable	7439-93-2	E450A	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450A	5.0	mg/kg	116	121	4.29%	30%	----
		molybdenum, leachable	7439-98-7	E450A	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450A	2.0	mg/kg	2.0	2.0	0.02	Diff <2x LOR	----
		phosphorus, leachable	7723-14-0	E450A	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		selenium, leachable	7782-49-2	E450A	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450A	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		strontium, leachable	7440-24-6	E450A	5.0	mg/kg	24.8	24.6	0.2	Diff <2x LOR	----
		thallium, leachable	7440-28-0	E450A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450A	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450A	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450A	0.050	mg/kg	0.158	0.148	0.010	Diff <2x LOR	----
		vanadium, leachable	7440-62-2	E450A	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		zinc, leachable	7440-66-6	E450A	1.0	mg/kg	5.3	5.3	0.003	Diff <2x LOR	----
Easily Reducible Metals and Iron Oxides (QC Lot: 690795)											
CG2212702-007	RG_GANF_SE-2_2022-09-13_N	aluminum, leachable	7429-90-5	E450B	50	mg/kg	490	466	5.04%	30%	----
		antimony, leachable	7440-36-0	E450B	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		arsenic, leachable	7440-38-2	E450B	0.050	mg/kg	0.450	0.460	2.13%	30%	----
		barium, leachable	7440-39-3	E450B	0.50	mg/kg	32.0	40.1	22.2%	30%	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Easily Reducible Metals and Iron Oxides (QC Lot: 690795) - continued											
CG2212702-007	RG_GANF_SE-2_2022-09-13_N	beryllium, leachable	7440-41-7	E450B	0.20	mg/kg	0.28	0.32	0.04	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450B	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450B	0.050	mg/kg	0.335	0.378	12.0%	30%	----
		calcium, leachable	7440-70-2	E450B	50	mg/kg	10300	16600	46.9%	30%	DUP-H
		chromium, leachable	7440-47-3	E450B	0.50	mg/kg	0.74	0.79	0.06	Diff <2x LOR	----
		cobalt, leachable	7440-48-4	E450B	0.10	mg/kg	3.28	3.51	6.49%	30%	----
		copper, leachable	7440-50-8	E450B	0.50	mg/kg	0.52	0.53	0.004	Diff <2x LOR	----
		iron, leachable	7439-89-6	E450B	50	mg/kg	3220	3220	0.246%	30%	----
		lead, leachable	7439-92-1	E450B	0.50	mg/kg	3.30	3.64	9.87%	30%	----
		lithium, leachable	7439-93-2	E450B	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450B	1.0	mg/kg	146	171	16.0%	30%	----
		molybdenum, leachable	7439-98-7	E450B	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450B	0.50	mg/kg	9.36	9.69	3.39%	30%	----
		phosphorus, leachable	7723-14-0	E450B	50	mg/kg	132	86	46	Diff <2x LOR	----
		selenium, leachable	7782-49-2	E450B	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450B	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		strontium, leachable	7440-24-6	E450B	0.50	mg/kg	8.12	11.4	33.4%	30%	DUP-H
		thallium, leachable	7440-28-0	E450B	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450B	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450B	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450B	0.050	mg/kg	0.152	0.180	0.028	Diff <2x LOR	----
		vanadium, leachable	7440-62-2	E450B	0.20	mg/kg	2.36	2.31	2.17%	30%	----
		zinc, leachable	7440-66-6	E450B	1.0	mg/kg	25.8	26.3	1.94%	30%	----
Organic Bound Metals (QC Lot: 693060)											
CG2212702-007	RG_GANF_SE-2_2022-09-13_N	aluminum, leachable	7429-90-5	E450C	50	mg/kg	1630	1650	1.57%	30%	----
		antimony, leachable	7440-36-0	E450C	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		arsenic, leachable	7440-38-2	E450C	0.050	mg/kg	0.446	0.490	9.37%	30%	----
		barium, leachable	7440-39-3	E450C	0.50	mg/kg	23.4	24.3	3.77%	30%	----
		beryllium, leachable	7440-41-7	E450C	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450C	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450C	0.050	mg/kg	0.067	0.074	0.006	Diff <2x LOR	----
		calcium, leachable	7440-70-2	E450C	50	mg/kg	1410	1740	21.2%	30%	----
		chromium, leachable	7440-47-3	E450C	0.50	mg/kg	3.30	3.30	0.004	Diff <2x LOR	----
		cobalt, leachable	7440-48-4	E450C	0.10	mg/kg	0.92	1.04	12.8%	30%	----
		copper, leachable	7440-50-8	E450C	0.50	mg/kg	6.69	7.27	8.28%	30%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Organic Bound Metals (QC Lot: 693060) - continued											
CG2212702-007	RG_GANF_SE-2_2022-09-13_N	iron, leachable	7439-89-6	E450C	50	mg/kg	2030	2190	7.76%	30%	----
		lead, leachable	7439-92-1	E450C	0.50	mg/kg	0.88	0.93	0.05	Diff <2x LOR	----
		lithium, leachable	7439-93-2	E450C	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450C	1.0	mg/kg	13.6	13.4	1.51%	30%	----
		molybdenum, leachable	7439-98-7	E450C	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450C	0.50	mg/kg	5.73	6.24	8.47%	30%	----
		selenium, leachable	7782-49-2	E450C	0.20	mg/kg	1.19	1.25	0.06	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450C	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		strontium, leachable	7440-24-6	E450C	0.50	mg/kg	4.67	5.13	9.37%	30%	----
		thallium, leachable	7440-28-0	E450C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450C	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450C	1.0	mg/kg	17.4	17.9	3.30%	30%	----
		uranium, leachable	7440-61-1	E450C	0.050	mg/kg	0.233	0.235	0.002	Diff <2x LOR	----
		vanadium, leachable	7440-62-2	E450C	0.20	mg/kg	4.38	4.44	1.15%	30%	----
		zinc, leachable	7440-66-6	E450C	1.0	mg/kg	7.3	7.8	6.27%	30%	----
Residual Metals (QC Lot: 695138)											
CG2212702-007	RG_GANF_SE-2_2022-09-13_N	aluminum, leachable	7429-90-5	E450D	50	mg/kg	6910	6150	11.6%	30%	----
		antimony, leachable	7440-36-0	E450D	0.10	mg/kg	0.62	0.60	0.03	Diff <2x LOR	----
		arsenic, leachable	7440-38-2	E450D	5.00	mg/kg	<5.00	<5.00	0	Diff <2x LOR	----
		barium, leachable	7440-39-3	E450D	2.0	mg/kg	106	104	1.94%	30%	----
		beryllium, leachable	7440-41-7	E450D	0.20	mg/kg	0.33	0.31	0.02	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450D	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450D	0.050	mg/kg	0.073	0.074	0.001	Diff <2x LOR	----
		calcium, leachable	7440-70-2	E450D	50	mg/kg	454	456	0.362%	30%	----
		chromium, leachable	7440-47-3	E450D	5.0	mg/kg	9.7	8.7	1.0	Diff <2x LOR	----
		cobalt, leachable	7440-48-4	E450D	0.10	mg/kg	2.54	2.34	8.09%	30%	----
		copper, leachable	7440-50-8	E450D	0.50	mg/kg	11.1	10.7	4.19%	30%	----
		iron, leachable	7439-89-6	E450D	50	mg/kg	8960	8630	3.73%	30%	----
		lead, leachable	7439-92-1	E450D	0.50	mg/kg	5.71	5.51	3.67%	30%	----
		lithium, leachable	7439-93-2	E450D	5.0	mg/kg	6.2	5.6	0.6	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450D	5.0	mg/kg	35.0	34.0	2.88%	30%	----
		molybdenum, leachable	7439-98-7	E450D	0.50	mg/kg	0.90	0.74	0.17	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450D	2.0	mg/kg	9.6	8.8	0.8	Diff <2x LOR	----
		selenium, leachable	7782-49-2	E450D	0.20	mg/kg	0.54	0.39	0.15	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450D	0.10	mg/kg	0.13	0.17	0.04	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Residual Metals (QC Lot: 695138) - continued											
CG2212702-007	RG_GANF_SE-2_2022-09-13_N	strontium, leachable	7440-24-6	E450D	5.0	mg/kg	19.2	18.1	1.0	Diff <2x LOR	----
		thallium, leachable	7440-28-0	E450D	0.050	mg/kg	0.128	0.120	0.008	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450D	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450D	5.0	mg/kg	16.8	14.2	2.6	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450D	0.050	mg/kg	0.254	0.242	0.012	Diff <2x LOR	----
		vanadium, leachable	7440-62-2	E450D	0.20	mg/kg	23.6	21.0	11.4%	30%	----
		zinc, leachable	7440-66-6	E450D	1.0	mg/kg	52.1	49.7	4.60%	30%	----

Qualifiers

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 653383)						
moisture	----	E144	0.25	%	<0.25	----
Organic / Inorganic Carbon (QCLot: 658653)						
carbon, total [TC]	----	E351	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 658655)						
carbon, total [TC]	----	E351	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 659640)						
carbon, inorganic [IC]	----	E354	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 659648)						
carbon, inorganic [IC]	----	E354	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 659916)						
carbon, inorganic [IC]	----	E354	0.05	%	<0.050	----
Metals (QCLot: 655189)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 655190)						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 655190) - continued						
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Polycyclic Aromatic Hydrocarbons (QCLot: 653382)						
acenaphthene	83-32-9	E641A	0.05	mg/kg	<0.050	----
acenaphthylene	208-96-8	E641A	0.05	mg/kg	<0.050	----
acridine	260-94-6	E641A	0.05	mg/kg	<0.050	----
anthracene	120-12-7	E641A	0.05	mg/kg	<0.050	----
benz(a)anthracene	56-55-3	E641A	0.05	mg/kg	<0.050	----
benzo(a)pyrene	50-32-8	E641A	0.05	mg/kg	<0.050	----
benzo(b+j)fluoranthene	n/a	E641A	0.05	mg/kg	<0.050	----
benzo(g,h,i)perylene	191-24-2	E641A	0.05	mg/kg	<0.050	----
benzo(k)fluoranthene	207-08-9	E641A	0.05	mg/kg	<0.050	----
chrysene	218-01-9	E641A	0.05	mg/kg	<0.050	----
dibenz(a,h)anthracene	53-70-3	E641A	0.05	mg/kg	<0.050	----
fluoranthene	206-44-0	E641A	0.05	mg/kg	<0.050	----
fluorene	86-73-7	E641A	0.05	mg/kg	<0.050	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.05	mg/kg	<0.050	----
methylnaphthalene, 1-	90-12-0	E641A	0.03	mg/kg	<0.030	----
methylnaphthalene, 2-	91-57-6	E641A	0.03	mg/kg	<0.030	----
naphthalene	91-20-3	E641A	0.01	mg/kg	<0.018	----
phenanthrene	85-01-8	E641A	0.05	mg/kg	<0.050	----
pyrene	129-00-0	E641A	0.05	mg/kg	<0.050	----
quinoline	91-22-5	E641A	0.05	mg/kg	<0.050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Exchangeable & Adsorbed Metals (QCLot: 686843)						
aluminum, leachable	7429-90-5	E450	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450	0.05	mg/kg	<0.050	----
barium, leachable	7440-39-3	E450	0.5	mg/kg	<0.50	----
beryllium, leachable	7440-41-7	E450	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450	50	mg/kg	<50	----
chromium, leachable	7440-47-3	E450	0.5	mg/kg	<0.50	----
cobalt, leachable	7440-48-4	E450	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450	1	mg/kg	<1.0	----
molybdenum, leachable	7439-98-7	E450	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450	0.5	mg/kg	<0.50	----
phosphorus, leachable	7723-14-0	E450	50	mg/kg	<50	----
potassium, leachable	7440-09-7	E450	100	mg/kg	<100	----
selenium, leachable	7782-49-2	E450	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450	0.1	mg/kg	<0.10	----
sodium, leachable	7440-23-5	E450	100	mg/kg	<100	----
strontium, leachable	7440-24-6	E450	0.5	mg/kg	<0.50	----
thallium, leachable	7440-28-0	E450	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450	2	mg/kg	<2.0	----
titanium, leachable	7440-32-6	E450	1	mg/kg	<1.0	----
uranium, leachable	7440-61-1	E450	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450	1	mg/kg	<1.0	----
Carbonate Metals (QCLot: 687058)						
aluminum, leachable	7429-90-5	E450A	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450A	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450A	0.05	mg/kg	<0.050	----
barium, leachable	7440-39-3	E450A	2	mg/kg	<2.0	----
beryllium, leachable	7440-41-7	E450A	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450A	0.2	mg/kg	<0.20	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Carbonate Metals (QCLot: 687058) - continued						
cadmium, leachable	7440-43-9	E450A	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450A	50	mg/kg	<50	----
chromium, leachable	7440-47-3	E450A	5	mg/kg	<5.0	----
cobalt, leachable	7440-48-4	E450A	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450A	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450A	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450A	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450A	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450A	5	mg/kg	<5.0	----
molybdenum, leachable	7439-98-7	E450A	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450A	2	mg/kg	<2.0	----
phosphorus, leachable	7723-14-0	E450A	50	mg/kg	<50	----
selenium, leachable	7782-49-2	E450A	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450A	0.1	mg/kg	<0.10	----
strontium, leachable	7440-24-6	E450A	5	mg/kg	<5.0	----
thallium, leachable	7440-28-0	E450A	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450A	2	mg/kg	<2.0	----
titanium, leachable	7440-32-6	E450A	5	mg/kg	<5.0	----
uranium, leachable	7440-61-1	E450A	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450A	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450A	1	mg/kg	<1.0	----
Easily Reducible Metals and Iron Oxides (QCLot: 690795)						
aluminum, leachable	7429-90-5	E450B	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450B	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450B	0.05	mg/kg	<0.050	----
barium, leachable	7440-39-3	E450B	0.5	mg/kg	<0.50	----
beryllium, leachable	7440-41-7	E450B	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450B	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450B	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450B	50	mg/kg	<50	----
chromium, leachable	7440-47-3	E450B	0.5	mg/kg	<0.50	----
cobalt, leachable	7440-48-4	E450B	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450B	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450B	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450B	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450B	5	mg/kg	<5.0	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Easily Reducible Metals and Iron Oxides (QCLot: 690795) - continued						
manganese, leachable	7439-96-5	E450B	1	mg/kg	<1.0	----
molybdenum, leachable	7439-98-7	E450B	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450B	0.5	mg/kg	<0.50	----
phosphorus, leachable	7723-14-0	E450B	50	mg/kg	<50	----
selenium, leachable	7782-49-2	E450B	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450B	0.1	mg/kg	<0.10	----
strontium, leachable	7440-24-6	E450B	0.5	mg/kg	<0.50	----
thallium, leachable	7440-28-0	E450B	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450B	2	mg/kg	<2.0	----
titanium, leachable	7440-32-6	E450B	1	mg/kg	<1.0	----
uranium, leachable	7440-61-1	E450B	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450B	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450B	1	mg/kg	<1.0	----
Organic Bound Metals (QCLot: 693060)						
aluminum, leachable	7429-90-5	E450C	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450C	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450C	0.05	mg/kg	<0.050	----
barium, leachable	7440-39-3	E450C	0.5	mg/kg	<0.50	----
beryllium, leachable	7440-41-7	E450C	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450C	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450C	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450C	50	mg/kg	<50	----
chromium, leachable	7440-47-3	E450C	0.5	mg/kg	<0.50	----
cobalt, leachable	7440-48-4	E450C	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450C	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450C	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450C	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450C	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450C	1	mg/kg	<1.0	----
molybdenum, leachable	7439-98-7	E450C	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450C	0.5	mg/kg	<0.50	----
selenium, leachable	7782-49-2	E450C	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450C	0.1	mg/kg	<0.10	----
strontium, leachable	7440-24-6	E450C	0.5	mg/kg	<0.50	----
thallium, leachable	7440-28-0	E450C	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450C	2	mg/kg	<2.0	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Organic Bound Metals (QCLot: 693060) - continued						
titanium, leachable	7440-32-6	E450C	1	mg/kg	<1.0	----
uranium, leachable	7440-61-1	E450C	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450C	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450C	1	mg/kg	<1.0	----
Residual Metals (QCLot: 695138)						
aluminum, leachable	7429-90-5	E450D	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450D	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450D	0.5	mg/kg	<0.50	----
barium, leachable	7440-39-3	E450D	2	mg/kg	<2.0	----
beryllium, leachable	7440-41-7	E450D	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450D	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450D	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450D	50	mg/kg	<50	----
chromium, leachable	7440-47-3	E450D	5	mg/kg	<5.0	----
cobalt, leachable	7440-48-4	E450D	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450D	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450D	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450D	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450D	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450D	5	mg/kg	<5.0	----
molybdenum, leachable	7439-98-7	E450D	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450D	2	mg/kg	<2.0	----
selenium, leachable	7782-49-2	E450D	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450D	0.1	mg/kg	<0.10	----
strontium, leachable	7440-24-6	E450D	5	mg/kg	<5.0	----
thallium, leachable	7440-28-0	E450D	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450D	2	mg/kg	<2.0	----
titanium, leachable	7440-32-6	E450D	5	mg/kg	<5.0	----
uranium, leachable	7440-61-1	E450D	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450D	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450D	1	mg/kg	<1.0	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 653383)									
moisture	----	E144	0.25	%	50 %	99.5	90.0	110	----
Physical Tests (QCLot: 655392)									
pH (1:2 soil:water)	----	E108	----	pH units	7 pH units	99.4	97.0	103	----
Organic / Inorganic Carbon (QCLot: 658653)									
carbon, total [TC]	----	E351	0.05	%	48 %	102	90.0	110	----
Organic / Inorganic Carbon (QCLot: 658655)									
carbon, total [TC]	----	E351	0.05	%	48 %	100	90.0	110	----
Organic / Inorganic Carbon (QCLot: 659640)									
carbon, inorganic [IC]	----	E354	0.05	%	0.5 %	94.5	90.0	110	----
Organic / Inorganic Carbon (QCLot: 659648)									
carbon, inorganic [IC]	----	E354	0.05	%	0.5 %	94.8	90.0	110	----
Organic / Inorganic Carbon (QCLot: 659916)									
carbon, inorganic [IC]	----	E354	0.05	%	0.5 %	93.0	90.0	110	----
Metals (QCLot: 655189)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	95.0	80.0	120	----
Metals (QCLot: 655190)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	98.8	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	100	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	89.6	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	92.6	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	90.9	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	91.7	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	91.7	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	90.5	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	112	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	88.3	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	87.5	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	87.6	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	112	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	93.0	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	89.1	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	88.6	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 655190) - continued									
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	90.9	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	94.8	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	87.7	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	97.1	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	91.1	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	91.7	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	87.0	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	90.2	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	96.9	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	94.3	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	95.3	80.0	120	----
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	93.7	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	99.6	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	87.8	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	91.9	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	90.9	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	96.4	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	98.0	80.0	120	----
Polycyclic Aromatic Hydrocarbons (QCLot: 653382)									
acenaphthene	83-32-9	E641A	0.05	mg/kg	0.5 mg/kg	101	60.0	130	----
acenaphthylene	208-96-8	E641A	0.05	mg/kg	0.5 mg/kg	92.6	60.0	130	----
acridine	260-94-6	E641A	0.05	mg/kg	0.5 mg/kg	90.7	60.0	130	----
anthracene	120-12-7	E641A	0.05	mg/kg	0.5 mg/kg	87.4	60.0	130	----
benz(a)anthracene	56-55-3	E641A	0.05	mg/kg	0.5 mg/kg	90.2	60.0	130	----
benzo(a)pyrene	50-32-8	E641A	0.05	mg/kg	0.5 mg/kg	65.6	60.0	130	----
benzo(b+j)fluoranthene	n/a	E641A	0.05	mg/kg	0.5 mg/kg	97.0	60.0	130	----
benzo(g,h,i)perylene	191-24-2	E641A	0.05	mg/kg	0.5 mg/kg	90.4	60.0	130	----
benzo(k)fluoranthene	207-08-9	E641A	0.05	mg/kg	0.5 mg/kg	88.1	60.0	130	----
chrysene	218-01-9	E641A	0.05	mg/kg	0.5 mg/kg	89.7	60.0	130	----
dibenz(a,h)anthracene	53-70-3	E641A	0.05	mg/kg	0.5 mg/kg	93.4	60.0	130	----
fluoranthene	206-44-0	E641A	0.05	mg/kg	0.5 mg/kg	98.5	60.0	130	----
fluorene	86-73-7	E641A	0.05	mg/kg	0.5 mg/kg	97.4	60.0	130	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.05	mg/kg	0.5 mg/kg	87.3	60.0	130	----
methylnaphthalene, 1-	90-12-0	E641A	0.03	mg/kg	0.5 mg/kg	104	60.0	130	----
methylnaphthalene, 2-	91-57-6	E641A	0.03	mg/kg	0.5 mg/kg	101	60.0	130	----
naphthalene	91-20-3	E641A	0.01	mg/kg	0.5 mg/kg	104	50.0	130	----
phenanthrene	85-01-8	E641A	0.05	mg/kg	0.5 mg/kg	97.8	60.0	130	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 653382) - continued									
pyrene	129-00-0	E641A	0.05	mg/kg	0.5 mg/kg	95.8	60.0	130	----
quinoline	91-22-5	E641A	0.05	mg/kg	0.5 mg/kg	93.0	60.0	130	----
Exchangeable & Adsorbed Metals (QCLot: 686843)									
aluminum, leachable	7429-90-5	E450	50	mg/kg	2 mg/kg	98.8	70.0	130	----
antimony, leachable	7440-36-0	E450	0.1	mg/kg	0.2 mg/kg	106	70.0	130	----
arsenic, leachable	7440-38-2	E450	0.05	mg/kg	0.2 mg/kg	99.8	70.0	130	----
barium, leachable	7440-39-3	E450	0.5	mg/kg	0.2 mg/kg	99.1	70.0	130	----
beryllium, leachable	7440-41-7	E450	0.2	mg/kg	0.4 mg/kg	109	70.0	130	----
bismuth, leachable	7440-69-9	E450	0.2	mg/kg	0.1 mg/kg	90.3	70.0	130	----
cadmium, leachable	7440-43-9	E450	0.05	mg/kg	0.04 mg/kg	102	70.0	130	----
calcium, leachable	7440-70-2	E450	50	mg/kg	40 mg/kg	104	70.0	130	----
chromium, leachable	7440-47-3	E450	0.5	mg/kg	0.4 mg/kg	99.8	70.0	130	----
cobalt, leachable	7440-48-4	E450	0.1	mg/kg	0.2 mg/kg	96.6	70.0	130	----
copper, leachable	7440-50-8	E450	0.5	mg/kg	0.2 mg/kg	98.6	70.0	130	----
iron, leachable	7439-89-6	E450	50	mg/kg	20 mg/kg	102	70.0	130	----
lead, leachable	7439-92-1	E450	0.5	mg/kg	0.2 mg/kg	98.9	70.0	130	----
lithium, leachable	7439-93-2	E450	5	mg/kg	1 mg/kg	106	70.0	130	----
manganese, leachable	7439-96-5	E450	1	mg/kg	0.2 mg/kg	97.2	70.0	130	----
molybdenum, leachable	7439-98-7	E450	0.5	mg/kg	0.2 mg/kg	104	70.0	130	----
nickel, leachable	7440-02-0	E450	0.5	mg/kg	0.4 mg/kg	95.8	70.0	130	----
phosphorus, leachable	7723-14-0	E450	50	mg/kg	100 mg/kg	106	70.0	130	----
potassium, leachable	7440-09-7	E450	100	mg/kg	40 mg/kg	92.3	70.0	130	----
selenium, leachable	7782-49-2	E450	0.2	mg/kg	0.4 mg/kg	106	70.0	130	----
silver, leachable	7440-22-4	E450	0.1	mg/kg	0.04 mg/kg	107	70.0	130	----
sodium, leachable	7440-23-5	E450	100	mg/kg	20 mg/kg	102	70.0	130	----
strontium, leachable	7440-24-6	E450	0.5	mg/kg	0.2 mg/kg	108	70.0	130	----
thallium, leachable	7440-28-0	E450	0.05	mg/kg	0.04 mg/kg	101	70.0	130	----
tin, leachable	7440-31-5	E450	2	mg/kg	0.2 mg/kg	103	70.0	130	----
titanium, leachable	7440-32-6	E450	1	mg/kg	0.4 mg/kg	96.1	70.0	130	----
uranium, leachable	7440-61-1	E450	0.05	mg/kg	0.04 mg/kg	99.3	70.0	130	----
vanadium, leachable	7440-62-2	E450	0.2	mg/kg	1 mg/kg	103	70.0	130	----
zinc, leachable	7440-66-6	E450	1	mg/kg	4 mg/kg	95.3	70.0	130	----
Carbonate Metals (QCLot: 687058)									
aluminum, leachable	7429-90-5	E450A	50	mg/kg	2 mg/kg	102	70.0	130	----
antimony, leachable	7440-36-0	E450A	0.1	mg/kg	0.2 mg/kg	104	70.0	130	----
arsenic, leachable	7440-38-2	E450A	0.05	mg/kg	0.2 mg/kg	101	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	**CAS Number**	**Method**	**LOR**	**Unit**	**Concentration**	**LCS**	**Low**	**High**	**Qualifier**
Carbonate Metals (QCLot: 687058) - continued									
barium, leachable	7440-39-3	E450A	2	mg/kg	0.2 mg/kg	98.6	70.0	130	----
beryllium, leachable	7440-41-7	E450A	0.2	mg/kg	0.4 mg/kg	99.1	70.0	130	----
bismuth, leachable	7440-69-9	E450A	0.2	mg/kg	0.1 mg/kg	93.2	70.0	130	----
cadmium, leachable	7440-43-9	E450A	0.05	mg/kg	0.04 mg/kg	101	70.0	130	----
calcium, leachable	7440-70-2	E450A	50	mg/kg	40 mg/kg	97.0	70.0	130	----
chromium, leachable	7440-47-3	E450A	5	mg/kg	0.4 mg/kg	97.4	70.0	130	----
cobalt, leachable	7440-48-4	E450A	0.1	mg/kg	0.2 mg/kg	97.2	70.0	130	----
copper, leachable	7440-50-8	E450A	0.5	mg/kg	0.2 mg/kg	96.0	70.0	130	----
iron, leachable	7439-89-6	E450A	50	mg/kg	20 mg/kg	94.3	70.0	130	----
lead, leachable	7439-92-1	E450A	0.5	mg/kg	0.2 mg/kg	94.8	70.0	130	----
lithium, leachable	7439-93-2	E450A	5	mg/kg	1 mg/kg	99.2	70.0	130	----
manganese, leachable	7439-96-5	E450A	5	mg/kg	0.2 mg/kg	98.6	70.0	130	----
molybdenum, leachable	7439-98-7	E450A	0.5	mg/kg	0.2 mg/kg	107	70.0	130	----
nickel, leachable	7440-02-0	E450A	2	mg/kg	0.4 mg/kg	97.4	70.0	130	----
phosphorus, leachable	7723-14-0	E450A	50	mg/kg	100 mg/kg	101	70.0	130	----
selenium, leachable	7782-49-2	E450A	0.2	mg/kg	0.4 mg/kg	100	70.0	130	----
silver, leachable	7440-22-4	E450A	0.1	mg/kg	0.04 mg/kg	103	70.0	130	----
strontium, leachable	7440-24-6	E450A	5	mg/kg	0.2 mg/kg	104	70.0	130	----
thallium, leachable	7440-28-0	E450A	0.05	mg/kg	0.04 mg/kg	93.8	70.0	130	----
tin, leachable	7440-31-5	E450A	2	mg/kg	0.2 mg/kg	101	70.0	130	----
titanium, leachable	7440-32-6	E450A	5	mg/kg	0.4 mg/kg	100	70.0	130	----
uranium, leachable	7440-61-1	E450A	0.05	mg/kg	0.04 mg/kg	98.1	70.0	130	----
vanadium, leachable	7440-62-2	E450A	0.2	mg/kg	1 mg/kg	102	70.0	130	----
zinc, leachable	7440-66-6	E450A	1	mg/kg	4 mg/kg	95.4	70.0	130	----
Easily Reducible Metals and Iron Oxides (QCLot: 690795)									
aluminum, leachable	7429-90-5	E450B	50	mg/kg	2 mg/kg	97.3	70.0	130	----
antimony, leachable	7440-36-0	E450B	0.1	mg/kg	0.2 mg/kg	92.1	70.0	130	----
arsenic, leachable	7440-38-2	E450B	0.05	mg/kg	0.2 mg/kg	106	70.0	130	----
barium, leachable	7440-39-3	E450B	0.5	mg/kg	0.2 mg/kg	101	70.0	130	----
beryllium, leachable	7440-41-7	E450B	0.2	mg/kg	0.4 mg/kg	91.3	70.0	130	----
bismuth, leachable	7440-69-9	E450B	0.2	mg/kg	0.1 mg/kg	85.0	70.0	130	----
cadmium, leachable	7440-43-9	E450B	0.05	mg/kg	0.04 mg/kg	103	70.0	130	----
calcium, leachable	7440-70-2	E450B	50	mg/kg	40 mg/kg	91.5	70.0	130	----
chromium, leachable	7440-47-3	E450B	0.5	mg/kg	0.4 mg/kg	101	70.0	130	----
cobalt, leachable	7440-48-4	E450B	0.1	mg/kg	0.2 mg/kg	102	70.0	130	----
copper, leachable	7440-50-8	E450B	0.5	mg/kg	0.2 mg/kg	104	70.0	130	----
iron, leachable	7439-89-6	E450B	50	mg/kg	20 mg/kg	102	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Easily Reducible Metals and Iron Oxides (QCLot: 690795) - continued									
lead, leachable	7439-92-1	E450B	0.5	mg/kg	0.2 mg/kg	90.4	70.0	130	----
lithium, leachable	7439-93-2	E450B	5	mg/kg	1 mg/kg	90.4	70.0	130	----
manganese, leachable	7439-96-5	E450B	1	mg/kg	0.2 mg/kg	102	70.0	130	----
molybdenum, leachable	7439-98-7	E450B	0.5	mg/kg	0.2 mg/kg	92.1	70.0	130	----
nickel, leachable	7440-02-0	E450B	0.5	mg/kg	0.4 mg/kg	103	70.0	130	----
phosphorus, leachable	7723-14-0	E450B	50	mg/kg	100 mg/kg	108	70.0	130	----
selenium, leachable	7782-49-2	E450B	0.2	mg/kg	0.4 mg/kg	122	70.0	130	----
silver, leachable	7440-22-4	E450B	0.1	mg/kg	0.04 mg/kg	95.9	70.0	130	----
strontium, leachable	7440-24-6	E450B	0.5	mg/kg	0.2 mg/kg	93.9	70.0	130	----
thallium, leachable	7440-28-0	E450B	0.05	mg/kg	0.04 mg/kg	88.0	70.0	130	----
tin, leachable	7440-31-5	E450B	2	mg/kg	0.2 mg/kg	91.3	70.0	130	----
titanium, leachable	7440-32-6	E450B	1	mg/kg	0.4 mg/kg	101	70.0	130	----
uranium, leachable	7440-61-1	E450B	0.05	mg/kg	0.04 mg/kg	90.2	70.0	130	----
vanadium, leachable	7440-62-2	E450B	0.2	mg/kg	1 mg/kg	103	70.0	130	----
zinc, leachable	7440-66-6	E450B	1	mg/kg	4 mg/kg	102	70.0	130	----
Organic Bound Metals (QCLot: 693060)									
aluminum, leachable	7429-90-5	E450C	50	mg/kg	2 mg/kg	98.7	70.0	130	----
antimony, leachable	7440-36-0	E450C	0.1	mg/kg	0.2 mg/kg	103	70.0	130	----
arsenic, leachable	7440-38-2	E450C	0.05	mg/kg	0.2 mg/kg	101	70.0	130	----
barium, leachable	7440-39-3	E450C	0.5	mg/kg	0.2 mg/kg	100	70.0	130	----
beryllium, leachable	7440-41-7	E450C	0.2	mg/kg	0.4 mg/kg	102	70.0	130	----
bismuth, leachable	7440-69-9	E450C	0.2	mg/kg	0.1 mg/kg	99.6	70.0	130	----
cadmium, leachable	7440-43-9	E450C	0.05	mg/kg	0.04 mg/kg	96.4	70.0	130	----
calcium, leachable	7440-70-2	E450C	50	mg/kg	40 mg/kg	99.2	70.0	130	----
chromium, leachable	7440-47-3	E450C	0.5	mg/kg	0.4 mg/kg	97.7	70.0	130	----
cobalt, leachable	7440-48-4	E450C	0.1	mg/kg	0.2 mg/kg	98.9	70.0	130	----
copper, leachable	7440-50-8	E450C	0.5	mg/kg	0.2 mg/kg	99.7	70.0	130	----
iron, leachable	7439-89-6	E450C	50	mg/kg	20 mg/kg	98.2	70.0	130	----
lead, leachable	7439-92-1	E450C	0.5	mg/kg	0.2 mg/kg	102	70.0	130	----
lithium, leachable	7439-93-2	E450C	5	mg/kg	1 mg/kg	99.4	70.0	130	----
manganese, leachable	7439-96-5	E450C	1	mg/kg	0.2 mg/kg	98.4	70.0	130	----
molybdenum, leachable	7439-98-7	E450C	0.5	mg/kg	0.2 mg/kg	101	70.0	130	----
nickel, leachable	7440-02-0	E450C	0.5	mg/kg	0.4 mg/kg	99.5	70.0	130	----
selenium, leachable	7782-49-2	E450C	0.2	mg/kg	0.4 mg/kg	105	70.0	130	----
silver, leachable	7440-22-4	E450C	0.1	mg/kg	0.04 mg/kg	107	70.0	130	----
strontium, leachable	7440-24-6	E450C	0.5	mg/kg	0.2 mg/kg	103	70.0	130	----
thallium, leachable	7440-28-0	E450C	0.05	mg/kg	0.04 mg/kg	103	70.0	130	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Organic Bound Metals (QCLot: 693060) - continued									
tin, leachable	7440-31-5	E450C	2	mg/kg	0.2 mg/kg	96.6	70.0	130	----
titanium, leachable	7440-32-6	E450C	1	mg/kg	0.4 mg/kg	97.8	70.0	130	----
uranium, leachable	7440-61-1	E450C	0.05	mg/kg	0.04 mg/kg	99.5	70.0	130	----
vanadium, leachable	7440-62-2	E450C	0.2	mg/kg	1 mg/kg	98.5	70.0	130	----
zinc, leachable	7440-66-6	E450C	1	mg/kg	4 mg/kg	100	70.0	130	----
Residual Metals (QCLot: 695138)									
aluminum, leachable	7429-90-5	E450D	50	mg/kg	2 mg/kg	100	70.0	130	----
antimony, leachable	7440-36-0	E450D	0.1	mg/kg	0.2 mg/kg	95.3	70.0	130	----
arsenic, leachable	7440-38-2	E450D	0.5	mg/kg	0.2 mg/kg	98.2	70.0	130	----
barium, leachable	7440-39-3	E450D	2	mg/kg	0.2 mg/kg	94.9	70.0	130	----
beryllium, leachable	7440-41-7	E450D	0.2	mg/kg	0.4 mg/kg	99.3	70.0	130	----
bismuth, leachable	7440-69-9	E450D	0.2	mg/kg	0.1 mg/kg	86.7	70.0	130	----
cadmium, leachable	7440-43-9	E450D	0.05	mg/kg	0.04 mg/kg	98.2	70.0	130	----
calcium, leachable	7440-70-2	E450D	50	mg/kg	40 mg/kg	95.7	70.0	130	----
chromium, leachable	7440-47-3	E450D	5	mg/kg	0.4 mg/kg	99.2	70.0	130	----
cobalt, leachable	7440-48-4	E450D	0.1	mg/kg	0.2 mg/kg	99.6	70.0	130	----
copper, leachable	7440-50-8	E450D	0.5	mg/kg	0.2 mg/kg	99.5	70.0	130	----
iron, leachable	7439-89-6	E450D	50	mg/kg	20 mg/kg	97.2	70.0	130	----
lead, leachable	7439-92-1	E450D	0.5	mg/kg	0.2 mg/kg	90.0	70.0	130	----
lithium, leachable	7439-93-2	E450D	5	mg/kg	1 mg/kg	102	70.0	130	----
manganese, leachable	7439-96-5	E450D	5	mg/kg	0.2 mg/kg	103	70.0	130	----
molybdenum, leachable	7439-98-7	E450D	0.5	mg/kg	0.2 mg/kg	94.5	70.0	130	----
nickel, leachable	7440-02-0	E450D	2	mg/kg	0.4 mg/kg	97.9	70.0	130	----
selenium, leachable	7782-49-2	E450D	0.2	mg/kg	0.4 mg/kg	94.9	70.0	130	----
silver, leachable	7440-22-4	E450D	0.1	mg/kg	0.04 mg/kg	100	70.0	130	----
strontium, leachable	7440-24-6	E450D	5	mg/kg	0.2 mg/kg	95.6	70.0	130	----
thallium, leachable	7440-28-0	E450D	0.05	mg/kg	0.04 mg/kg	91.7	70.0	130	----
tin, leachable	7440-31-5	E450D	2	mg/kg	0.2 mg/kg	94.0	70.0	130	----
titanium, leachable	7440-32-6	E450D	5	mg/kg	0.4 mg/kg	98.6	70.0	130	----
uranium, leachable	7440-61-1	E450D	0.05	mg/kg	0.04 mg/kg	90.6	70.0	130	----
vanadium, leachable	7440-62-2	E450D	0.2	mg/kg	1 mg/kg	98.5	70.0	130	----
zinc, leachable	7440-66-6	E450D	1	mg/kg	4 mg/kg	98.7	70.0	130	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 653382)										
CG2212702-001	RG_GHBP_SE-1_2022-09-12_N	acenaphthene	83-32-9	E641A	0.400 mg/kg	0.5 mg/kg	102	50.0	140	----
		acenaphthylene	208-96-8	E641A	0.369 mg/kg	0.5 mg/kg	93.9	50.0	140	----
		acridine	260-94-6	E641A	0.438 mg/kg	0.5 mg/kg	112	50.0	140	----
		anthracene	120-12-7	E641A	0.452 mg/kg	0.5 mg/kg	115	50.0	140	----
		benz(a)anthracene	56-55-3	E641A	0.387 mg/kg	0.5 mg/kg	98.3	50.0	140	----
		benzo(a)pyrene	50-32-8	E641A	0.356 mg/kg	0.5 mg/kg	90.5	50.0	140	----
		benzo(b+j)fluoranthene	n/a	E641A	0.371 mg/kg	0.5 mg/kg	94.3	50.0	140	----
		benzo(g,h,i)perylene	191-24-2	E641A	0.333 mg/kg	0.5 mg/kg	84.6	50.0	140	----
		benzo(k)fluoranthene	207-08-9	E641A	0.364 mg/kg	0.5 mg/kg	92.6	50.0	140	----
		chrysene	218-01-9	E641A	0.349 mg/kg	0.5 mg/kg	88.8	50.0	140	----
		dibenz(a,h)anthracene	53-70-3	E641A	0.355 mg/kg	0.5 mg/kg	90.3	50.0	140	----
		fluoranthene	206-44-0	E641A	0.399 mg/kg	0.5 mg/kg	102	50.0	140	----
		fluorene	86-73-7	E641A	0.507 mg/kg	0.5 mg/kg	129	50.0	140	----
		indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.435 mg/kg	0.5 mg/kg	111	50.0	140	----
		methylnaphthalene, 1-	90-12-0	E641A	ND mg/kg	0.5 mg/kg	ND	50.0	140	----
		methylnaphthalene, 2-	91-57-6	E641A	ND mg/kg	0.5 mg/kg	ND	50.0	140	----
		naphthalene	91-20-3	E641A	0.367 mg/kg	0.5 mg/kg	93.2	50.0	140	----
		phenanthrene	85-01-8	E641A	ND mg/kg	0.5 mg/kg	ND	50.0	140	MS-B
		pyrene	129-00-0	E641A	0.385 mg/kg	0.5 mg/kg	97.8	50.0	140	----
		quinoline	91-22-5	E641A	0.363 mg/kg	0.5 mg/kg	92.3	50.0	140	----

Qualifiers

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	High	Qualifier
Physical Tests (QCLot: 655392)									
	RM	pH (1:2 soil:water)	----	E108	8.06 pH units	99.1	96.0	104	----
Organic / Inorganic Carbon (QCLot: 658653)									
	RM	carbon, total [TC]	----	E351	1.4 %	93.2	80.0	120	----
Organic / Inorganic Carbon (QCLot: 658655)									
	RM	carbon, total [TC]	----	E351	1.4 %	103	80.0	120	----
Organic / Inorganic Carbon (QCLot: 659640)									
	RM	carbon, inorganic [IC]	----	E354	0.383 %	95.4	80.0	120	----
Organic / Inorganic Carbon (QCLot: 659648)									
	RM	carbon, inorganic [IC]	----	E354	0.383 %	96.4	80.0	120	----
Organic / Inorganic Carbon (QCLot: 659916)									
	RM	carbon, inorganic [IC]	----	E354	0.383 %	97.2	80.0	120	----
Metals (QCLot: 655189)									
	RM	mercury	7439-97-6	E510	0.062 mg/kg	99.0	70.0	130	----
Metals (QCLot: 655190)									
	RM	aluminum	7429-90-5	E440	9817 mg/kg	107	70.0	130	----
	RM	antimony	7440-36-0	E440	3.99 mg/kg	99.7	70.0	130	----
	RM	arsenic	7440-38-2	E440	3.73 mg/kg	99.1	70.0	130	----
	RM	barium	7440-39-3	E440	105 mg/kg	103	70.0	130	----
	RM	beryllium	7440-41-7	E440	0.349 mg/kg	110	70.0	130	----
	RM	boron	7440-42-8	E440	8.5 mg/kg	129	40.0	160	----
	RM	cadmium	7440-43-9	E440	0.91 mg/kg	126	70.0	130	----
	RM	calcium	7440-70-2	E440	31082 mg/kg	101	70.0	130	----
	RM	chromium	7440-47-3	E440	101 mg/kg	106	70.0	130	----
	RM	cobalt	7440-48-4	E440	6.9 mg/kg	102	70.0	130	----
	RM	copper	7440-50-8	E440	123 mg/kg	99.9	70.0	130	----
	RM	iron	7439-89-6	E440	23558 mg/kg	102	70.0	130	----
	RM	lead	7439-92-1	E440	267 mg/kg	101	70.0	130	----
	RM	lithium	7439-93-2	E440	9.5 mg/kg	115	70.0	130	----
	RM	magnesium	7439-95-4	E440	5509 mg/kg	102	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 655190) - continued									
	RM	manganese	7439-96-5	E440	269 mg/kg	106	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.03 mg/kg	113	70.0	130	----
	RM	nickel	7440-02-0	E440	26.7 mg/kg	103	70.0	130	----
	RM	phosphorus	7723-14-0	E440	752 mg/kg	98.1	70.0	130	----
	RM	potassium	7440-09-7	E440	1587 mg/kg	114	70.0	130	----
	RM	silver	7440-22-4	E440	4.06 mg/kg	79.8	70.0	130	----
	RM	sodium	7440-23-5	E440	797 mg/kg	110	70.0	130	----
	RM	strontium	7440-24-6	E440	86.1 mg/kg	104	70.0	130	----
	RM	thallium	7440-28-0	E440	0.0786 mg/kg	118	40.0	160	----
	RM	tin	7440-31-5	E440	10.6 mg/kg	114	70.0	130	----
	RM	titanium	7440-32-6	E440	839 mg/kg	113	70.0	130	----
	RM	uranium	7440-61-1	E440	0.52 mg/kg	104	70.0	130	----
	RM	vanadium	7440-62-2	E440	32.7 mg/kg	104	70.0	130	----
	RM	zinc	7440-66-6	E440	297 mg/kg	100	70.0	130	----
	RM	zirconium	7440-67-7	E440	5.73 mg/kg	109	70.0	130	----

Page 1 of 1

Teck

COC ID:	REP_LAEMP_GC_2022-09_ALS	TURNAROUND TIME:	2-3 Business Days	RUSH:	Priorty

PROJECT/CLIENT INFO			
Facility Name / Job#	Regional Effects Program		
Project Manager	Giovanna Diaz		
Email	Giovanna.Diaz@Teck.com		
Address	421 Pine Avenue		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
	1-250-865-3048		

LABORATORY			
Lab Name	ALS Calgary		
Lab Contact	Lyudmyla Shvets		
Email	Lyudmyla.Shvets@ALSGlobal.com		
Address	2559 29 Street NE		
City	Calgary	Province	AB
Postal Code	T1Y 7B5	Country	Canada
Phone Number	403 407 1794		

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDI
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	Lisa.Bowron@minnow.ca	X	X	X
Email 5:	Awiebe@minnow.ca	X	X	X
Email 6:	Giovanna.Diaz@Teck.com	X	X	X
PO number	VPO00816101			

Environmental Division
Calgary
Work Order Reference
CG2212702

Telephone : +1 403 407 1800

Environmental Division
Calgary
Work Order Reference
CG2212702

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field

	Sample ID	Sample Location (sys loc code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	C-TOC-SK	MET-CCME+FULL-CL	MOISTURE-CL - % Moisture	PSA-PIPET-DETAIL-SK Particle Size	PAH-TMB-D/A-MS-CL-PAHs	MET-TESS-STD-VA
								PRESERV.	NONE	NONE	NONE	NONE	NONE	NONE
								Filt.	N	N	N	N	N	N
1	RG_GHBP_SE-1_2022-09-12_N	RG_GHBP	SE		2022/09/12	8:37	G	2	1	1	1	1	1	1
2	RG_GHBP_SE-2_2022-09-12_N	RG_GHBP	SE		2022/09/12	9:55	G	2	1	1	1	1	1	1
3	RG_GHBP_SE-3_2022-09-12_N	RG_GHBP	SE		2022/09/12	11:16	G	2	1	1	1	1	1	1
4	RG_GHBP_SE-4_2022-09-12_N	RG_GHBP	SE		2022/09/12	12:00	G	2	1	1	1	1	1	1
5	RG_GHBP_SE-5_2022-09-12_N	RG_GHBP	SE		2022/09/12	13:45	G	2	1	1	1	1	1	1
6	RG_GANF_SE-1_2022-09-13_N	RG_GANF	SE		2022/09/13	10:20	G	2	1	1	1	1	1	1
7	RG_GANF_SE-2_2022-09-13_N	RG_GANF	SE		2022/09/13	10:45	G	2	1	1	1	1	1	1
8	RG_GANF_SE-3_2022-09-13_N	RG_GANF	SE		2022/09/13	11:45	G	2	1	1	1	1	1	1
9	RG_GANF_SE-4_2022-09-13_N	RG_GANF	SE		2022/09/13	12:30	G	2	1	1	1	1	1	1
10	RG_GANF_SE-5_2022-09-13_N	RG_GANF	SE		2022/09/13	13:08	G	2	1	1	1	1	1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Jennifer Ings/Minnow	##############		9/15 8:50

SERVICE REQUEST (rush - subject to availability)	
Regular (default)	
Priority (2-3 Business days) - 50% surcharge	X
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jennifer Ings	5195003444	
Sampler's Signature	Jennifer Ings	Date/Time	September 14, 2022

ALS Canada Ltd.

right solutions.
right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **CG2213407**	Page	: 1 of 18
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 27-Sep-2022 14:00
PO	: VPO00816101	Date Analysis Commenced	: 30-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 20-Oct-2022 18:26
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Metals, Calgary, Alberta
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Sask Soils, Saskatoon, Saskatchewan
Kelsey Schaefer	Lab Analyst	Organics, Calgary, Alberta
Kevin Baxter		Metals, Calgary, Alberta
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Sorina Motea	Laboratory Analyst	Organics, Calgary, Alberta
Vishnu Patel		Inorganics, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
mg/kg	milligrams per kilogram
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Sample Comments

Sample	Client Id	*Comment*
CG2213407-001	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
CG2213407-003	RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
CG2213407-004	RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
CG2213407-005	RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid)**

Analyte	CAS Number	Method	LOR	Unit	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	RG_GHP_SE-5_LAEMP_GC_2022-09-19_N
				Client sampling date / time	19-Sep-2022 09:15	19-Sep-2022 09:30	19-Sep-2022 09:45	19-Sep-2022 10:00	19-Sep-2022 10:15
					CG2213407-001	CG2213407-002	CG2213407-003	CG2213407-004	CG2213407-005
					Result	Result	Result	Result	Result
Physical Tests									
moisture	----	E144	0.25	%	73.0	69.0	60.5	65.5	61.2
pH (1:2 soil:water)	----	E108	0.10	pH units	7.80	8.09	7.94	8.04	7.85
Particle Size									
grain size curve	----	E185A	-	-	See Attached	See Attached	See Attached	See Attached	See Attached
clay (<0.004mm)	----	EC184A	1.0	%	20.2	19.6	34.6	29.2	34.7
silt (0.063mm - 0.0312mm)	----	EC184A	1.0	%	23.4	15.7	13.0	17.9	13.8
silt (0.0312mm - 0.004mm)	----	EC184A	1.0	%	48.5	40.9	50.9	45.6	50.2
sand (0.125mm - 0.063mm)	----	EC184A	1.0	%	6.8	9.9	1.2	4.8	<1.0
sand (0.25mm - 0.125mm)	----	EC184A	1.0	%	<1.0	8.9	<1.0	2.1	<1.0
sand (0.5mm - 0.25mm)	----	EC184A	1.0	%	<1.0	4.0	<1.0	<1.0	<1.0
sand (1.0mm - 0.50mm)	----	EC184A	1.0	%	<1.0	<1.0	<1.0	<1.0	<1.0
sand (2.0mm - 1.0mm)	----	EC184A	1.0	%	<1.0	<1.0	<1.0	<1.0	<1.0
gravel (>2mm)	----	EC184A	1.0	%	<1.0	<1.0	<1.0	<1.0	<1.0
Organic / Inorganic Carbon									
carbon, total [TC], <63µm	----	E351A	0.050	%	20.1	21.8	19.1	26.7	20.6
carbon, inorganic [IC], <63 µm	----	E354A	0.050	%	2.58	3.02	1.35	1.61	1.86
carbon, total organic [TOC], <63µm	----	EC356A	0.050	%	17.5	18.8	17.8	25.1	18.7
Metals									
aluminum	7429-90-5	E440	50	mg/kg	7280	5120	8320	7180	8840
antimony	7440-36-0	E440	0.10	mg/kg	1.23	1.11	1.25	1.02	1.21
arsenic	7440-38-2	E440	0.10	mg/kg	4.94	3.37	6.30	5.28	6.71
barium	7440-39-3	E440	0.50	mg/kg	400	259	343	294	346
beryllium	7440-41-7	E440	0.10	mg/kg	0.63	0.46	0.83	0.70	0.86
bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0.20	<0.20	0.20
boron	7440-42-8	E440	5.0	mg/kg	5.7	<5.0	5.9	5.6	<5.0
cadmium	7440-43-9	E440	0.020	mg/kg	1.46	1.32	1.40	1.16	1.52
calcium	7440-70-2	E440	50	mg/kg	104000	180000	48300	55700	60300

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	RG_GHP_SE-5_LAEMP_GC_2022-09-19_N
				Client sampling date / time	19-Sep-2022 09:15	19-Sep-2022 09:30	19-Sep-2022 09:45	19-Sep-2022 10:00	19-Sep-2022 10:15
					CG2213407-001	CG2213407-002	CG2213407-003	CG2213407-004	CG2213407-005
					Result	Result	Result	Result	Result
Metals									
chromium	7440-47-3	E440	0.50	mg/kg	11.4	8.18	13.5	10.9	13.7
cobalt	7440-48-4	E440	0.10	mg/kg	8.92	6.85	11.3	8.58	12.2
copper	7440-50-8	E440	0.50	mg/kg	22.2	17.0	26.7	23.5	29.9
iron	7439-89-6	E440	50	mg/kg	11500	7860	14500	11400	14600
lead	7439-92-1	E440	0.50	mg/kg	10.7	8.13	13.7	11.6	14.7
lithium	7439-93-2	E440	2.0	mg/kg	7.2	5.3	8.9	7.8	8.3
magnesium	7439-95-4	E440	20	mg/kg	5900	5620	4920	4440	4880
manganese	7439-96-5	E440	1.0	mg/kg	216	176	530	215	671
mercury	7439-97-6	E510	0.0050	mg/kg	0.0822	0.0628	0.117	0.0933	0.111
molybdenum	7439-98-7	E440	0.10	mg/kg	1.54	1.15	1.68	1.36	1.83
nickel	7440-02-0	E440	0.50	mg/kg	64.5	64.4	66.6	59.0	70.6
phosphorus	7723-14-0	E440	50	mg/kg	847	697	1040	964	1040
potassium	7440-09-7	E440	100	mg/kg	1730	1260	1910	1730	2140
selenium	7782-49-2	E440	0.20	mg/kg	80.9	76.2	16.8	28.6	14.2
silver	7440-22-4	E440	0.10	mg/kg	0.35	0.26	0.45	0.39	0.44
sodium	7440-23-5	E440	50	mg/kg	81	95	66	65	70
strontium	7440-24-6	E440	0.50	mg/kg	83.7	152	59.0	58.8	65.7
sulfur	7704-34-9	E440	1000	mg/kg	6600	3400	1200	1800	1200
thallium	7440-28-0	E440	0.050	mg/kg	0.181	0.113	0.146	0.102	0.118
tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg	9.0	7.4	10.5	8.6	5.9
tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg	2.87	4.16	1.24	1.42	1.25
vanadium	7440-62-2	E440	0.20	mg/kg	26.6	19.5	31.5	28.0	34.4
zinc	7440-66-6	E440	2.0	mg/kg	128	106	138	117	148
zirconium	7440-67-7	E440	1.0	mg/kg	1.8	1.1	<1.0	1.0	<1.0
Polycyclic Aromatic Hydrocarbons									
acenaphthene	83-32-9	E641A	0.050	mg/kg	0.540	0.430	0.435	0.738	0.469
acenaphthylene	208-96-8	E641A	0.050	mg/kg	0.078	0.058	0.066	0.101	0.068

Analytical Results

Sub-Matrix: **Sediment**

(Matrix: **Soil/Solid)**

Analyte	CAS Number	Method	LOR	Unit	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	RG_GHP_SE-5_LAEMP_GC_2022-09-19_N
				Client sampling date / time	19-Sep-2022 09:15	19-Sep-2022 09:30	19-Sep-2022 09:45	19-Sep-2022 10:00	19-Sep-2022 10:15
					CG2213407-001	CG2213407-002	CG2213407-003	CG2213407-004	CG2213407-005
					Result	Result	Result	Result	Result
Polycyclic Aromatic Hydrocarbons									
acridine	260-94-6	E641A	0.050	mg/kg	0.929	0.768	0.802	1.37	0.879
anthracene	120-12-7	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
benz(a)anthracene	56-55-3	E641A	0.050	mg/kg	0.354	0.245	0.260	0.398	0.276
benzo(a)pyrene	50-32-8	E641A	0.050	mg/kg	0.232	0.172	0.173	0.263	0.182
benzo(b+j)fluoranthene	n/a	E641A	0.050	mg/kg	0.857	0.664	0.733	0.979	0.715
benzo(b+j+k)fluoranthene	n/a	E641A	0.075	mg/kg	0.939	0.736	0.833	1.09	0.795
benzo(g,h,i)perylene	191-24-2	E641A	0.050	mg/kg	0.257	0.203	0.217	0.289	0.208
benzo(k)fluoranthene	207-08-9	E641A	0.050	mg/kg	0.082	0.072	0.100	0.110	0.080
chrysene	218-01-9	E641A	0.050	mg/kg	1.85	1.30	1.47	2.04	1.49
dibenz(a,h)anthracene	53-70-3	E641A	0.050	mg/kg	0.157	0.119	0.122	0.173	0.122
fluoranthene	206-44-0	E641A	0.050	mg/kg	0.298	0.197	0.220	0.306	0.229
fluorene	86-73-7	E641A	0.050	mg/kg	1.36	1.12	1.10	2.01	1.26
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.050	mg/kg	0.130	0.098	0.093	0.133	0.096
methylnaphthalene, 1-	90-12-0	E641A	0.030	mg/kg	7.02	5.49	5.48	9.71	5.86
methylnaphthalene, 1+2-	----	E641A	0.050	mg/kg	19.5	15.5	15.0	27.7	16.0
methylnaphthalene, 2-	91-57-6	E641A	0.030	mg/kg	12.5	10.0	9.54	18.0	10.1
naphthalene	91-20-3	E641A	0.010	mg/kg	4.09	3.33	2.98	6.31	3.16
phenanthrene	85-01-8	E641A	0.050	mg/kg	5.25	4.11	4.40	6.90	4.68
pyrene	129-00-0	E641A	0.050	mg/kg	0.540	0.434	0.489	0.680	0.481
quinoline	91-22-5	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.065	mg/kg	0.552	0.414	0.430	0.621	0.438
IACR (CCME)	----	E641A	0.60	-	9.22	7.01	7.76	10.5	7.60
IACR AB (coarse)	----	E641A	0.10	-	0.31	0.24	0.28	0.36	0.26
IACR AB (fine)	----	E641A	0.10	-	0.59	0.46	0.53	0.69	0.50
PAHs, total (BC Sched 3.4)	n/a	E641A	0.20	mg/kg	27.2	21.5	21.2	37.9	22.5
PAHs, total (EPA 16)	n/a	E641A	0.20	mg/kg	16.1	12.6	12.8	21.4	13.5
Polycyclic Aromatic Hydrocarbons Surrogates									
acridine-d9	34749-75-2	E641A	0.1	%	96.3	102	98.8	102	97.2
chrysene-d12	1719-03-5	E641A	0.1	%	119	114	109	112	108

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	RG_GHP_SE-5_LAEMP_GC_2022-09-19_N
Client sampling date / time					19-Sep-2022 09:15	19-Sep-2022 09:30	19-Sep-2022 09:45	19-Sep-2022 10:00	19-Sep-2022 10:15
					CG2213407-001	CG2213407-002	CG2213407-003	CG2213407-004	CG2213407-005
					Result	Result	Result	Result	Result
Polycyclic Aromatic Hydrocarbons Surrogates									
naphthalene-d8	1146-65-2	E641A	0.1	%	82.2	93.3	89.1	84.3	89.2
phenanthrene-d10	1517-22-2	E641A	0.1	%	105	110	109	110	108
Exchangeable & Adsorbed Metals									
aluminum, leachable	7429-90-5	E450	50	mg/kg	<50	<50	<50	<50	<50
antimony, leachable	7440-36-0	E450	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450	0.050	mg/kg	<0.050	<0.050	<0.050	0.067	<0.050
barium, leachable	7440-39-3	E450	0.50	mg/kg	21.4	9.14	22.6	22.9	18.8
beryllium, leachable	7440-41-7	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
bismuth, leachable	7440-69-9	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450	0.050	mg/kg	<0.050	<0.050	0.180	0.092	0.179
calcium, leachable	7440-70-2	E450	50	mg/kg	3910	3360	3600	3160	3340
chromium, leachable	7440-47-3	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
cobalt, leachable	7440-48-4	E450	0.10	mg/kg	0.25	0.18	0.39	0.32	0.30
copper, leachable	7440-50-8	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
iron, leachable	7439-89-6	E450	50	mg/kg	<50	<50	<50	<50	<50
lead, leachable	7439-92-1	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
lithium, leachable	7439-93-2	E450	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450	1.0	mg/kg	17.4	13.2	124	37.3	134
molybdenum, leachable	7439-98-7	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450	0.50	mg/kg	1.63	1.96	1.99	1.83	1.94
phosphorus, leachable	7723-14-0	E450	50	mg/kg	<50	<50	<50	<50	<50
potassium, leachable	7440-09-7	E450	100	mg/kg	110	130	140	160	130
selenium, leachable	7782-49-2	E450	0.20	mg/kg	0.61	1.66	0.31	0.54	0.33
silver, leachable	7440-22-4	E450	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
sodium, leachable	7440-23-5	E450	100	mg/kg	<100	<100	<100	<100	<100
strontium, leachable	7440-24-6	E450	0.50	mg/kg	6.16	5.45	5.61	4.60	5.04
thallium, leachable	7440-28-0	E450	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid)**

Analyte	CAS Number	Method	LOR	Unit	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	RG_GHP_SE-5_LAEMP_GC_2022-09-19_N
				Client sampling date / time	19-Sep-2022 09:15	19-Sep-2022 09:30	19-Sep-2022 09:45	19-Sep-2022 10:00	19-Sep-2022 10:15
					CG2213407-001	CG2213407-002	CG2213407-003	CG2213407-004	CG2213407-005
					Result	Result	Result	Result	Result
Exchangeable & Adsorbed Metals									
uranium, leachable	7440-61-1	E450	0.050	mg/kg	0.517	0.426	0.091	0.173	0.109
vanadium, leachable	7440-62-2	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
zinc, leachable	7440-66-6	E450	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Carbonate Metals									
aluminum, leachable	7429-90-5	E450A	50	mg/kg	<50	<50	<50	<50	<50
antimony, leachable	7440-36-0	E450A	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450A	0.050	mg/kg	0.087	0.121	<0.050	0.119	0.052
barium, leachable	7440-39-3	E450A	2.0	mg/kg	68.4	49.8	56.1	52.6	57.4
beryllium, leachable	7440-41-7	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
bismuth, leachable	7440-69-9	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450A	0.050	mg/kg	0.442	0.335	0.531	0.536	0.623
calcium, leachable	7440-70-2	E450A	50	mg/kg	44000	47200	30500	37400	40800
chromium, leachable	7440-47-3	E450A	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
cobalt, leachable	7440-48-4	E450A	0.10	mg/kg	1.81	1.09	1.32	1.37	1.03
copper, leachable	7440-50-8	E450A	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
iron, leachable	7439-89-6	E450A	50	mg/kg	<50	<50	<50	<50	<50
lead, leachable	7439-92-1	E450A	0.50	mg/kg	<0.50	<0.50	0.59	1.12	<0.50
lithium, leachable	7439-93-2	E450A	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450A	5.0	mg/kg	80.3	63.2	146	70.1	177
molybdenum, leachable	7439-98-7	E450A	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450A	2.0	mg/kg	13.4	11.9	10.9	11.6	11.0
phosphorus, leachable	7723-14-0	E450A	50	mg/kg	<50	<50	<50	<50	<50
selenium, leachable	7782-49-2	E450A	0.20	mg/kg	0.20	0.80	<0.20	0.22	0.20
silver, leachable	7440-22-4	E450A	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
strontium, leachable	7440-24-6	E450A	5.0	mg/kg	26.2	55.2	15.8	17.8	20.0
thallium, leachable	7440-28-0	E450A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450A	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450A	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
uranium, leachable	7440-61-1	E450A	0.050	mg/kg	0.979	1.60	0.214	0.364	0.265

Analytical Results

Sub-Matrix: **Sediment**

(Matrix: **Soil/Solid**)

				Client sample ID	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	RG_GHP_SE-5_LAEMP_GC_2022-09-19_N
				Client sampling date / time	19-Sep-2022 09:15	19-Sep-2022 09:30	19-Sep-2022 09:45	19-Sep-2022 10:00	19-Sep-2022 10:15
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	CG2213407-001	CG2213407-002	CG2213407-003	CG2213407-004	CG2213407-005
					Result	Result	Result	Result	Result
Carbonate Metals									
vanadium, leachable	7440-62-2	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
zinc, leachable	7440-66-6	E450A	1.0	mg/kg	29.3	17.6	17.7	23.9	15.4
Easily Reducible Metals and Iron Oxides									
aluminum, leachable	7429-90-5	E450B	50	mg/kg	435	334	660	645	589
antimony, leachable	7440-36-0	E450B	0.10	mg/kg	0.11	0.13	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450B	0.050	mg/kg	1.45	0.626	0.496	0.888	0.388
barium, leachable	7440-39-3	E450B	0.50	mg/kg	42.3	60.9	51.7	40.1	45.4
beryllium, leachable	7440-41-7	E450B	0.20	mg/kg	0.29	0.22	0.35	0.38	0.36
bismuth, leachable	7440-69-9	E450B	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450B	0.050	mg/kg	0.858	0.797	0.530	0.500	0.527
calcium, leachable	7440-70-2	E450B	50	mg/kg	39400	104000	6140	5700	6820
chromium, leachable	7440-47-3	E450B	0.50	mg/kg	1.39	0.97	0.97	1.03	0.97
cobalt, leachable	7440-48-4	E450B	0.10	mg/kg	3.58	2.74	5.73	3.59	5.74
copper, leachable	7440-50-8	E450B	0.50	mg/kg	0.68	<0.50	0.93	0.86	0.90
iron, leachable	7439-89-6	E450B	50	mg/kg	5310	2300	3810	3870	3460
lead, leachable	7439-92-1	E450B	0.50	mg/kg	5.64	4.41	4.59	4.02	5.06
lithium, leachable	7439-93-2	E450B	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450B	1.0	mg/kg	67.9	59.4	198	56.2	250
molybdenum, leachable	7439-98-7	E450B	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450B	0.50	mg/kg	29.9	30.5	31.7	27.1	30.3
phosphorus, leachable	7723-14-0	E450B	50	mg/kg	52	68	114	125	72
selenium, leachable	7782-49-2	E450B	0.20	mg/kg	5.36	9.58	1.20	1.12	0.91
silver, leachable	7440-22-4	E450B	0.10	mg/kg	<0.10	<0.10	0.14	<0.10	0.13
strontium, leachable	7440-24-6	E450B	0.50	mg/kg	18.5	59.1	6.54	6.52	7.17
thallium, leachable	7440-28-0	E450B	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450B	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450B	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
uranium, leachable	7440-61-1	E450B	0.050	mg/kg	0.582	1.40	0.254	0.256	0.209
vanadium, leachable	7440-62-2	E450B	0.20	mg/kg	4.64	2.71	3.88	3.87	3.69

Analytical Results

Sub-Matrix: **Sediment**

(Matrix: **Soil/Solid**)

				Client sample ID	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	RG_GHP_SE-5_LAEMP_GC_2022-09-19_N
				Client sampling date / time	19-Sep-2022 09:15	19-Sep-2022 09:30	19-Sep-2022 09:45	19-Sep-2022 10:00	19-Sep-2022 10:15
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	CG2213407-001	CG2213407-002	CG2213407-003	CG2213407-004	CG2213407-005
					Result	Result	Result	Result	Result
Easily Reducible Metals and Iron Oxides									
zinc, leachable	7440-66-6	E450B	1.0	mg/kg	66.6	59.4	55.3	43.9	53.3
Organic Bound Metals									
aluminum, leachable	7429-90-5	E450C	50	mg/kg	1510	876	1830	1570	1640
antimony, leachable	7440-36-0	E450C	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450C	0.050	mg/kg	0.823	0.365	0.420	0.370	0.421
barium, leachable	7440-39-3	E450C	0.50	mg/kg	15.5	22.3	28.1	22.3	32.1
beryllium, leachable	7440-41-7	E450C	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
bismuth, leachable	7440-69-9	E450C	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450C	0.050	mg/kg	0.126	0.110	0.101	0.094	0.116
calcium, leachable	7440-70-2	E450C	50	mg/kg	2220	2570	1400	1040	1460
chromium, leachable	7440-47-3	E450C	0.50	mg/kg	3.23	2.22	4.10	3.59	3.61
cobalt, leachable	7440-48-4	E450C	0.10	mg/kg	1.39	0.98	1.12	0.86	1.05
copper, leachable	7440-50-8	E450C	0.50	mg/kg	12.6	9.69	9.69	8.58	9.15
iron, leachable	7439-89-6	E450C	50	mg/kg	2250	1210	1530	1360	1330
lead, leachable	7439-92-1	E450C	0.50	mg/kg	0.72	<0.50	1.04	0.94	1.10
lithium, leachable	7439-93-2	E450C	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450C	1.0	mg/kg	7.4	6.0	15.4	7.3	18.9
molybdenum, leachable	7439-98-7	E450C	0.50	mg/kg	0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450C	0.50	mg/kg	11.8	10.9	10.4	8.87	9.83
selenium, leachable	7782-49-2	E450C	0.20	mg/kg	49.8	51.9	12.1	19.8	11.7
silver, leachable	7440-22-4	E450C	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
strontium, leachable	7440-24-6	E450C	0.50	mg/kg	6.13	4.72	4.86	3.86	4.87
thallium, leachable	7440-28-0	E450C	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450C	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450C	1.0	mg/kg	<1.0	14.4	1.0	1.5	<1.0
uranium, leachable	7440-61-1	E450C	0.050	mg/kg	0.324	0.288	0.356	0.307	0.310
vanadium, leachable	7440-62-2	E450C	0.20	mg/kg	4.61	3.41	5.54	5.00	5.67
zinc, leachable	7440-66-6	E450C	1.0	mg/kg	12.8	7.6	11.6	9.2	11.6
Residual Metals									

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	RG_GHP_SE-5_LAEMP_GC_2022-09-19_N
Client sampling date / time					19-Sep-2022 09:15	19-Sep-2022 09:30	19-Sep-2022 09:45	19-Sep-2022 10:00	19-Sep-2022 10:15
					CG2213407-001	CG2213407-002	CG2213407-003	CG2213407-004	CG2213407-005
					Result	Result	Result	Result	Result
Residual Metals									
aluminum, leachable	7429-90-5	E450D	50	mg/kg	6560	5670	8690	6220	8420
antimony, leachable	7440-36-0	E450D	0.10	mg/kg	0.76	0.84	0.97	0.82	1.05
arsenic, leachable	7440-38-2	E450D	5.00	mg/kg	<5.00	<5.00	5.36	<5.00	5.38
barium, leachable	7440-39-3	E450D	2.0	mg/kg	208	105	172	136	164
beryllium, leachable	7440-41-7	E450D	0.20	mg/kg	0.28	0.28	0.43	0.35	0.44
bismuth, leachable	7440-69-9	E450D	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450D	0.050	mg/kg	<0.050	<0.050	0.097	0.070	0.101
calcium, leachable	7440-70-2	E450D	50	mg/kg	250	322	109	85	97
chromium, leachable	7440-47-3	E450D	5.0	mg/kg	9.2	7.7	12.5	9.3	12.5
cobalt, leachable	7440-48-4	E450D	0.10	mg/kg	1.50	1.64	3.39	2.79	3.61
copper, leachable	7440-50-8	E450D	0.50	mg/kg	9.93	7.62	18.4	16.5	20.2
iron, leachable	7439-89-6	E450D	50	mg/kg	4940	5030	11300	8520	11100
lead, leachable	7439-92-1	E450D	0.50	mg/kg	3.90	2.76	7.98	6.55	8.58
lithium, leachable	7439-93-2	E450D	5.0	mg/kg	<5.0	<5.0	5.8	<5.0	5.3
manganese, leachable	7439-96-5	E450D	5.0	mg/kg	18.8	20.6	44.2	36.9	47.5
molybdenum, leachable	7439-98-7	E450D	0.50	mg/kg	0.58	<0.50	1.24	1.02	1.41
nickel, leachable	7440-02-0	E450D	2.0	mg/kg	6.4	6.5	14.3	11.3	15.4
selenium, leachable	7782-49-2	E450D	0.20	mg/kg	16.6	12.0	3.18	6.05	3.01
silver, leachable	7440-22-4	E450D	0.10	mg/kg	0.30	0.24	0.25	0.30	0.27
strontium, leachable	7440-24-6	E450D	5.0	mg/kg	17.9	15.8	23.4	19.9	27.0
thallium, leachable	7440-28-0	E450D	0.050	mg/kg	0.123	0.126	0.152	0.100	0.157
tin, leachable	7440-31-5	E450D	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450D	5.0	mg/kg	15.9	13.3	16.3	14.6	15.3
uranium, leachable	7440-61-1	E450D	0.050	mg/kg	0.244	0.221	0.380	0.320	0.394
vanadium, leachable	7440-62-2	E450D	0.20	mg/kg	23.8	20.4	33.5	25.9	33.5
zinc, leachable	7440-66-6	E450D	1.0	mg/kg	31.8	34.5	77.6	61.1	80.8

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: Sediment
(Matrix: Soil/Solid)

Analyte	CAS Number	Method	LOR	Unit	RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	----	----	----	----
				Client sampling date / time	20-Sep-2022 09:15	----	----	----	----
					CG2213407-006	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
moisture	----	E144	0.25	%	65.8	----	----	----	----
pH (1:2 soil:water)	----	E108	0.10	pH units	7.95	----	----	----	----
Particle Size									
grain size curve	----	E185A	-	-	See Attached	----	----	----	----
clay (<0.004mm)	----	EC184A	1.0	%	28.8	----	----	----	----
silt (0.063mm - 0.0312mm)	----	EC184A	1.0	%	20.5	----	----	----	----
silt (0.0312mm - 0.004mm)	----	EC184A	1.0	%	47.9	----	----	----	----
sand (0.125mm - 0.063mm)	----	EC184A	1.0	%	1.5	----	----	----	----
sand (0.25mm - 0.125mm)	----	EC184A	1.0	%	<1.0	----	----	----	----
sand (0.5mm - 0.25mm)	----	EC184A	1.0	%	<1.0	----	----	----	----
sand (1.0mm - 0.50mm)	----	EC184A	1.0	%	<1.0	----	----	----	----
sand (2.0mm - 1.0mm)	----	EC184A	1.0	%	<1.0	----	----	----	----
gravel (>2mm)	----	EC184A	1.0	%	<1.0	----	----	----	----
Organic / Inorganic Carbon									
carbon, total [TC], <63µm	----	E351A	0.050	%	28.2	----	----	----	----
carbon, inorganic [IC], <63 µm	----	E354A	0.050	%	2.10	----	----	----	----
carbon, total organic [TOC], <63µm	----	EC356A	0.050	%	26.1	----	----	----	----
Metals									
aluminum	7429-90-5	E440	50	mg/kg	7720	----	----	----	----
antimony	7440-36-0	E440	0.10	mg/kg	1.11	----	----	----	----
arsenic	7440-38-2	E440	0.10	mg/kg	5.77	----	----	----	----
barium	7440-39-3	E440	0.50	mg/kg	285	----	----	----	----
beryllium	7440-41-7	E440	0.10	mg/kg	0.81	----	----	----	----
bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	----	----	----	----
boron	7440-42-8	E440	5.0	mg/kg	<5.0	----	----	----	----
cadmium	7440-43-9	E440	0.020	mg/kg	1.30	----	----	----	----
calcium	7440-70-2	E440	50	mg/kg	72000	----	----	----	----
chromium	7440-47-3	E440	0.50	mg/kg	12.0	----	----	----	----

Analytical Results

Sub-Matrix: **Sediment**

(Matrix: **Soil/Solid)**

				Client sample ID	RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	----	----	----	----
				Client sampling date / time	20-Sep-2022 09:15	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2213407-006	--------	--------	--------	--------
					Result	----	----	----	----
Metals									
cobalt	7440-48-4	E440	0.10	mg/kg	9.74	----	----	----	----
copper	7440-50-8	E440	0.50	mg/kg	25.0	----	----	----	----
iron	7439-89-6	E440	50	mg/kg	11800	----	----	----	----
lead	7439-92-1	E440	0.50	mg/kg	12.3	----	----	----	----
lithium	7439-93-2	E440	2.0	mg/kg	7.8	----	----	----	----
magnesium	7439-95-4	E440	20	mg/kg	4500	----	----	----	----
manganese	7439-96-5	E440	1.0	mg/kg	585	----	----	----	----
mercury	7439-97-6	E510	0.0050	mg/kg	0.0930	----	----	----	----
molybdenum	7439-98-7	E440	0.10	mg/kg	1.59	----	----	----	----
nickel	7440-02-0	E440	0.50	mg/kg	67.4	----	----	----	----
phosphorus	7723-14-0	E440	50	mg/kg	874	----	----	----	----
potassium	7440-09-7	E440	100	mg/kg	1880	----	----	----	----
selenium	7782-49-2	E440	0.20	mg/kg	9.02	----	----	----	----
silver	7440-22-4	E440	0.10	mg/kg	0.40	----	----	----	----
sodium	7440-23-5	E440	50	mg/kg	69	----	----	----	----
strontium	7440-24-6	E440	0.50	mg/kg	67.7	----	----	----	----
sulfur	7704-34-9	E440	1000	mg/kg	1400	----	----	----	----
thallium	7440-28-0	E440	0.050	mg/kg	0.096	----	----	----	----
tin	7440-31-5	E440	2.0	mg/kg	<2.0	----	----	----	----
titanium	7440-32-6	E440	1.0	mg/kg	6.7	----	----	----	----
tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	----	----	----	----
uranium	7440-61-1	E440	0.050	mg/kg	1.08	----	----	----	----
vanadium	7440-62-2	E440	0.20	mg/kg	29.9	----	----	----	----
zinc	7440-66-6	E440	2.0	mg/kg	128	----	----	----	----
zirconium	7440-67-7	E440	1.0	mg/kg	<1.0	----	----	----	----
Polycyclic Aromatic Hydrocarbons									
acenaphthene	83-32-9	E641A	0.050	mg/kg	0.751	----	----	----	----
acenaphthylene	208-96-8	E641A	0.050	mg/kg	0.111	----	----	----	----
acridine	260-94-6	E641A	0.050	mg/kg	1.46	----	----	----	----

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid)**

				Client sample ID	RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	----	----	----	----
				Client sampling date / time	20-Sep-2022 09:15	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	CG2213407-006	--------	--------	--------	--------
					Result	----	----	----	----
Polycyclic Aromatic Hydrocarbons									
anthracene	120-12-7	E641A	0.050	mg/kg	<0.050	----	----	----	----
benz(a)anthracene	56-55-3	E641A	0.050	mg/kg	0.416	----	----	----	----
benzo(a)pyrene	50-32-8	E641A	0.050	mg/kg	0.290	----	----	----	----
benzo(b+j)fluoranthene	n/a	E641A	0.050	mg/kg	0.997	----	----	----	----
benzo(b+j+k)fluoranthene	n/a	E641A	0.075	mg/kg	1.09	----	----	----	----
benzo(g,h,i)perylene	191-24-2	E641A	0.050	mg/kg	0.324	----	----	----	----
benzo(k)fluoranthene	207-08-9	E641A	0.050	mg/kg	0.091	----	----	----	----
chrysene	218-01-9	E641A	0.050	mg/kg	2.21	----	----	----	----
dibenz(a,h)anthracene	53-70-3	E641A	0.050	mg/kg	0.188	----	----	----	----
fluoranthene	206-44-0	E641A	0.050	mg/kg	0.311	----	----	----	----
fluorene	86-73-7	E641A	0.050	mg/kg	2.08	----	----	----	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.050	mg/kg	0.137	----	----	----	----
methylnaphthalene, 1-	90-12-0	E641A	0.030	mg/kg	10.0	----	----	----	----
methylnaphthalene, 1+2-	----	E641A	0.050	mg/kg	28.2	----	----	----	----
methylnaphthalene, 2-	91-57-6	E641A	0.030	mg/kg	18.2	----	----	----	----
naphthalene	91-20-3	E641A	0.010	mg/kg	6.28	----	----	----	----
phenanthrene	85-01-8	E641A	0.050	mg/kg	7.25	----	----	----	----
pyrene	129-00-0	E641A	0.050	mg/kg	0.684	----	----	----	----
quinoline	91-22-5	E641A	0.050	mg/kg	<0.050	----	----	----	----
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.065	mg/kg	0.667	----	----	----	----
IACR (CCME)	----	E641A	0.60	-	10.8	----	----	----	----
IACR AB (coarse)	----	E641A	0.10	-	0.36	----	----	----	----
IACR AB (fine)	----	E641A	0.10	-	0.68	----	----	----	----
PAHs, total (BC Sched 3.4)	n/a	E641A	0.20	mg/kg	38.8	----	----	----	----
PAHs, total (EPA 16)	n/a	E641A	0.20	mg/kg	22.1	----	----	----	----
Polycyclic Aromatic Hydrocarbons Surrogates									
acridine-d9	34749-75-2	E641A	0.1	%	103	----	----	----	----
chrysene-d12	1719-03-5	E641A	0.1	%	116	----	----	----	----
naphthalene-d8	1146-65-2	E641A	0.1	%	96.6	----	----	----	----

Analytical Results

Sub-Matrix: **Sediment**

(Matrix: **Soil/Solid)**

				Client sample ID	RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	----	----	----	----
				Client sampling date / time	20-Sep-2022 09:15	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**CG2213407-006**	--------	--------	--------	--------
					Result	----	----	----	----
Polycyclic Aromatic Hydrocarbons Surrogates									
phenanthrene-d10	1517-22-2	E641A	0.1	%	114	----	----	----	----
Exchangeable & Adsorbed Metals									
aluminum, leachable	7429-90-5	E450	50	mg/kg	<50	----	----	----	----
antimony, leachable	7440-36-0	E450	0.10	mg/kg	<0.10	----	----	----	----
arsenic, leachable	7440-38-2	E450	0.050	mg/kg	<0.050	----	----	----	----
barium, leachable	7440-39-3	E450	0.50	mg/kg	16.4	----	----	----	----
beryllium, leachable	7440-41-7	E450	0.20	mg/kg	<0.20	----	----	----	----
bismuth, leachable	7440-69-9	E450	0.20	mg/kg	<0.20	----	----	----	----
cadmium, leachable	7440-43-9	E450	0.050	mg/kg	0.111	----	----	----	----
calcium, leachable	7440-70-2	E450	50	mg/kg	2960	----	----	----	----
chromium, leachable	7440-47-3	E450	0.50	mg/kg	<0.50	----	----	----	----
cobalt, leachable	7440-48-4	E450	0.10	mg/kg	0.24	----	----	----	----
copper, leachable	7440-50-8	E450	0.50	mg/kg	<0.50	----	----	----	----
iron, leachable	7439-89-6	E450	50	mg/kg	<50	----	----	----	----
lead, leachable	7439-92-1	E450	0.50	mg/kg	<0.50	----	----	----	----
lithium, leachable	7439-93-2	E450	5.0	mg/kg	<5.0	----	----	----	----
manganese, leachable	7439-96-5	E450	1.0	mg/kg	124	----	----	----	----
molybdenum, leachable	7439-98-7	E450	0.50	mg/kg	<0.50	----	----	----	----
nickel, leachable	7440-02-0	E450	0.50	mg/kg	2.31	----	----	----	----
phosphorus, leachable	7723-14-0	E450	50	mg/kg	<50	----	----	----	----
potassium, leachable	7440-09-7	E450	100	mg/kg	140	----	----	----	----
selenium, leachable	7782-49-2	E450	0.20	mg/kg	0.25	----	----	----	----
silver, leachable	7440-22-4	E450	0.10	mg/kg	<0.10	----	----	----	----
sodium, leachable	7440-23-5	E450	100	mg/kg	<100	----	----	----	----
strontium, leachable	7440-24-6	E450	0.50	mg/kg	4.20	----	----	----	----
thallium, leachable	7440-28-0	E450	0.050	mg/kg	<0.050	----	----	----	----
tin, leachable	7440-31-5	E450	2.0	mg/kg	<2.0	----	----	----	----
titanium, leachable	7440-32-6	E450	1.0	mg/kg	<1.0	----	----	----	----
uranium, leachable	7440-61-1	E450	0.050	mg/kg	0.078	----	----	----	----

Analytical Results

Sub-Matrix: **Sediment**

(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	----	----	----	----
				Client sampling date / time	20-Sep-2022 09:15	----	----	----	----
					CG2213407-006	--------	--------	--------	--------
					Result	----	----	----	----
Exchangeable & Adsorbed Metals									
vanadium, leachable	7440-62-2	E450	0.20	mg/kg	<0.20	----	----	----	----
zinc, leachable	7440-66-6	E450	1.0	mg/kg	<1.0	----	----	----	----
Carbonate Metals									
aluminum, leachable	7429-90-5	E450A	50	mg/kg	<50	----	----	----	----
antimony, leachable	7440-36-0	E450A	0.10	mg/kg	<0.10	----	----	----	----
arsenic, leachable	7440-38-2	E450A	0.050	mg/kg	<0.050	----	----	----	----
barium, leachable	7440-39-3	E450A	2.0	mg/kg	51.4	----	----	----	----
beryllium, leachable	7440-41-7	E450A	0.20	mg/kg	<0.20	----	----	----	----
bismuth, leachable	7440-69-9	E450A	0.20	mg/kg	<0.20	----	----	----	----
cadmium, leachable	7440-43-9	E450A	0.050	mg/kg	0.570	----	----	----	----
calcium, leachable	7440-70-2	E450A	50	mg/kg	44200	----	----	----	----
chromium, leachable	7440-47-3	E450A	5.0	mg/kg	<5.0	----	----	----	----
cobalt, leachable	7440-48-4	E450A	0.10	mg/kg	0.78	----	----	----	----
copper, leachable	7440-50-8	E450A	0.50	mg/kg	<0.50	----	----	----	----
iron, leachable	7439-89-6	E450A	50	mg/kg	<50	----	----	----	----
lead, leachable	7439-92-1	E450A	0.50	mg/kg	<0.50	----	----	----	----
lithium, leachable	7439-93-2	E450A	5.0	mg/kg	<5.0	----	----	----	----
manganese, leachable	7439-96-5	E450A	5.0	mg/kg	141	----	----	----	----
molybdenum, leachable	7439-98-7	E450A	0.50	mg/kg	<0.50	----	----	----	----
nickel, leachable	7440-02-0	E450A	2.0	mg/kg	12.0	----	----	----	----
phosphorus, leachable	7723-14-0	E450A	50	mg/kg	<50	----	----	----	----
selenium, leachable	7782-49-2	E450A	0.20	mg/kg	<0.20	----	----	----	----
silver, leachable	7440-22-4	E450A	0.10	mg/kg	<0.10	----	----	----	----
strontium, leachable	7440-24-6	E450A	5.0	mg/kg	19.6	----	----	----	----
thallium, leachable	7440-28-0	E450A	0.050	mg/kg	<0.050	----	----	----	----
tin, leachable	7440-31-5	E450A	2.0	mg/kg	<2.0	----	----	----	----
titanium, leachable	7440-32-6	E450A	5.0	mg/kg	<5.0	----	----	----	----
uranium, leachable	7440-61-1	E450A	0.050	mg/kg	0.246	----	----	----	----
vanadium, leachable	7440-62-2	E450A	0.20	mg/kg	<0.20	----	----	----	----

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

				Client sample ID	RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	----	----	----	----
				Client sampling date / time	20-Sep-2022 09:15	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2213407-006	--------	--------	--------	--------
					Result	----	----	----	----
Carbonate Metals									
zinc, leachable	7440-66-6	E450A	1.0	mg/kg	16.7	----	----	----	----
Easily Reducible Metals and Iron Oxides									
aluminum, leachable	7429-90-5	E450B	50	mg/kg	584	----	----	----	----
antimony, leachable	7440-36-0	E450B	0.10	mg/kg	<0.10	----	----	----	----
arsenic, leachable	7440-38-2	E450B	0.050	mg/kg	0.438	----	----	----	----
barium, leachable	7440-39-3	E450B	0.50	mg/kg	33.4	----	----	----	----
beryllium, leachable	7440-41-7	E450B	0.20	mg/kg	0.32	----	----	----	----
bismuth, leachable	7440-69-9	E450B	0.20	mg/kg	<0.20	----	----	----	----
cadmium, leachable	7440-43-9	E450B	0.050	mg/kg	0.425	----	----	----	----
calcium, leachable	7440-70-2	E450B	50	mg/kg	8950	----	----	----	----
chromium, leachable	7440-47-3	E450B	0.50	mg/kg	0.94	----	----	----	----
cobalt, leachable	7440-48-4	E450B	0.10	mg/kg	4.76	----	----	----	----
copper, leachable	7440-50-8	E450B	0.50	mg/kg	0.72	----	----	----	----
iron, leachable	7439-89-6	E450B	50	mg/kg	3450	----	----	----	----
lead, leachable	7439-92-1	E450B	0.50	mg/kg	4.62	----	----	----	----
lithium, leachable	7439-93-2	E450B	5.0	mg/kg	<5.0	----	----	----	----
manganese, leachable	7439-96-5	E450B	1.0	mg/kg	228	----	----	----	----
molybdenum, leachable	7439-98-7	E450B	0.50	mg/kg	<0.50	----	----	----	----
nickel, leachable	7440-02-0	E450B	0.50	mg/kg	30.8	----	----	----	----
phosphorus, leachable	7723-14-0	E450B	50	mg/kg	100	----	----	----	----
selenium, leachable	7782-49-2	E450B	0.20	mg/kg	0.62	----	----	----	----
silver, leachable	7440-22-4	E450B	0.10	mg/kg	0.11	----	----	----	----
strontium, leachable	7440-24-6	E450B	0.50	mg/kg	8.17	----	----	----	----
thallium, leachable	7440-28-0	E450B	0.050	mg/kg	<0.050	----	----	----	----
tin, leachable	7440-31-5	E450B	2.0	mg/kg	<2.0	----	----	----	----
titanium, leachable	7440-32-6	E450B	1.0	mg/kg	<1.0	----	----	----	----
uranium, leachable	7440-61-1	E450B	0.050	mg/kg	0.170	----	----	----	----
vanadium, leachable	7440-62-2	E450B	0.20	mg/kg	3.54	----	----	----	----
zinc, leachable	7440-66-6	E450B	1.0	mg/kg	51.6	----	----	----	----

Analytical Results

Sub-Matrix: **Sediment**

(Matrix: **Soil/Solid**)

				Client sample ID	RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	----	----	----	----
				Client sampling date / time	20-Sep-2022 09:15	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	CG2213407-006	--------	--------	--------	--------
					Result	----	----	----	----
Organic Bound Metals									
aluminum, leachable	7429-90-5	E450C	50	mg/kg	1420	----	----	----	----
antimony, leachable	7440-36-0	E450C	0.10	mg/kg	<0.10	----	----	----	----
arsenic, leachable	7440-38-2	E450C	0.050	mg/kg	0.434	----	----	----	----
barium, leachable	7440-39-3	E450C	0.50	mg/kg	30.3	----	----	----	----
beryllium, leachable	7440-41-7	E450C	0.20	mg/kg	<0.20	----	----	----	----
bismuth, leachable	7440-69-9	E450C	0.20	mg/kg	<0.20	----	----	----	----
cadmium, leachable	7440-43-9	E450C	0.050	mg/kg	0.105	----	----	----	----
calcium, leachable	7440-70-2	E450C	50	mg/kg	1280	----	----	----	----
chromium, leachable	7440-47-3	E450C	0.50	mg/kg	3.07	----	----	----	----
cobalt, leachable	7440-48-4	E450C	0.10	mg/kg	0.76	----	----	----	----
copper, leachable	7440-50-8	E450C	0.50	mg/kg	7.79	----	----	----	----
iron, leachable	7439-89-6	E450C	50	mg/kg	1140	----	----	----	----
lead, leachable	7439-92-1	E450C	0.50	mg/kg	0.95	----	----	----	----
lithium, leachable	7439-93-2	E450C	5.0	mg/kg	<5.0	----	----	----	----
manganese, leachable	7439-96-5	E450C	1.0	mg/kg	13.4	----	----	----	----
molybdenum, leachable	7439-98-7	E450C	0.50	mg/kg	<0.50	----	----	----	----
nickel, leachable	7440-02-0	E450C	0.50	mg/kg	8.24	----	----	----	----
selenium, leachable	7782-49-2	E450C	0.20	mg/kg	6.80	----	----	----	----
silver, leachable	7440-22-4	E450C	0.10	mg/kg	<0.10	----	----	----	----
strontium, leachable	7440-24-6	E450C	0.50	mg/kg	4.23	----	----	----	----
thallium, leachable	7440-28-0	E450C	0.050	mg/kg	<0.050	----	----	----	----
tin, leachable	7440-31-5	E450C	2.0	mg/kg	<2.0	----	----	----	----
titanium, leachable	7440-32-6	E450C	1.0	mg/kg	10.1	----	----	----	----
uranium, leachable	7440-61-1	E450C	0.050	mg/kg	0.246	----	----	----	----
vanadium, leachable	7440-62-2	E450C	0.20	mg/kg	5.12	----	----	----	----
zinc, leachable	7440-66-6	E450C	1.0	mg/kg	9.8	----	----	----	----
Residual Metals									
aluminum, leachable	7429-90-5	E450D	50	mg/kg	6970	----	----	----	----
antimony, leachable	7440-36-0	E450D	0.10	mg/kg	0.79	----	----	----	----

Analytical Results

Sub-Matrix: **Sediment**

(Matrix: **Soil/Solid)**

				Client sample ID	RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	----	----	----	----
				Client sampling date / time	20-Sep-2022 09:15	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**CG2213407-006**	--------	--------	--------	--------
					Result	----	----	----	----
Residual Metals									
arsenic, leachable	7440-38-2	E450D	5.00	mg/kg	<5.00	----	----	----	----
barium, leachable	7440-39-3	E450D	2.0	mg/kg	124	----	----	----	----
beryllium, leachable	7440-41-7	E450D	0.20	mg/kg	0.39	----	----	----	----
bismuth, leachable	7440-69-9	E450D	0.20	mg/kg	<0.20	----	----	----	----
cadmium, leachable	7440-43-9	E450D	0.050	mg/kg	0.072	----	----	----	----
calcium, leachable	7440-70-2	E450D	50	mg/kg	90	----	----	----	----
chromium, leachable	7440-47-3	E450D	5.0	mg/kg	10.2	----	----	----	----
cobalt, leachable	7440-48-4	E450D	0.10	mg/kg	2.85	----	----	----	----
copper, leachable	7440-50-8	E450D	0.50	mg/kg	17.0	----	----	----	----
iron, leachable	7439-89-6	E450D	50	mg/kg	8550	----	----	----	----
lead, leachable	7439-92-1	E450D	0.50	mg/kg	6.35	----	----	----	----
lithium, leachable	7439-93-2	E450D	5.0	mg/kg	<5.0	----	----	----	----
manganese, leachable	7439-96-5	E450D	5.0	mg/kg	39.0	----	----	----	----
molybdenum, leachable	7439-98-7	E450D	0.50	mg/kg	1.00	----	----	----	----
nickel, leachable	7440-02-0	E450D	2.0	mg/kg	11.7	----	----	----	----
selenium, leachable	7782-49-2	E450D	0.20	mg/kg	1.67	----	----	----	----
silver, leachable	7440-22-4	E450D	0.10	mg/kg	0.20	----	----	----	----
strontium, leachable	7440-24-6	E450D	5.0	mg/kg	23.7	----	----	----	----
thallium, leachable	7440-28-0	E450D	0.050	mg/kg	0.091	----	----	----	----
tin, leachable	7440-31-5	E450D	2.0	mg/kg	<2.0	----	----	----	----
titanium, leachable	7440-32-6	E450D	5.0	mg/kg	12.1	----	----	----	----
uranium, leachable	7440-61-1	E450D	0.050	mg/kg	0.300	----	----	----	----
vanadium, leachable	7440-62-2	E450D	0.20	mg/kg	27.8	----	----	----	----
zinc, leachable	7440-66-6	E450D	1.0	mg/kg	65.4	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

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QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2213407**	Page	:
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 27-Sep-2022 14:00
PO	: VPO00816101	Issue Date	: 20-Oct-2022 18:27
C-O-C number	: REP_LAEMP_GC_2022-09_ALS		
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- Method Blank value outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Method Blank (MB) Values								
Exchangeable & Adsorbed Metals	QC-695314-001	----	barium, leachable	7440-39-3	E450	0.63 B mg/kg	0.5 mg/kg	Blank result exceeds permitted value

Result Qualifiers

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
Glass soil jar/Teflon lined cap RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	E450A	20-Sep-2022	14-Oct-2022	----	----		15-Oct-2022	180 days	25 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
Glass soil jar/Teflon lined cap RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	E450A	19-Sep-2022	14-Oct-2022	----	----		15-Oct-2022	180 days	26 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
Glass soil jar/Teflon lined cap RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	E450A	19-Sep-2022	14-Oct-2022	----	----		15-Oct-2022	180 days	26 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
Glass soil jar/Teflon lined cap RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	E450A	19-Sep-2022	14-Oct-2022	----	----		15-Oct-2022	180 days	26 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
Glass soil jar/Teflon lined cap RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	E450A	19-Sep-2022	14-Oct-2022	----	----		15-Oct-2022	180 days	26 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
Glass soil jar/Teflon lined cap RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	E450A	19-Sep-2022	14-Oct-2022	----	----		15-Oct-2022	180 days	26 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
Glass soil jar/Teflon lined cap RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	E450B	20-Sep-2022	15-Oct-2022	----	----		16-Oct-2022	180 days	26 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
Glass soil jar/Teflon lined cap RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	E450B	19-Sep-2022	15-Oct-2022	----	----		16-Oct-2022	180 days	27 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
Glass soil jar/Teflon lined cap RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	E450B	19-Sep-2022	15-Oct-2022	----	----		16-Oct-2022	180 days	27 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
Glass soil jar/Teflon lined cap RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	E450B	19-Sep-2022	15-Oct-2022	----	----		16-Oct-2022	180 days	27 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
Glass soil jar/Teflon lined cap RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	E450B	19-Sep-2022	15-Oct-2022	----	----		16-Oct-2022	180 days	27 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
Glass soil jar/Teflon lined cap RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	E450B	19-Sep-2022	15-Oct-2022	----	----		16-Oct-2022	180 days	27 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
Glass soil jar/Teflon lined cap RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	E450	20-Sep-2022	13-Oct-2022	----	----		14-Oct-2022	180 days	25 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
Glass soil jar/Teflon lined cap RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	E450	19-Sep-2022	13-Oct-2022	----	----		14-Oct-2022	180 days	26 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
Glass soil jar/Teflon lined cap RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	E450	19-Sep-2022	13-Oct-2022	----	----		14-Oct-2022	180 days	26 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
Glass soil jar/Teflon lined cap RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	E450	19-Sep-2022	13-Oct-2022	----	----		14-Oct-2022	180 days	26 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
Glass soil jar/Teflon lined cap RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	E450	19-Sep-2022	13-Oct-2022	----	----		14-Oct-2022	180 days	26 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
Glass soil jar/Teflon lined cap RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	E450	19-Sep-2022	13-Oct-2022	----	----		14-Oct-2022	180 days	26 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	E510	19-Sep-2022	04-Oct-2022	----	----		05-Oct-2022	28 days	16 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	E510	19-Sep-2022	04-Oct-2022	----	----		05-Oct-2022	28 days	16 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	E510	20-Sep-2022	04-Oct-2022	----	----		05-Oct-2022	28 days	16 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	E510	19-Sep-2022	04-Oct-2022	----	----		05-Oct-2022	28 days	17 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	E510	19-Sep-2022	04-Oct-2022	----	----		05-Oct-2022	28 days	17 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	E510	19-Sep-2022	04-Oct-2022	----	----		05-Oct-2022	28 days	17 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	E440	19-Sep-2022	04-Oct-2022	----	----		05-Oct-2022	180 days	16 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	E440	19-Sep-2022	04-Oct-2022	----	----		05-Oct-2022	180 days	16 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	E440	20-Sep-2022	04-Oct-2022	----	----		05-Oct-2022	180 days	16 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	E440	19-Sep-2022	04-Oct-2022	----	----		05-Oct-2022	180 days	17 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	E440	19-Sep-2022	04-Oct-2022	----	----		05-Oct-2022	180 days	17 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	E440	19-Sep-2022	04-Oct-2022	----	----		05-Oct-2022	180 days	17 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion (<63 µm)										
LDPE bag RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	E351A	19-Sep-2022	08-Oct-2022	----	----		08-Oct-2022	----	0 days	
Organic / Inorganic Carbon : Total Carbon by Combustion (<63 µm)										
LDPE bag RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	E351A	19-Sep-2022	08-Oct-2022	----	----		08-Oct-2022	----	0 days	
Organic / Inorganic Carbon : Total Carbon by Combustion (<63 µm)										
LDPE bag RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	E351A	19-Sep-2022	08-Oct-2022	----	----		08-Oct-2022	----	0 days	
Organic / Inorganic Carbon : Total Carbon by Combustion (<63 µm)										
LDPE bag RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	E351A	19-Sep-2022	08-Oct-2022	----	----		08-Oct-2022	----	0 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Organic / Inorganic Carbon : Total Carbon by Combustion (<63 µm)										
LDPE bag RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	E351A	19-Sep-2022	08-Oct-2022	----	----		08-Oct-2022	----	0 days	
Organic / Inorganic Carbon : Total Carbon by Combustion (<63 µm)										
LDPE bag RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	E351A	20-Sep-2022	08-Oct-2022	----	----		08-Oct-2022	----	0 days	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve (<63 µm)										
LDPE bag RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	E354A	19-Sep-2022	----	----	----		12-Oct-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve (<63 µm)										
LDPE bag RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	E354A	19-Sep-2022	----	----	----		12-Oct-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve (<63 µm)										
LDPE bag RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	E354A	19-Sep-2022	----	----	----		12-Oct-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve (<63 µm)										
LDPE bag RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	E354A	19-Sep-2022	----	----	----		12-Oct-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve (<63 µm)										
LDPE bag RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	E354A	19-Sep-2022	----	----	----		12-Oct-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve (<63 µm)										
LDPE bag RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	E354A	20-Sep-2022	----	----	----		12-Oct-2022	----	----	
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
Glass soil jar/Teflon lined cap RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	E450C	20-Sep-2022	18-Oct-2022	----	----		19-Oct-2022	180 days	29 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
Glass soil jar/Teflon lined cap RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	E450C	19-Sep-2022	18-Oct-2022	----	----		19-Oct-2022	180 days	30 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
Glass soil jar/Teflon lined cap RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	E450C	19-Sep-2022	18-Oct-2022	----	----		19-Oct-2022	180 days	30 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
Glass soil jar/Teflon lined cap RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	E450C	19-Sep-2022	18-Oct-2022	----	----		19-Oct-2022	180 days	30 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
Glass soil jar/Teflon lined cap RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	E450C	19-Sep-2022	18-Oct-2022	----	----		19-Oct-2022	180 days	30 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
Glass soil jar/Teflon lined cap RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	E450C	19-Sep-2022	18-Oct-2022	----	----		19-Oct-2022	180 days	30 days	✓
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	E185A	19-Sep-2022	----	----	----		12-Oct-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	E185A	19-Sep-2022	----	----	----		08-Oct-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	E185A	19-Sep-2022	----	----	----		12-Oct-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	E185A	19-Sep-2022	----	----	----		12-Oct-2022	365 days	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag										
RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	E185A	19-Sep-2022	----	----	----		12-Oct-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag										
RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	E185A	20-Sep-2022	----	----	----		08-Oct-2022	365 days	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	E144	19-Sep-2022	----	----	----		04-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	E144	19-Sep-2022	----	----	----		04-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	E144	19-Sep-2022	----	----	----		04-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	E144	19-Sep-2022	----	----	----		04-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	E144	19-Sep-2022	----	----	----		04-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	E144	20-Sep-2022	----	----	----		04-Oct-2022	----	----	
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	E108	20-Sep-2022	05-Oct-2022	----	----		05-Oct-2022	30 days	15 days	✓

Matrix: **Soil/Solid**

Evaluation: ✘ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	E108	19-Sep-2022	05-Oct-2022	----	----		05-Oct-2022	30 days	16 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	E108	19-Sep-2022	05-Oct-2022	----	----		05-Oct-2022	30 days	16 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	E108	19-Sep-2022	05-Oct-2022	----	----		05-Oct-2022	30 days	16 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	E108	19-Sep-2022	05-Oct-2022	----	----		05-Oct-2022	30 days	16 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	E108	19-Sep-2022	05-Oct-2022	----	----		05-Oct-2022	30 days	16 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	E641A	20-Sep-2022	04-Oct-2022	14 days	14 days	✓	04-Oct-2022	40 days	0 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	E641A	19-Sep-2022	04-Oct-2022	14 days	15 days	✘ EHT	04-Oct-2022	40 days	0 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	E641A	19-Sep-2022	04-Oct-2022	14 days	15 days	✘ EHT	04-Oct-2022	40 days	0 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	E641A	19-Sep-2022	04-Oct-2022	14 days	15 days	✘ EHT	04-Oct-2022	40 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	E641A	19-Sep-2022	04-Oct-2022	14 days	15 days	× EHT	04-Oct-2022	40 days	0 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	E641A	19-Sep-2022	04-Oct-2022	14 days	15 days	× EHT	04-Oct-2022	40 days	0 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
Glass soil jar/Teflon lined cap RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	E450D	20-Sep-2022	19-Oct-2022	----	----		20-Oct-2022	180 days	30 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
Glass soil jar/Teflon lined cap RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	E450D	19-Sep-2022	19-Oct-2022	----	----		20-Oct-2022	180 days	31 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
Glass soil jar/Teflon lined cap RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	E450D	19-Sep-2022	19-Oct-2022	----	----		20-Oct-2022	180 days	31 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
Glass soil jar/Teflon lined cap RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	E450D	19-Sep-2022	19-Oct-2022	----	----		20-Oct-2022	180 days	31 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
Glass soil jar/Teflon lined cap RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	E450D	19-Sep-2022	19-Oct-2022	----	----		20-Oct-2022	180 days	31 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
Glass soil jar/Teflon lined cap RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	E450D	19-Sep-2022	19-Oct-2022	----	----		20-Oct-2022	180 days	31 days	✓

Legend & Qualifier Definitions

EHT: Exceeded ALS recommended hold time prior to analysis.

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Duplicates (DUP)							
Mercury in Soil/Solid by CVAAS	E510	680465	1	19	5.2	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #1)	E450	695314	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #2)	E450A	697168	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #3)	E450B	697833	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #4)	E450C	702272	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction RM)	E450D	704532	1	12	8.3	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	680466	1	19	5.2	5.0	✓
Moisture Content by Gravimetry	E144	679063	1	6	16.6	5.0	✓
PAHs by Hex:Ace GC-MS	E641A	679062	1	6	16.6	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	681792	1	6	16.6	5.0	✓
Total Carbon by Combustion (<63 µm)	E351A	686565	1	15	6.6	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve (<63 µm)	E354A	691434	1	13	7.6	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Soil/Solid by CVAAS	E510	680465	2	19	10.5	10.0	✓
Metals by CRC ICPMS (Tessier Extraction #1)	E450	695314	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #2)	E450A	697168	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #3)	E450B	697833	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #4)	E450C	702272	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction RM)	E450D	704532	1	12	8.3	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	680466	2	19	10.5	10.0	✓
Moisture Content by Gravimetry	E144	679063	1	6	16.6	5.0	✓
PAHs by Hex:Ace GC-MS	E641A	679062	1	6	16.6	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	681792	2	6	33.3	10.0	✓
Total Carbon by Combustion (<63 µm)	E351A	686565	2	15	13.3	10.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve (<63 µm)	E354A	691434	2	13	15.3	10.0	✓
Method Blanks (MB)							
Mercury in Soil/Solid by CVAAS	E510	680465	1	19	5.2	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #1)	E450	695314	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #2)	E450A	697168	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #3)	E450B	697833	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #4)	E450C	702272	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction RM)	E450D	704532	1	12	8.3	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	680466	1	19	5.2	5.0	✓
Moisture Content by Gravimetry	E144	679063	1	6	16.6	5.0	✓
PAHs by Hex:Ace GC-MS	E641A	679062	1	6	16.6	5.0	✓

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
Total Carbon by Combustion (<63 µm)	E351A	686565	1	15	6.6	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve (<63 µm)	E354A	691434	1	13	7.6	5.0	✓
Matrix Spikes (MS)							
PAHs by Hex:Ace GC-MS	E641A	679062	1	6	16.6	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
pH by Meter (1:2 Soil:Water Extraction)	E108 Calgary - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
Moisture Content by Gravimetry	E144 Calgary - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Grain Size Report (Attachment) Pipet/Sieve Method	E185A Saskatoon - Environmental	Soil/Solid	SSIR-51 Method 3.2.1	A grain size curve is a graphical representation of the particle sizing of a sample representing the percent passing against the effective particle size.
Total Carbon by Combustion (<63 µm)	E351A Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2 (mod)	Total Carbon is determined on a sample which is first sieved through a 63 µm sieve prior to analysis by the high temperature combustion method with measurement by an infrared detector.
Total Inorganic Carbon by Acetic Acid pH Standard Curve (<63 µm)	E354A Saskatoon - Environmental	Soil/Solid	CSSS (2008) 20.2	Total Inorganic Carbon is determined on a sample which is first sieved through a 63 µm sieve prior to analysis by acetic acid pH standard curve, where a known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.
Metals in Soil/Solid by CRC ICPMS	E440 Calgary - Environmental	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals by CRC ICPMS (Tessier Extraction #1)	E450 Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by Collision/Reaction Cell ICPMS. Note: For Extraction #1, the extraction solution is 1M Magnesium Chloride and is intended to extract the "Exchangeable and Adsorbed" metals.
Metals by CRC ICPMS (Tessier Extraction #2)	E450A Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by collision cell ICPMS. Note: For Extraction #2, the extraction solution is 1M Sodium Acetate adjusted to pH 5 and is intended to extract the "Carbonate" metals.
Metals by CRC ICPMS (Tessier Extraction #3)	E450B Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by CRC ICPMS.Note: For Extraction #3, the extraction solution is 0.1 M Hydroxylamine Hydro- Chloride in 25% v/v Acetic Acid and is intended to extract the Easily Reducible Metals and Iron Oxides.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals by CRC ICPMS (Tessier Extraction #4)	E450C Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by Collision Reaction Cell ICPMS. Note: For Extraction #4, the extraction solution is 0.02 M Nitric Acid followed by 3.2M Ammonium Acetate and is intended to extract the Organic Bound metals.
Metals by CRC ICPMS (Tessier Extraction RM)	E450D Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with up to 6 different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by CRC ICPMS. Note: For the Tessier "RM" Extraction, the extraction solution is 50/50 mix of 1:1 Nitric Acid along with 1:1 Hydrochloric Acid, and is hot block digested as per the BC SALM procedure. This is intended to extract the Residual metals.
Mercury in Soil/Solid by CVAAS	E510 Calgary - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
PAHs by Hex:Ace GC-MS	E641A Calgary - Environmental	Soil/Solid	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are extracted with hexane/acetone and analyzed by GC-MS. If reported, IACR (index of additive cancer risk, unitless) and B(a)P toxic potency equivalent (in soil concentration units) are calculated as per CCME PAH Soil Quality Guidelines fact sheet (2010) or ABT1.
Particle Size Analysis (Pipette) - Wentworth Classification	EC184A Saskatoon - Environmental	Soil/Solid	Modified Wentworth	The particle size determination is performed by various methods to generate a Grain Size curve. The data from the curve is then used to produce particle size ranges based on the Modified Wentworth Classification system.
Total Organic Carbon (Calculated) in soil (<63 µm)	EC356A Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2	Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon (TIC) analyzed on material passing a 63 µm sieve.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Calgary - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Digestion for Metals and Mercury	EP440 Calgary - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available.
Extraction of Metals for CRC ICPMS (Tessier - EA)	EP450 Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by Collision/Reaction Cell ICPMS. Note: For Extraction #1, the extraction solution is 1M Magnesium Chloride and is intended to extract the "Exchangeable and Adsorbed" metals.
Extraction of Metals for CRC ICPMS (Tessier - CM)	EP450A Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by collision cell ICPMS. Note: For Extraction #2, the extraction solution is 1M Sodium Acetate adjusted to pH 5 and is intended to extract the "Carbonate" metals.
Extraction of Metals for CRC ICPMS (Tessier-FEO)	EP450B Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by CRC ICPMS.Note: For Extraction #3, the extraction solution is 0.1 M Hydroxylamine Hydro- Chloride in 25% v/v Acetic Acid and is intended to extract the Easily Reducible Metals and Iron Oxides.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Extraction of Metals for CRC ICPMS (Tessier - OB)	EP450C Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	"This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by Collision Reaction Cell ICPMS. Note: For Extraction #4, the extraction solution is 0.02 M Nitric Acid followed by 3.2M Ammonium Acetate and is intended to extract the Organic Bound metals.
Extraction of Metals for CRC ICPMS (Tessier - RM)	EP450D Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	"This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with up to 6 different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by CRC ICPMS. Note: For the Tessier "RM" Extraction, the extraction solution is 50/50 mix of 1:1 Nitric Acid along with 1:1 Hydrochloric Acid, and is hot block digested as per the BC SALM procedure. This is intended to extract the Residual metals.
PHCs and PAHs Hexane-Acetone Tumbler Extraction	EP601 Calgary - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1 (mod)	Samples are subsampled and Petroleum Hydrocarbons (PHC) and PAHs are extracted with 1:1 hexane:acetone using a rotary extractor.
Dry and Grind in Soil/Solid <60°C	EPP442 Calgary - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **CG2213407**	Page	: 1 of 25
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	:	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 27-Sep-2022 14:00
PO	: VPO00816101	Date Analysis Commenced	: 30-Sep-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 20-Oct-2022 18:27
Sampler	: Jennifer Ings ----		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Calgary Metals, Calgary, Alberta
Hedy Lai	Team Leader - Inorganics	Saskatoon Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Saskatoon Sask Soils, Saskatoon, Saskatchewan
Kelsey Schaefer	Lab Analyst	Calgary Organics, Calgary, Alberta
Kevin Baxter		Calgary Metals, Calgary, Alberta
Robin Weeks	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia
Sorina Motea	Laboratory Analyst	Calgary Organics, Calgary, Alberta
Vishnu Patel		Calgary Inorganics, Calgary, Alberta

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 679063)											
CG2213407-001	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	moisture	----	E144	0.25	%	73.0	77.5	5.97%	20%	----
Physical Tests (QC Lot: 681792)											
CG2213407-001	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	pH (1:2 soil:water)	----	E108	0.10	pH units	7.80	7.87	0.893%	5%	----
Organic / Inorganic Carbon (QC Lot: 686565)											
CG2213407-002	RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	carbon, total [TC], <63µm	----	E351A	0.050	%	21.8	22.1	1.56%	20%	----
Organic / Inorganic Carbon (QC Lot: 691434)											
CG2213407-001	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	carbon, inorganic [IC], <63 µm	----	E354A	0.050	%	2.58	2.58	0.0867%	20%	----
Metals (QC Lot: 680465)											
CG2213407-001	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	mercury	7439-97-6	E510	0.0050	mg/kg	0.0822	0.0842	2.29%	40%	----
Metals (QC Lot: 680466)											
CG2213407-001	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	aluminum	7429-90-5	E440	50	mg/kg	7280	7670	5.11%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	1.23	1.30	5.78%	30%	----
		arsenic	7440-38-2	E440	0.10	mg/kg	4.94	5.26	6.25%	30%	----
		barium	7440-39-3	E440	0.50	mg/kg	400	400	0.0294%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.63	0.63	0.0003	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	5.7	6.7	1.0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	1.46	1.50	3.27%	30%	----
		calcium	7440-70-2	E440	50	mg/kg	104000	116000	10.6%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	11.4	11.9	4.25%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	8.92	9.33	4.50%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	22.2	23.2	4.32%	30%	----
		iron	7439-89-6	E440	50	mg/kg	11500	12500	8.29%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	10.7	11.9	10.8%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	7.2	8.3	1.1	Diff <2x LOR	----
		magnesium	7439-95-4	E440	20	mg/kg	5900	6120	3.74%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	216	223	2.92%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	1.54	1.74	12.0%	40%	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Metals (QC Lot: 680466) - continued											
CG2213407-001	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	nickel	7440-02-0	E440	0.50	mg/kg	64.5	66.6	3.17%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	847	969	13.3%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	1730	1810	4.51%	40%	----
		selenium	7782-49-2	E440	0.20	mg/kg	80.9	89.0	9.53%	30%	----
		silver	7440-22-4	E440	0.10	mg/kg	0.35	0.40	0.05	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	81	84	3	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.50	mg/kg	83.7	92.2	9.64%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	6600	7200	8.06%	30%	----
		thallium	7440-28-0	E440	0.050	mg/kg	0.181	0.185	0.004	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	9.0	10.6	15.4%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	2.87	3.22	11.4%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	26.6	28.5	6.57%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	128	133	3.92%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	1.8	1.6	0.2	Diff <2x LOR	----
Polycyclic Aromatic Hydrocarbons (QC Lot: 679062)											
CG2213407-001	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	acenaphthene	83-32-9	E641A	0.050	mg/kg	0.540	0.480	11.7%	50%	----
		acenaphthylene	208-96-8	E641A	0.050	mg/kg	0.078	0.068	0.010	Diff <2x LOR	----
		acridine	260-94-6	E641A	0.050	mg/kg	0.929	0.836	10.6%	50%	----
		anthracene	120-12-7	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		benz(a)anthracene	56-55-3	E641A	0.050	mg/kg	0.354	0.316	11.2%	50%	----
		benzo(a)pyrene	50-32-8	E641A	0.050	mg/kg	0.232	0.181	24.5%	50%	----
		benzo(b+j)fluoranthene	n/a	E641A	0.050	mg/kg	0.857	0.741	14.5%	50%	----
		benzo(g,h,i)perylene	191-24-2	E641A	0.050	mg/kg	0.257	0.229	11.6%	50%	----
		benzo(k)fluoranthene	207-08-9	E641A	0.050	mg/kg	0.082	0.094	0.013	Diff <2x LOR	----
		chrysene	218-01-9	E641A	0.050	mg/kg	1.85	1.59	15.1%	50%	----
		dibenz(a,h)anthracene	53-70-3	E641A	0.050	mg/kg	0.157	0.138	0.018	Diff <2x LOR	----
		fluoranthene	206-44-0	E641A	0.050	mg/kg	0.298	0.216	31.8%	50%	----
		fluorene	86-73-7	E641A	0.050	mg/kg	1.36	1.21	11.9%	50%	----
		indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.050	mg/kg	0.130	0.117	0.013	Diff <2x LOR	----
		methylnaphthalene, 1-	90-12-0	E641A	0.030	mg/kg	7.02	6.21	12.4%	50%	----
		methylnaphthalene, 2-	91-57-6	E641A	0.030	mg/kg	12.5	11.1	11.9%	50%	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Polycyclic Aromatic Hydrocarbons (QC Lot: 679062) - continued											
CG2213407-001	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	naphthalene	91-20-3	E641A	0.010	mg/kg	4.09	3.56	13.7%	50%	----
		phenanthrene	85-01-8	E641A	0.050	mg/kg	5.25	4.70	11.0%	50%	----
		pyrene	129-00-0	E641A	0.050	mg/kg	0.540	0.525	2.79%	50%	----
		quinoline	91-22-5	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
Exchangeable & Adsorbed Metals (QC Lot: 695314)											
CG2213623-001	Anonymous	aluminum, leachable	7429-90-5	E450	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		antimony, leachable	7440-36-0	E450	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		arsenic, leachable	7440-38-2	E450	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		barium, leachable	7440-39-3	E450	0.50	mg/kg	44.2	41.7	5.62%	30%	----
		beryllium, leachable	7440-41-7	E450	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450	0.050	mg/kg	0.152	0.146	0.006	Diff <2x LOR	----
		calcium, leachable	7440-70-2	E450	50	mg/kg	3750	3710	0.948%	30%	----
		chromium, leachable	7440-47-3	E450	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		cobalt, leachable	7440-48-4	E450	0.10	mg/kg	0.17	0.17	0.004	Diff <2x LOR	----
		copper, leachable	7440-50-8	E450	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		iron, leachable	7439-89-6	E450	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		lead, leachable	7439-92-1	E450	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		lithium, leachable	7439-93-2	E450	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450	1.0	mg/kg	36.1	32.8	9.48%	30%	----
		molybdenum, leachable	7439-98-7	E450	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		phosphorus, leachable	7723-14-0	E450	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		potassium, leachable	7440-09-7	E450	100	mg/kg	140	110	20	Diff <2x LOR	----
		selenium, leachable	7782-49-2	E450	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		sodium, leachable	7440-23-5	E450	100	mg/kg	<100	<100	0	Diff <2x LOR	----
		strontium, leachable	7440-24-6	E450	0.50	mg/kg	12.9	12.9	0.0825%	30%	----
		thallium, leachable	7440-28-0	E450	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		vanadium, leachable	7440-62-2	E450	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		zinc, leachable	7440-66-6	E450	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Carbonate Metals (QC Lot: 697168)											
CG2213623-001	Anonymous	aluminum, leachable	7429-90-5	E450A	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		antimony, leachable	7440-36-0	E450A	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		arsenic, leachable	7440-38-2	E450A	0.050	mg/kg	0.054	0.056	0.002	Diff <2x LOR	----
		barium, leachable	7440-39-3	E450A	2.0	mg/kg	35.7	34.9	2.34%	30%	----
		beryllium, leachable	7440-41-7	E450A	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450A	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450A	0.050	mg/kg	0.166	0.169	0.004	Diff <2x LOR	----
		calcium, leachable	7440-70-2	E450A	50	mg/kg	2760	2920	5.83%	30%	----
		chromium, leachable	7440-47-3	E450A	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		cobalt, leachable	7440-48-4	E450A	0.10	mg/kg	0.70	0.64	8.88%	30%	----
		copper, leachable	7440-50-8	E450A	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		iron, leachable	7439-89-6	E450A	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		lead, leachable	7439-92-1	E450A	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		lithium, leachable	7439-93-2	E450A	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450A	5.0	mg/kg	101	100	0.987%	30%	----
		molybdenum, leachable	7439-98-7	E450A	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450A	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		phosphorus, leachable	7723-14-0	E450A	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		selenium, leachable	7782-49-2	E450A	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450A	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		strontium, leachable	7440-24-6	E450A	5.0	mg/kg	5.4	5.7	0.4	Diff <2x LOR	----
		thallium, leachable	7440-28-0	E450A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450A	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450A	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450A	0.050	mg/kg	<0.050	0.051	0.0009	Diff <2x LOR	----
		vanadium, leachable	7440-62-2	E450A	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		zinc, leachable	7440-66-6	E450A	1.0	mg/kg	5.0	5.2	0.2	Diff <2x LOR	----
Easily Reducible Metals and Iron Oxides (QC Lot: 697833)											
CG2213623-001	Anonymous	aluminum, leachable	7429-90-5	E450B	50	mg/kg	595	596	0.176%	30%	----
		antimony, leachable	7440-36-0	E450B	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		arsenic, leachable	7440-38-2	E450B	0.050	mg/kg	0.516	0.603	15.5%	30%	----
		barium, leachable	7440-39-3	E450B	0.50	mg/kg	51.3	50.5	1.49%	30%	----
		beryllium, leachable	7440-41-7	E450B	0.20	mg/kg	0.30	0.27	0.03	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450B	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Easily Reducible Metals and Iron Oxides (QC Lot: 697833) - continued											
CG2213623-001	Anonymous	cadmium, leachable	7440-43-9	E450B	0.050	mg/kg	0.385	0.411	6.54%	30%	----
		calcium, leachable	7440-70-2	E450B	50	mg/kg	3020	3320	9.62%	30%	----
		chromium, leachable	7440-47-3	E450B	0.50	mg/kg	0.80	0.83	0.03	Diff <2x LOR	----
		cobalt, leachable	7440-48-4	E450B	0.10	mg/kg	4.46	4.21	5.73%	30%	----
		copper, leachable	7440-50-8	E450B	0.50	mg/kg	0.69	0.64	0.05	Diff <2x LOR	----
		iron, leachable	7439-89-6	E450B	50	mg/kg	3810	3570	6.46%	30%	----
		lead, leachable	7439-92-1	E450B	0.50	mg/kg	3.26	3.19	0.07	Diff <2x LOR	----
		lithium, leachable	7439-93-2	E450B	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450B	1.0	mg/kg	218	193	11.9%	30%	----
		molybdenum, leachable	7439-98-7	E450B	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450B	0.50	mg/kg	11.3	11.2	0.818%	30%	----
		phosphorus, leachable	7723-14-0	E450B	50	mg/kg	183	147	35	Diff <2x LOR	----
		selenium, leachable	7782-49-2	E450B	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450B	0.10	mg/kg	0.10	<0.10	0.006	Diff <2x LOR	----
		strontium, leachable	7440-24-6	E450B	0.50	mg/kg	6.18	6.58	6.24%	30%	----
		thallium, leachable	7440-28-0	E450B	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450B	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450B	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450B	0.050	mg/kg	0.161	0.176	0.015	Diff <2x LOR	----
		vanadium, leachable	7440-62-2	E450B	0.20	mg/kg	2.78	2.76	0.736%	30%	----
		zinc, leachable	7440-66-6	E450B	1.0	mg/kg	26.5	27.9	5.24%	30%	----
Organic Bound Metals (QC Lot: 702272)											
CG2213623-001	Anonymous	aluminum, leachable	7429-90-5	E450C	50	mg/kg	1850	1790	3.64%	30%	----
		antimony, leachable	7440-36-0	E450C	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		arsenic, leachable	7440-38-2	E450C	0.050	mg/kg	0.408	0.463	12.6%	30%	----
		barium, leachable	7440-39-3	E450C	0.50	mg/kg	25.3	22.8	10.4%	30%	----
		beryllium, leachable	7440-41-7	E450C	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450C	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450C	0.050	mg/kg	0.080	0.082	0.002	Diff <2x LOR	----
		calcium, leachable	7440-70-2	E450C	50	mg/kg	1040	1030	1.28%	30%	----
		chromium, leachable	7440-47-3	E450C	0.50	mg/kg	3.66	3.62	0.996%	30%	----
		cobalt, leachable	7440-48-4	E450C	0.10	mg/kg	1.10	1.01	8.37%	30%	----
		copper, leachable	7440-50-8	E450C	0.50	mg/kg	6.38	6.65	4.16%	30%	----
		iron, leachable	7439-89-6	E450C	50	mg/kg	1890	1910	1.12%	30%	----

Sub-Matrix: **Soil/Solid**

Laboratory Duplicate (DUP) Report

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Organic Bound Metals (QC Lot: 702272) - continued											
CG2213623-001	Anonymous	lead, leachable	7439-92-1	E450C	0.50	mg/kg	0.80	0.88	0.08	Diff <2x LOR	----
		lithium, leachable	7439-93-2	E450C	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450C	1.0	mg/kg	19.9	16.8	16.9%	30%	----
		molybdenum, leachable	7439-98-7	E450C	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450C	0.50	mg/kg	6.08	6.11	0.543%	30%	----
		selenium, leachable	7782-49-2	E450C	0.20	mg/kg	0.90	0.94	0.04	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450C	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		strontium, leachable	7440-24-6	E450C	0.50	mg/kg	4.75	4.63	2.63%	30%	----
		thallium, leachable	7440-28-0	E450C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450C	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450C	1.0	mg/kg	1.7	2.1	0.4	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450C	0.050	mg/kg	0.255	0.271	0.017	Diff <2x LOR	----
		vanadium, leachable	7440-62-2	E450C	0.20	mg/kg	4.26	4.46	4.63%	30%	----
		zinc, leachable	7440-66-6	E450C	1.0	mg/kg	8.9	8.9	0.125%	30%	----
Residual Metals (QC Lot: 704532)											
CG2213623-001	Anonymous	aluminum, leachable	7429-90-5	E450D	50	mg/kg	8080	7600	6.07%	30%	----
		antimony, leachable	7440-36-0	E450D	0.10	mg/kg	0.70	0.77	9.57%	30%	----
		arsenic, leachable	7440-38-2	E450D	5.00	mg/kg	<5.00	<5.00	0	Diff <2x LOR	----
		barium, leachable	7440-39-3	E450D	2.0	mg/kg	120	131	8.45%	30%	----
		beryllium, leachable	7440-41-7	E450D	0.20	mg/kg	0.38	0.37	0.008	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450D	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450D	0.050	mg/kg	0.074	0.081	0.008	Diff <2x LOR	----
		calcium, leachable	7440-70-2	E450D	50	mg/kg	678	592	13.6%	30%	----
		chromium, leachable	7440-47-3	E450D	5.0	mg/kg	11.4	10.8	0.6	Diff <2x LOR	----
		cobalt, leachable	7440-48-4	E450D	0.10	mg/kg	2.85	2.75	3.73%	30%	----
		copper, leachable	7440-50-8	E450D	0.50	mg/kg	12.3	12.1	2.08%	30%	----
		iron, leachable	7439-89-6	E450D	50	mg/kg	11600	10200	13.0%	30%	----
		lead, leachable	7439-92-1	E450D	0.50	mg/kg	7.04	7.14	1.38%	30%	----
		lithium, leachable	7439-93-2	E450D	5.0	mg/kg	7.0	6.4	0.5	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450D	5.0	mg/kg	43.4	40.0	8.05%	30%	----
		molybdenum, leachable	7439-98-7	E450D	0.50	mg/kg	0.96	0.98	0.02	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450D	2.0	mg/kg	11.4	10.8	0.6	Diff <2x LOR	----
		selenium, leachable	7782-49-2	E450D	0.20	mg/kg	0.46	0.40	0.06	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450D	0.10	mg/kg	0.12	0.15	0.03	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Residual Metals (QC Lot: 704532) - continued											
CG2213623-001	Anonymous	strontium, leachable	7440-24-6	E450D	5.0	mg/kg	19.1	21.8	2.7	Diff <2x LOR	----
		thallium, leachable	7440-28-0	E450D	0.050	mg/kg	0.137	0.159	0.022	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450D	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450D	5.0	mg/kg	16.8	22.1	5.3	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450D	0.050	mg/kg	0.346	0.366	5.52%	30%	----
		vanadium, leachable	7440-62-2	E450D	0.20	mg/kg	28.9	27.3	5.76%	30%	----
		zinc, leachable	7440-66-6	E450D	1.0	mg/kg	62.7	60.7	3.31%	30%	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 679063)						
moisture	----	E144	0.25	%	<0.25	----
Organic / Inorganic Carbon (QCLot: 686565)						
carbon, total [TC], <63µm	----	E351A	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 691434)						
carbon, inorganic [IC], <63 µm	----	E354A	0.05	%	<0.050	----
Metals (QCLot: 680465)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 680466)						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 680466) - continued						
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Polycyclic Aromatic Hydrocarbons (QCLot: 679062)						
acenaphthene	83-32-9	E641A	0.05	mg/kg	<0.050	----
acenaphthylene	208-96-8	E641A	0.05	mg/kg	<0.050	----
acridine	260-94-6	E641A	0.05	mg/kg	<0.050	----
anthracene	120-12-7	E641A	0.05	mg/kg	<0.050	----
benz(a)anthracene	56-55-3	E641A	0.05	mg/kg	<0.050	----
benzo(a)pyrene	50-32-8	E641A	0.05	mg/kg	<0.050	----
benzo(b+j)fluoranthene	n/a	E641A	0.05	mg/kg	<0.050	----
benzo(g,h,i)perylene	191-24-2	E641A	0.05	mg/kg	<0.050	----
benzo(k)fluoranthene	207-08-9	E641A	0.05	mg/kg	<0.050	----
chrysene	218-01-9	E641A	0.05	mg/kg	<0.050	----
dibenz(a,h)anthracene	53-70-3	E641A	0.05	mg/kg	<0.050	----
fluoranthene	206-44-0	E641A	0.05	mg/kg	<0.050	----
fluorene	86-73-7	E641A	0.05	mg/kg	<0.050	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.05	mg/kg	<0.050	----
methylnaphthalene, 1-	90-12-0	E641A	0.03	mg/kg	<0.030	----
methylnaphthalene, 2-	91-57-6	E641A	0.03	mg/kg	<0.030	----
naphthalene	91-20-3	E641A	0.01	mg/kg	<0.010	----
phenanthrene	85-01-8	E641A	0.05	mg/kg	<0.050	----
pyrene	129-00-0	E641A	0.05	mg/kg	<0.050	----
quinoline	91-22-5	E641A	0.05	mg/kg	<0.050	----
Exchangeable & Adsorbed Metals (QCLot: 695314)						
aluminum, leachable	7429-90-5	E450	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450	0.05	mg/kg	<0.050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Exchangeable & Adsorbed Metals (QCLot: 695314) - continued						
barium, leachable	7440-39-3	E450	0.5	mg/kg	# 0.63	B
beryllium, leachable	7440-41-7	E450	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450	50	mg/kg	<50	----
chromium, leachable	7440-47-3	E450	0.5	mg/kg	<0.50	----
cobalt, leachable	7440-48-4	E450	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450	1	mg/kg	<1.0	----
molybdenum, leachable	7439-98-7	E450	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450	0.5	mg/kg	<0.50	----
phosphorus, leachable	7723-14-0	E450	50	mg/kg	<50	----
potassium, leachable	7440-09-7	E450	100	mg/kg	<100	----
selenium, leachable	7782-49-2	E450	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450	0.1	mg/kg	<0.10	----
sodium, leachable	7440-23-5	E450	100	mg/kg	<100	----
strontium, leachable	7440-24-6	E450	0.5	mg/kg	<0.50	----
thallium, leachable	7440-28-0	E450	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450	2	mg/kg	<2.0	----
titanium, leachable	7440-32-6	E450	1	mg/kg	<1.0	----
uranium, leachable	7440-61-1	E450	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450	1	mg/kg	<1.0	----
Carbonate Metals (QCLot: 697168)						
aluminum, leachable	7429-90-5	E450A	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450A	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450A	0.05	mg/kg	<0.050	----
barium, leachable	7440-39-3	E450A	2	mg/kg	<2.0	----
beryllium, leachable	7440-41-7	E450A	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450A	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450A	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450A	50	mg/kg	<50	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Carbonate Metals (QCLot: 697168) - continued						
chromium, leachable	7440-47-3	E450A	5	mg/kg	<5.0	----
cobalt, leachable	7440-48-4	E450A	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450A	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450A	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450A	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450A	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450A	5	mg/kg	<5.0	----
molybdenum, leachable	7439-98-7	E450A	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450A	2	mg/kg	<2.0	----
phosphorus, leachable	7723-14-0	E450A	50	mg/kg	<50	----
selenium, leachable	7782-49-2	E450A	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450A	0.1	mg/kg	<0.10	----
strontium, leachable	7440-24-6	E450A	5	mg/kg	<5.0	----
thallium, leachable	7440-28-0	E450A	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450A	2	mg/kg	<2.0	----
titanium, leachable	7440-32-6	E450A	5	mg/kg	<5.0	----
uranium, leachable	7440-61-1	E450A	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450A	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450A	1	mg/kg	<1.0	----
Easily Reducible Metals and Iron Oxides (QCLot: 697833)						
aluminum, leachable	7429-90-5	E450B	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450B	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450B	0.05	mg/kg	<0.050	----
barium, leachable	7440-39-3	E450B	0.5	mg/kg	<0.50	----
beryllium, leachable	7440-41-7	E450B	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450B	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450B	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450B	50	mg/kg	<50	----
chromium, leachable	7440-47-3	E450B	0.5	mg/kg	<0.50	----
cobalt, leachable	7440-48-4	E450B	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450B	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450B	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450B	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450B	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450B	1	mg/kg	<1.0	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Easily Reducible Metals and Iron Oxides (QCLot: 697833) - continued						
molybdenum, leachable	7439-98-7	E450B	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450B	0.5	mg/kg	<0.50	----
phosphorus, leachable	7723-14-0	E450B	50	mg/kg	<50	----
selenium, leachable	7782-49-2	E450B	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450B	0.1	mg/kg	<0.10	----
strontium, leachable	7440-24-6	E450B	0.5	mg/kg	<0.50	----
thallium, leachable	7440-28-0	E450B	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450B	2	mg/kg	<2.0	----
titanium, leachable	7440-32-6	E450B	1	mg/kg	<1.0	----
uranium, leachable	7440-61-1	E450B	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450B	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450B	1	mg/kg	<1.0	----
Organic Bound Metals (QCLot: 702272)						
aluminum, leachable	7429-90-5	E450C	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450C	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450C	0.05	mg/kg	<0.050	----
barium, leachable	7440-39-3	E450C	0.5	mg/kg	<0.50	----
beryllium, leachable	7440-41-7	E450C	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450C	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450C	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450C	50	mg/kg	<50	----
chromium, leachable	7440-47-3	E450C	0.5	mg/kg	<0.50	----
cobalt, leachable	7440-48-4	E450C	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450C	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450C	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450C	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450C	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450C	1	mg/kg	<1.0	----
molybdenum, leachable	7439-98-7	E450C	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450C	0.5	mg/kg	<0.50	----
selenium, leachable	7782-49-2	E450C	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450C	0.1	mg/kg	<0.10	----
strontium, leachable	7440-24-6	E450C	0.5	mg/kg	<0.50	----
thallium, leachable	7440-28-0	E450C	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450C	2	mg/kg	<2.0	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Organic Bound Metals (QCLot: 702272) - continued						
titanium, leachable	7440-32-6	E450C	1	mg/kg	<1.0	----
uranium, leachable	7440-61-1	E450C	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450C	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450C	1	mg/kg	<1.0	----
Residual Metals (QCLot: 704532)						
aluminum, leachable	7429-90-5	E450D	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450D	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450D	0.5	mg/kg	<0.50	----
barium, leachable	7440-39-3	E450D	2	mg/kg	<2.0	----
beryllium, leachable	7440-41-7	E450D	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450D	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450D	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450D	50	mg/kg	<50	----
chromium, leachable	7440-47-3	E450D	5	mg/kg	<5.0	----
cobalt, leachable	7440-48-4	E450D	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450D	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450D	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450D	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450D	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450D	5	mg/kg	<5.0	----
molybdenum, leachable	7439-98-7	E450D	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450D	2	mg/kg	<2.0	----
selenium, leachable	7782-49-2	E450D	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450D	0.1	mg/kg	<0.10	----
strontium, leachable	7440-24-6	E450D	5	mg/kg	<5.0	----
thallium, leachable	7440-28-0	E450D	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450D	2	mg/kg	<2.0	----
titanium, leachable	7440-32-6	E450D	5	mg/kg	<5.0	----
uranium, leachable	7440-61-1	E450D	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450D	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450D	1	mg/kg	<1.0	----

Qualifiers

Qualifier	*Description*
B	*Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.*

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 679063)									
moisture	----	E144	0.25	%	50 %	95.4	90.0	110	----
Physical Tests (QCLot: 681792)									
pH (1:2 soil:water)	----	E108	----	pH units	7 pH units	101	97.0	103	----
Organic / Inorganic Carbon (QCLot: 686565)									
carbon, total [TC], <63µm	----	E351A	0.05	%	48 %	99.2	90.0	110	----
Organic / Inorganic Carbon (QCLot: 691434)									
carbon, inorganic [IC], <63 µm	----	E354A	0.05	%	0.5 %	93.4	80.0	120	----
Metals (QCLot: 680465)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	97.1	80.0	120	----
Metals (QCLot: 680466)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	97.4	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	101	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	99.0	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	97.3	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	96.3	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	94.7	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	93.6	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	96.6	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	100	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	98.2	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	99.1	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	96.9	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	94.5	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	98.4	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	91.2	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	98.0	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	100	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	97.2	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	97.6	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	98.4	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	98.1	80.0	120	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 680466) - continued									
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	99.6	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	97.9	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	101	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	98.6	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	103	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	96.2	80.0	120	----
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	96.9	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	103	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	96.6	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	94.1	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	100	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	95.2	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	96.6	80.0	120	----
Polycyclic Aromatic Hydrocarbons (QCLot: 679062)									
acenaphthene	83-32-9	E641A	0.05	mg/kg	0.5 mg/kg	84.6	60.0	130	----
acenaphthylene	208-96-8	E641A	0.05	mg/kg	0.5 mg/kg	92.2	60.0	130	----
acridine	260-94-6	E641A	0.05	mg/kg	0.5 mg/kg	84.7	60.0	130	----
anthracene	120-12-7	E641A	0.05	mg/kg	0.5 mg/kg	86.0	60.0	130	----
benz(a)anthracene	56-55-3	E641A	0.05	mg/kg	0.5 mg/kg	87.8	60.0	130	----
benzo(a)pyrene	50-32-8	E641A	0.05	mg/kg	0.5 mg/kg	93.6	60.0	130	----
benzo(b+j)fluoranthene	n/a	E641A	0.05	mg/kg	0.5 mg/kg	92.4	60.0	130	----
benzo(g,h,i)perylene	191-24-2	E641A	0.05	mg/kg	0.5 mg/kg	84.2	60.0	130	----
benzo(k)fluoranthene	207-08-9	E641A	0.05	mg/kg	0.5 mg/kg	92.9	60.0	130	----
chrysene	218-01-9	E641A	0.05	mg/kg	0.5 mg/kg	86.0	60.0	130	----
dibenz(a,h)anthracene	53-70-3	E641A	0.05	mg/kg	0.5 mg/kg	90.0	60.0	130	----
fluoranthene	206-44-0	E641A	0.05	mg/kg	0.5 mg/kg	93.0	60.0	130	----
fluorene	86-73-7	E641A	0.05	mg/kg	0.5 mg/kg	88.5	60.0	130	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.05	mg/kg	0.5 mg/kg	98.8	60.0	130	----
methylnaphthalene, 1-	90-12-0	E641A	0.03	mg/kg	0.5 mg/kg	89.6	60.0	130	----
methylnaphthalene, 2-	91-57-6	E641A	0.03	mg/kg	0.5 mg/kg	86.7	60.0	130	----
naphthalene	91-20-3	E641A	0.01	mg/kg	0.5 mg/kg	86.3	50.0	130	----
phenanthrene	85-01-8	E641A	0.05	mg/kg	0.5 mg/kg	89.8	60.0	130	----
pyrene	129-00-0	E641A	0.05	mg/kg	0.5 mg/kg	92.0	60.0	130	----
quinoline	91-22-5	E641A	0.05	mg/kg	0.5 mg/kg	84.8	60.0	130	----

Sub-Matrix: **Soil/Solid**

Laboratory Control Sample (LCS) Report

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Exchangeable & Adsorbed Metals (QCLot: 695314)									
aluminum, leachable	7429-90-5	E450	50	mg/kg	2 mg/kg	104	70.0	130	----
antimony, leachable	7440-36-0	E450	0.1	mg/kg	0.2 mg/kg	97.5	70.0	130	----
arsenic, leachable	7440-38-2	E450	0.05	mg/kg	0.2 mg/kg	96.4	70.0	130	----
barium, leachable	7440-39-3	E450	0.5	mg/kg	0.2 mg/kg	94.0	70.0	130	----
beryllium, leachable	7440-41-7	E450	0.2	mg/kg	0.4 mg/kg	99.9	70.0	130	----
bismuth, leachable	7440-69-9	E450	0.2	mg/kg	0.1 mg/kg	83.0	70.0	130	----
cadmium, leachable	7440-43-9	E450	0.05	mg/kg	0.04 mg/kg	99.5	70.0	130	----
calcium, leachable	7440-70-2	E450	50	mg/kg	40 mg/kg	99.5	70.0	130	----
chromium, leachable	7440-47-3	E450	0.5	mg/kg	0.4 mg/kg	98.3	70.0	130	----
cobalt, leachable	7440-48-4	E450	0.1	mg/kg	0.2 mg/kg	95.6	70.0	130	----
copper, leachable	7440-50-8	E450	0.5	mg/kg	0.2 mg/kg	92.4	70.0	130	----
iron, leachable	7439-89-6	E450	50	mg/kg	20 mg/kg	98.1	70.0	130	----
lead, leachable	7439-92-1	E450	0.5	mg/kg	0.2 mg/kg	87.5	70.0	130	----
lithium, leachable	7439-93-2	E450	5	mg/kg	1 mg/kg	100	70.0	130	----
manganese, leachable	7439-96-5	E450	1	mg/kg	0.2 mg/kg	103	70.0	130	----
molybdenum, leachable	7439-98-7	E450	0.5	mg/kg	0.2 mg/kg	101	70.0	130	----
nickel, leachable	7440-02-0	E450	0.5	mg/kg	0.4 mg/kg	92.8	70.0	130	----
phosphorus, leachable	7723-14-0	E450	50	mg/kg	100 mg/kg	111	70.0	130	----
potassium, leachable	7440-09-7	E450	100	mg/kg	40 mg/kg	98.5	70.0	130	----
selenium, leachable	7782-49-2	E450	0.2	mg/kg	0.4 mg/kg	98.6	70.0	130	----
silver, leachable	7440-22-4	E450	0.1	mg/kg	0.04 mg/kg	102	70.0	130	----
sodium, leachable	7440-23-5	E450	100	mg/kg	20 mg/kg	103	70.0	130	----
strontium, leachable	7440-24-6	E450	0.5	mg/kg	0.2 mg/kg	102	70.0	130	----
thallium, leachable	7440-28-0	E450	0.05	mg/kg	0.04 mg/kg	88.0	70.0	130	----
tin, leachable	7440-31-5	E450	2	mg/kg	0.2 mg/kg	96.0	70.0	130	----
titanium, leachable	7440-32-6	E450	1	mg/kg	0.4 mg/kg	97.7	70.0	130	----
uranium, leachable	7440-61-1	E450	0.05	mg/kg	0.04 mg/kg	86.8	70.0	130	----
vanadium, leachable	7440-62-2	E450	0.2	mg/kg	1 mg/kg	101	70.0	130	----
zinc, leachable	7440-66-6	E450	1	mg/kg	4 mg/kg	97.3	70.0	130	----
Carbonate Metals (QCLot: 697168)									
aluminum, leachable	7429-90-5	E450A	50	mg/kg	2 mg/kg	105	70.0	130	----
antimony, leachable	7440-36-0	E450A	0.1	mg/kg	0.2 mg/kg	100	70.0	130	----
arsenic, leachable	7440-38-2	E450A	0.05	mg/kg	0.2 mg/kg	104	70.0	130	----
barium, leachable	7440-39-3	E450A	2	mg/kg	0.2 mg/kg	102	70.0	130	----
beryllium, leachable	7440-41-7	E450A	0.2	mg/kg	0.4 mg/kg	100	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Carbonate Metals (QCLot: 697168) - continued									
bismuth, leachable	7440-69-9	E450A	0.2	mg/kg	0.1 mg/kg	86.0	70.0	130	----
cadmium, leachable	7440-43-9	E450A	0.05	mg/kg	0.04 mg/kg	102	70.0	130	----
calcium, leachable	7440-70-2	E450A	50	mg/kg	40 mg/kg	97.6	70.0	130	----
chromium, leachable	7440-47-3	E450A	5	mg/kg	0.4 mg/kg	100	70.0	130	----
cobalt, leachable	7440-48-4	E450A	0.1	mg/kg	0.2 mg/kg	100	70.0	130	----
copper, leachable	7440-50-8	E450A	0.5	mg/kg	0.2 mg/kg	98.1	70.0	130	----
iron, leachable	7439-89-6	E450A	50	mg/kg	20 mg/kg	97.0	70.0	130	----
lead, leachable	7439-92-1	E450A	0.5	mg/kg	0.2 mg/kg	91.5	70.0	130	----
lithium, leachable	7439-93-2	E450A	5	mg/kg	1 mg/kg	103	70.0	130	----
manganese, leachable	7439-96-5	E450A	5	mg/kg	0.2 mg/kg	104	70.0	130	----
molybdenum, leachable	7439-98-7	E450A	0.5	mg/kg	0.2 mg/kg	104	70.0	130	----
nickel, leachable	7440-02-0	E450A	2	mg/kg	0.4 mg/kg	98.2	70.0	130	----
phosphorus, leachable	7723-14-0	E450A	50	mg/kg	100 mg/kg	103	70.0	130	----
selenium, leachable	7782-49-2	E450A	0.2	mg/kg	0.4 mg/kg	99.3	70.0	130	----
silver, leachable	7440-22-4	E450A	0.1	mg/kg	0.04 mg/kg	102	70.0	130	----
strontium, leachable	7440-24-6	E450A	5	mg/kg	0.2 mg/kg	105	70.0	130	----
thallium, leachable	7440-28-0	E450A	0.05	mg/kg	0.04 mg/kg	91.9	70.0	130	----
tin, leachable	7440-31-5	E450A	2	mg/kg	0.2 mg/kg	100	70.0	130	----
titanium, leachable	7440-32-6	E450A	5	mg/kg	0.4 mg/kg	100	70.0	130	----
uranium, leachable	7440-61-1	E450A	0.05	mg/kg	0.04 mg/kg	91.7	70.0	130	----
vanadium, leachable	7440-62-2	E450A	0.2	mg/kg	1 mg/kg	104	70.0	130	----
zinc, leachable	7440-66-6	E450A	1	mg/kg	4 mg/kg	102	70.0	130	----
Easily Reducible Metals and Iron Oxides (QCLot: 697833)									
aluminum, leachable	7429-90-5	E450B	50	mg/kg	2 mg/kg	99.9	70.0	130	----
antimony, leachable	7440-36-0	E450B	0.1	mg/kg	0.2 mg/kg	100	70.0	130	----
arsenic, leachable	7440-38-2	E450B	0.05	mg/kg	0.2 mg/kg	106	70.0	130	----
barium, leachable	7440-39-3	E450B	0.5	mg/kg	0.2 mg/kg	97.9	70.0	130	----
beryllium, leachable	7440-41-7	E450B	0.2	mg/kg	0.4 mg/kg	102	70.0	130	----
bismuth, leachable	7440-69-9	E450B	0.2	mg/kg	0.1 mg/kg	91.0	70.0	130	----
cadmium, leachable	7440-43-9	E450B	0.05	mg/kg	0.04 mg/kg	102	70.0	130	----
calcium, leachable	7440-70-2	E450B	50	mg/kg	40 mg/kg	99.1	70.0	130	----
chromium, leachable	7440-47-3	E450B	0.5	mg/kg	0.4 mg/kg	102	70.0	130	----
cobalt, leachable	7440-48-4	E450B	0.1	mg/kg	0.2 mg/kg	104	70.0	130	----
copper, leachable	7440-50-8	E450B	0.5	mg/kg	0.2 mg/kg	102	70.0	130	----
iron, leachable	7439-89-6	E450B	50	mg/kg	20 mg/kg	101	70.0	130	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Easily Reducible Metals and Iron Oxides (QCLot: 697833) - continued									
lead, leachable	7439-92-1	E450B	0.5	mg/kg	0.2 mg/kg	95.7	70.0	130	----
lithium, leachable	7439-93-2	E450B	5	mg/kg	1 mg/kg	104	70.0	130	----
manganese, leachable	7439-96-5	E450B	1	mg/kg	0.2 mg/kg	103	70.0	130	----
molybdenum, leachable	7439-98-7	E450B	0.5	mg/kg	0.2 mg/kg	100	70.0	130	----
nickel, leachable	7440-02-0	E450B	0.5	mg/kg	0.4 mg/kg	102	70.0	130	----
phosphorus, leachable	7723-14-0	E450B	50	mg/kg	100 mg/kg	99.7	70.0	130	----
selenium, leachable	7782-49-2	E450B	0.2	mg/kg	0.4 mg/kg	118	70.0	130	----
silver, leachable	7440-22-4	E450B	0.1	mg/kg	0.04 mg/kg	104	70.0	130	----
strontium, leachable	7440-24-6	E450B	0.5	mg/kg	0.2 mg/kg	101	70.0	130	----
thallium, leachable	7440-28-0	E450B	0.05	mg/kg	0.04 mg/kg	98.8	70.0	130	----
tin, leachable	7440-31-5	E450B	2	mg/kg	0.2 mg/kg	99.5	70.0	130	----
titanium, leachable	7440-32-6	E450B	1	mg/kg	0.4 mg/kg	96.7	70.0	130	----
uranium, leachable	7440-61-1	E450B	0.05	mg/kg	0.04 mg/kg	95.0	70.0	130	----
vanadium, leachable	7440-62-2	E450B	0.2	mg/kg	1 mg/kg	103	70.0	130	----
zinc, leachable	7440-66-6	E450B	1	mg/kg	4 mg/kg	107	70.0	130	----
Organic Bound Metals (QCLot: 702272)									
aluminum, leachable	7429-90-5	E450C	50	mg/kg	2 mg/kg	104	70.0	130	----
antimony, leachable	7440-36-0	E450C	0.1	mg/kg	0.2 mg/kg	97.6	70.0	130	----
arsenic, leachable	7440-38-2	E450C	0.05	mg/kg	0.2 mg/kg	108	70.0	130	----
barium, leachable	7440-39-3	E450C	0.5	mg/kg	0.2 mg/kg	101	70.0	130	----
beryllium, leachable	7440-41-7	E450C	0.2	mg/kg	0.4 mg/kg	95.0	70.0	130	----
bismuth, leachable	7440-69-9	E450C	0.2	mg/kg	0.1 mg/kg	95.9	70.0	130	----
cadmium, leachable	7440-43-9	E450C	0.05	mg/kg	0.04 mg/kg	102	70.0	130	----
calcium, leachable	7440-70-2	E450C	50	mg/kg	40 mg/kg	93.0	70.0	130	----
chromium, leachable	7440-47-3	E450C	0.5	mg/kg	0.4 mg/kg	100	70.0	130	----
cobalt, leachable	7440-48-4	E450C	0.1	mg/kg	0.2 mg/kg	101	70.0	130	----
copper, leachable	7440-50-8	E450C	0.5	mg/kg	0.2 mg/kg	102	70.0	130	----
iron, leachable	7439-89-6	E450C	50	mg/kg	20 mg/kg	98.3	70.0	130	----
lead, leachable	7439-92-1	E450C	0.5	mg/kg	0.2 mg/kg	98.2	70.0	130	----
lithium, leachable	7439-93-2	E450C	5	mg/kg	1 mg/kg	94.9	70.0	130	----
manganese, leachable	7439-96-5	E450C	1	mg/kg	0.2 mg/kg	100	70.0	130	----
molybdenum, leachable	7439-98-7	E450C	0.5	mg/kg	0.2 mg/kg	98.2	70.0	130	----
nickel, leachable	7440-02-0	E450C	0.5	mg/kg	0.4 mg/kg	101	70.0	130	----
selenium, leachable	7782-49-2	E450C	0.2	mg/kg	0.4 mg/kg	106	70.0	130	----
silver, leachable	7440-22-4	E450C	0.1	mg/kg	0.04 mg/kg	104	70.0	130	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Organic Bound Metals (QCLot: 702272) - continued									
strontium, leachable	7440-24-6	E450C	0.5	mg/kg	0.2 mg/kg	99.7	70.0	130	----
thallium, leachable	7440-28-0	E450C	0.05	mg/kg	0.04 mg/kg	97.1	70.0	130	----
tin, leachable	7440-31-5	E450C	2	mg/kg	0.2 mg/kg	97.0	70.0	130	----
titanium, leachable	7440-32-6	E450C	1	mg/kg	0.4 mg/kg	99.4	70.0	130	----
uranium, leachable	7440-61-1	E450C	0.05	mg/kg	0.04 mg/kg	97.1	70.0	130	----
vanadium, leachable	7440-62-2	E450C	0.2	mg/kg	1 mg/kg	100	70.0	130	----
zinc, leachable	7440-66-6	E450C	1	mg/kg	4 mg/kg	103	70.0	130	----
Residual Metals (QCLot: 704532)									
aluminum, leachable	7429-90-5	E450D	50	mg/kg	2 mg/kg	98.3	70.0	130	----
antimony, leachable	7440-36-0	E450D	0.1	mg/kg	0.2 mg/kg	103	70.0	130	----
arsenic, leachable	7440-38-2	E450D	0.5	mg/kg	0.2 mg/kg	97.9	70.0	130	----
barium, leachable	7440-39-3	E450D	2	mg/kg	0.2 mg/kg	97.5	70.0	130	----
beryllium, leachable	7440-41-7	E450D	0.2	mg/kg	0.4 mg/kg	99.7	70.0	130	----
bismuth, leachable	7440-69-9	E450D	0.2	mg/kg	0.1 mg/kg	97.1	70.0	130	----
cadmium, leachable	7440-43-9	E450D	0.05	mg/kg	0.04 mg/kg	98.4	70.0	130	----
calcium, leachable	7440-70-2	E450D	50	mg/kg	40 mg/kg	102	70.0	130	----
chromium, leachable	7440-47-3	E450D	5	mg/kg	0.4 mg/kg	98.4	70.0	130	----
cobalt, leachable	7440-48-4	E450D	0.1	mg/kg	0.2 mg/kg	99.3	70.0	130	----
copper, leachable	7440-50-8	E450D	0.5	mg/kg	0.2 mg/kg	98.1	70.0	130	----
iron, leachable	7439-89-6	E450D	50	mg/kg	20 mg/kg	99.6	70.0	130	----
lead, leachable	7439-92-1	E450D	0.5	mg/kg	0.2 mg/kg	99.1	70.0	130	----
lithium, leachable	7439-93-2	E450D	5	mg/kg	1 mg/kg	103	70.0	130	----
manganese, leachable	7439-96-5	E450D	5	mg/kg	0.2 mg/kg	101	70.0	130	----
molybdenum, leachable	7439-98-7	E450D	0.5	mg/kg	0.2 mg/kg	95.2	70.0	130	----
nickel, leachable	7440-02-0	E450D	2	mg/kg	0.4 mg/kg	99.6	70.0	130	----
selenium, leachable	7782-49-2	E450D	0.2	mg/kg	0.4 mg/kg	98.7	70.0	130	----
silver, leachable	7440-22-4	E450D	0.1	mg/kg	0.04 mg/kg	102	70.0	130	----
strontium, leachable	7440-24-6	E450D	5	mg/kg	0.2 mg/kg	98.6	70.0	130	----
thallium, leachable	7440-28-0	E450D	0.05	mg/kg	0.04 mg/kg	101	70.0	130	----
tin, leachable	7440-31-5	E450D	2	mg/kg	0.2 mg/kg	97.0	70.0	130	----
titanium, leachable	7440-32-6	E450D	5	mg/kg	0.4 mg/kg	97.8	70.0	130	----
uranium, leachable	7440-61-1	E450D	0.05	mg/kg	0.04 mg/kg	99.2	70.0	130	----
vanadium, leachable	7440-62-2	E450D	0.2	mg/kg	1 mg/kg	99.7	70.0	130	----
zinc, leachable	7440-66-6	E450D	1	mg/kg	4 mg/kg	101	70.0	130	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*Target*	*MS*	*Low*	*High*	*Qualifier*
Polycyclic Aromatic Hydrocarbons (QCLot: 679062)										
CG2213407-001	RG_GHP_SE-1_LAEMP_GC_2022-09-20_N	acenaphthene	83-32-9	E641A	0.313 mg/kg	0.5 mg/kg	83.1	50.0	140	----
		acenaphthylene	208-96-8	E641A	0.291 mg/kg	0.5 mg/kg	77.2	50.0	140	----
		acridine	260-94-6	E641A	0.280 mg/kg	0.5 mg/kg	74.1	50.0	140	----
		anthracene	120-12-7	E641A	0.321 mg/kg	0.5 mg/kg	85.1	50.0	140	----
		benz(a)anthracene	56-55-3	E641A	0.330 mg/kg	0.5 mg/kg	87.6	50.0	140	----
		benzo(a)pyrene	50-32-8	E641A	0.325 mg/kg	0.5 mg/kg	86.3	50.0	140	----
		benzo(b+j)fluoranthene	n/a	E641A	0.343 mg/kg	0.5 mg/kg	91.1	50.0	140	----
		benzo(g,h,i)perylene	191-24-2	E641A	0.296 mg/kg	0.5 mg/kg	78.4	50.0	140	----
		benzo(k)fluoranthene	207-08-9	E641A	0.331 mg/kg	0.5 mg/kg	87.8	50.0	140	----
		chrysene	218-01-9	E641A	ND mg/kg	0.5 mg/kg	ND	50.0	140	----
		dibenz(a,h)anthracene	53-70-3	E641A	0.328 mg/kg	0.5 mg/kg	87.1	50.0	140	----
		fluoranthene	206-44-0	E641A	0.355 mg/kg	0.5 mg/kg	94.2	50.0	140	----
		fluorene	86-73-7	E641A	0.274 mg/kg	0.5 mg/kg	72.7	50.0	140	----
		indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.313 mg/kg	0.5 mg/kg	83.0	50.0	140	----
		methylnaphthalene, 1-	90-12-0	E641A	ND mg/kg	0.5 mg/kg	ND	50.0	140	----
		methylnaphthalene, 2-	91-57-6	E641A	ND mg/kg	0.5 mg/kg	ND	50.0	140	----
		naphthalene	91-20-3	E641A	ND mg/kg	0.5 mg/kg	ND	50.0	140	----
		phenanthrene	85-01-8	E641A	ND mg/kg	0.5 mg/kg	ND	50.0	140	----
		pyrene	129-00-0	E641A	0.320 mg/kg	0.5 mg/kg	84.9	50.0	140	----
		quinoline	91-22-5	E641A	0.342 mg/kg	0.5 mg/kg	90.9	50.0	140	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	High	Qualifier
Physical Tests (QCLot: 681792)									
	RM	pH (1:2 soil:water)	----	E108	8.06 pH units	98.4	96.0	104	----
Organic / Inorganic Carbon (QCLot: 686565)									
	RM	carbon, total [TC], <63µm	----	E351A	1.4 %	101	80.0	120	----
Organic / Inorganic Carbon (QCLot: 691434)									
	RM	carbon, inorganic [IC], <63 µm	----	E354A	0.383 %	95.9	80.0	120	----
Metals (QCLot: 680465)									
	RM	mercury	7439-97-6	E510	0.062 mg/kg	107	70.0	130	----
Metals (QCLot: 680466)									
	RM	aluminum	7429-90-5	E440	9817 mg/kg	104	70.0	130	----
	RM	antimony	7440-36-0	E440	3.99 mg/kg	111	70.0	130	----
	RM	arsenic	7440-38-2	E440	3.73 mg/kg	117	70.0	130	----
	RM	barium	7440-39-3	E440	105 mg/kg	113	70.0	130	----
	RM	beryllium	7440-41-7	E440	0.349 mg/kg	108	70.0	130	----
	RM	boron	7440-42-8	E440	8.5 mg/kg	112	40.0	160	----
	RM	cadmium	7440-43-9	E440	0.91 mg/kg	104	70.0	130	----
	RM	calcium	7440-70-2	E440	31082 mg/kg	108	70.0	130	----
	RM	chromium	7440-47-3	E440	101 mg/kg	105	70.0	130	----
	RM	cobalt	7440-48-4	E440	6.9 mg/kg	106	70.0	130	----
	RM	copper	7440-50-8	E440	123 mg/kg	109	70.0	130	----
	RM	iron	7439-89-6	E440	23558 mg/kg	106	70.0	130	----
	RM	lead	7439-92-1	E440	267 mg/kg	107	70.0	130	----
	RM	lithium	7439-93-2	E440	9.5 mg/kg	106	70.0	130	----
	RM	magnesium	7439-95-4	E440	5509 mg/kg	104	70.0	130	----
	RM	manganese	7439-96-5	E440	269 mg/kg	110	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.03 mg/kg	108	70.0	130	----
	RM	nickel	7440-02-0	E440	26.7 mg/kg	106	70.0	130	----
	RM	phosphorus	7723-14-0	E440	752 mg/kg	104	70.0	130	----
	RM	potassium	7440-09-7	E440	1587 mg/kg	104	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 680466) - continued									
	RM	silver	7440-22-4	E440	4.06 mg/kg	124	70.0	130	----
	RM	sodium	7440-23-5	E440	797 mg/kg	103	70.0	130	----
	RM	strontium	7440-24-6	E440	86.1 mg/kg	108	70.0	130	----
	RM	thallium	7440-28-0	E440	0.0786 mg/kg	107	40.0	160	----
	RM	tin	7440-31-5	E440	10.6 mg/kg	107	70.0	130	----
	RM	titanium	7440-32-6	E440	839 mg/kg	104	70.0	130	----
	RM	uranium	7440-61-1	E440	0.52 mg/kg	102	70.0	130	----
	RM	vanadium	7440-62-2	E440	32.7 mg/kg	105	70.0	130	----
	RM	zinc	7440-66-6	E440	297 mg/kg	100	70.0	130	----
	RM	zirconium	7440-67-7	E440	5.73 mg/kg	108	70.0	130	----

Teck

COC ID: **REP_LAEMP_GC_2022-09_ALS** TURNAROUND TIME: 2-3 Business Days RUSH: Priorty

Environmental Division Calgary Work Order Reference CG2213407

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Regional Effects Program			Lab Name	ALS Calgary			Report Format / Distribution	Excel	PDF	EDD
Project Manager	Giovanna Diaz			Lab Contact	Lyudmyla Shvets			Email 1: AquaSciLab@Teck.com	X	X	X
Email	Giovanna.Diaz@Teck.com			Email	Lyudmyla.Shvets@ALSGlobal.com			Email 2: teckcoal@equisonline.com			X
Address	421 Pine Avenue			Address	2559 29 Street NE			Email 3: Teck.Lab.Results@teck.com	X	X	X
								Email 4: Lisa.Bowron@minnow.ca	X	X	X
City	Sparwood	Province	BC	City	Calgary	Province	AB	Email 5: Awiebe@minnow.ca	X	X	X
Postal Code	V0B 2G0	Country	Canada	Postal Code	T1Y 7B5	Country	Canada	Email 6: Giovanna.Diaz@Teck.com	X	X	X
Phone Number	1-250-865-3048			Phone Number	403 407 1794			PO number	VPO00816101		

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	C-TOC-SK	MET-CCME+FULL-CL	MOISTURE-CL - % Moisture	PSA-PIPET-DETAIL-SK Particle Size	PAH-TMB-D/A-MS-CL-PAHs	MET-TESS-STD-VA
Filtered								N	N	N	N	N	N
Preserv.								NONE	NONE	NONE	NONE	NONE	NONE
RG_GHP_SE-1_LAEMP_GC_2022-09-19_N	RG_GHP	SE		19-Sep-22	9:15	G	2	1	1	1	1	1	1
RG_GHP_SE-2_LAEMP_GC_2022-09-19_N	RG_GHP	SE		19-Sep-22	9:30	G	2	1	1	1	1	1	1
RG_GHP_SE-3_LAEMP_GC_2022-09-19_N	RG_GHP	SE		19-Sep-22	9:45	G	2	1	1	1	1	1	1
RG_GHP_SE-4_LAEMP_GC_2022-09-19_N	RG_GHP	SE		19-Sep-22	10:00	G	2	1	1	1	1	1	1
RG_GHP_SE-5_LAEMP_GC_2022-09-19_N	RG_GHP	SE		19-Sep-22	10:15	G	2	1	1	1	1	1	1
RG_GHP_SE-6_LAEMP_GC_2022-09-19_N	RG_GHP	SE		20-Sep-22	9:15	G	2	1	1	1	1	1	1

Handwritten: tpk 5 4 (MET-CCME+FULL-CL); Wentworth Method (PAH column)

Environmental Division Calgary Work Order Reference CG2213407

Telephone : +1 403 407 1800

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Jennifer Ings/Minnow	##############		
			(signature)	09/27 2:00pm

SERVICE REQUEST (rush - subject to availability)					
Regular (default)		Sampler's Name	Jennifer Ings	5195003444	
Priority (2-3 business days) - 50% surcharge	X	Sampler's Signature	(signature)	Date/Time	September 22, 2022
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

6°C

ALS Canada Ltd.

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CERTIFICATE OF ANALYSIS

Work Order	: **CG2213623**	Page	: 1 of 18
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: Regional Effects Program	Date Samples Received	: 04-Oct-2022 09:00
PO	: VPO00816101	Date Analysis Commenced	: 05-Oct-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 20-Oct-2022 18:27
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Metals, Calgary, Alberta
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Sask Soils, Saskatoon, Saskatchewan
Jeanie Mark	Laboratory Analyst	Organics, Calgary, Alberta
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Sorina Motea	Laboratory Analyst	Organics, Calgary, Alberta
Vishnu Patel		Inorganics, Calgary, Alberta
Xihua Yao	Laboratory Analyst	Inorganics, Saskatoon, Saskatchewan
Xihua Yao	Laboratory Analyst	Sask Soils, Saskatoon, Saskatchewan

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
mg/kg	milligrams per kilogram
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	RG_GAUT_SE-1_2022-09-14_N	RG_GAUT_SE-2_2022-09-14_N	RG_GAUT_SE-3_2022-09-14_N	RG_GAUT_SE-4_2022-09-14_N	RG_GAUT_SE-5_2022-09-14_N
				Client sampling date / time	14-Sep-2022 09:10	14-Sep-2022 10:40	14-Sep-2022 11:45	14-Sep-2022 13:00	14-Sep-2022 13:42
					CG2213623-001	CG2213623-002	CG2213623-003	CG2213623-004	CG2213623-005
					Result	Result	Result	Result	Result
Physical Tests									
moisture	----	E144	0.25	%	22.7	26.1	38.1	31.1	25.4
pH (1:2 soil:water)	----	E108	0.10	pH units	8.25	8.26	8.02	8.15	8.20
Particle Size									
grain size curve	----	E185A	-	-	See Attached	See Attached	See Attached	See Attached	See Attached
clay (<0.004mm)	----	EC184A	1.0	%	7.8	6.7	10.2	9.0	8.1
silt (0.063mm - 0.0312mm)	----	EC184A	1.0	%	13.0	12.8	26.3	18.7	17.2
silt (0.0312mm - 0.004mm)	----	EC184A	1.0	%	21.1	20.6	42.3	29.4	27.1
sand (0.125mm - 0.063mm)	----	EC184A	1.0	%	7.8	6.9	7.6	8.9	8.2
sand (0.25mm - 0.125mm)	----	EC184A	1.0	%	11.9	9.4	4.8	8.9	6.0
sand (0.5mm - 0.25mm)	----	EC184A	1.0	%	14.9	13.8	3.0	11.5	10.2
sand (1.0mm - 0.50mm)	----	EC184A	1.0	%	13.6	13.5	2.5	7.4	12.2
sand (2.0mm - 1.0mm)	----	EC184A	1.0	%	4.4	6.1	1.4	2.1	5.5
gravel (>2mm)	----	EC184A	1.0	%	5.5	10.2	1.9	4.1	5.5
Organic / Inorganic Carbon									
carbon, total [TC]	----	E351	0.050	%	11.5	9.70	22.4	13.7	14.8
carbon, inorganic [IC]	----	E354	0.050	%	0.332	0.336	0.409	0.360	0.378
carbon, inorganic [IC], (as CaCO3 equivalent)	----	E354	0.40	%	2.77	2.80	3.41	3.00	3.15
carbon, total organic [TOC]	----	EC356	0.050	%	11.2	9.36	22.0	13.3	14.4
Metals									
aluminum	7429-90-5	E440	50	mg/kg	9440	8130	6860	9840	10600
antimony	7440-36-0	E440	0.10	mg/kg	0.90	0.89	0.86	0.97	0.88
arsenic	7440-38-2	E440	0.10	mg/kg	6.89	6.99	5.22	6.81	6.46
barium	7440-39-3	E440	0.50	mg/kg	318	312	306	347	370
beryllium	7440-41-7	E440	0.10	mg/kg	0.83	0.78	0.73	0.81	0.81
bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg	7.6	5.4	5.4	8.2	9.5
cadmium	7440-43-9	E440	0.020	mg/kg	0.809	0.918	0.978	0.958	0.891
calcium	7440-70-2	E440	50	mg/kg	11800	12000	13400	12700	12200

Analytical Results

Sub-Matrix: Sediment (Matrix: Soil/Solid)				Client sample ID	RG_GAUT_SE-1 _2022-09-14_N	RG_GAUT_SE-2 _2022-09-14_N	RG_GAUT_SE-3 _2022-09-14_N	RG_GAUT_SE-4 _2022-09-14_N	RG_GAUT_SE-5 _2022-09-14_N
				Client sampling date / time	14-Sep-2022 09:10	14-Sep-2022 10:40	14-Sep-2022 11:45	14-Sep-2022 13:00	14-Sep-2022 13:42
Analyte	CAS Number	Method	LOR	Unit	CG2213623-001	CG2213623-002	CG2213623-003	CG2213623-004	CG2213623-005
					Result	Result	Result	Result	Result
Metals									
chromium	7440-47-3	E440	0.50	mg/kg	13.3	11.6	11.1	14.6	14.9
cobalt	7440-48-4	E440	0.10	mg/kg	11.5	11.1	7.57	10.7	10.3
copper	7440-50-8	E440	0.50	mg/kg	19.8	20.0	21.6	21.0	20.4
iron	7439-89-6	E440	50	mg/kg	20400	19500	12700	18800	18700
lead	7439-92-1	E440	0.50	mg/kg	14.0	13.6	11.6	13.4	12.7
lithium	7439-93-2	E440	2.0	mg/kg	13.5	12.4	8.9	12.3	13.1
magnesium	7439-95-4	E440	20	mg/kg	4410	3920	3420	4090	4100
manganese	7439-96-5	E440	1.0	mg/kg	548	622	357	508	486
mercury	7439-97-6	E510	0.0050	mg/kg	0.0623	0.0668	0.0898	0.0737	0.0748
molybdenum	7439-98-7	E440	0.10	mg/kg	1.40	1.42	1.27	1.45	1.34
nickel	7440-02-0	E440	0.50	mg/kg	33.8	33.1	25.8	33.3	31.2
phosphorus	7723-14-0	E440	50	mg/kg	1340	1300	1020	1270	1300
potassium	7440-09-7	E440	100	mg/kg	1850	1500	1380	2060	2270
selenium	7782-49-2	E440	0.20	mg/kg	1.18	1.22	1.57	1.49	1.32
silver	7440-22-4	E440	0.10	mg/kg	0.25	0.27	0.37	0.30	0.27
sodium	7440-23-5	E440	50	mg/kg	63	56	54	66	70
strontium	7440-24-6	E440	0.50	mg/kg	51.0	47.8	50.7	52.4	50.6
sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	<1000	<1000	<1000
thallium	7440-28-0	E440	0.050	mg/kg	0.178	0.140	0.135	0.167	0.169
tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg	17.1	10.1	13.0	18.3	17.6
tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg	0.825	0.845	1.00	0.941	0.881
vanadium	7440-62-2	E440	0.20	mg/kg	29.4	26.5	24.4	33.6	34.0
zinc	7440-66-6	E440	2.0	mg/kg	114	113	90.7	124	110
zirconium	7440-67-7	E440	1.0	mg/kg	1.3	1.2	1.4	1.1	1.0
Polycyclic Aromatic Hydrocarbons									
acenaphthene	83-32-9	E641A	0.050	mg/kg	0.092	0.167	0.384	0.204	0.138
acenaphthylene	208-96-8	E641A	0.050	mg/kg	<0.050	<0.050	0.056	<0.050	<0.050
acridine	260-94-6	E641A	0.050	mg/kg	0.140	0.282	0.646	0.320	0.218

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	RG_GAUT_SE-1_2022-09-14_N	RG_GAUT_SE-2_2022-09-14_N	RG_GAUT_SE-3_2022-09-14_N	RG_GAUT_SE-4_2022-09-14_N	RG_GAUT_SE-5_2022-09-14_N
Client sampling date / time					14-Sep-2022 09:10	14-Sep-2022 10:40	14-Sep-2022 11:45	14-Sep-2022 13:00	14-Sep-2022 13:42
					CG2213623-001	CG2213623-002	CG2213623-003	CG2213623-004	CG2213623-005
					Result	Result	Result	Result	Result
Polycyclic Aromatic Hydrocarbons									
anthracene	120-12-7	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
benz(a)anthracene	56-55-3	E641A	0.050	mg/kg	<0.050	0.090	0.206	0.108	0.070
benzo(a)pyrene	50-32-8	E641A	0.050	mg/kg	<0.050	0.060	0.123	0.064	<0.050
benzo(b+j)fluoranthene	n/a	E641A	0.050	mg/kg	0.130	0.248	0.507	0.268	0.184
benzo(b+j+k)fluoranthene	n/a	E641A	0.075	mg/kg	0.130	0.248	0.567	0.268	0.184
benzo(g,h,i)perylene	191-24-2	E641A	0.050	mg/kg	0.056	0.094	0.187	0.097	0.065
benzo(k)fluoranthene	207-08-9	E641A	0.050	mg/kg	<0.050	<0.050	0.060	<0.050	<0.050
chrysene	218-01-9	E641A	0.050	mg/kg	0.303	0.537	1.13	0.579	0.430
dibenz(a,h)anthracene	53-70-3	E641A	0.050	mg/kg	<0.050	<0.050	0.091	<0.050	<0.050
fluoranthene	206-44-0	E641A	0.050	mg/kg	<0.050	0.073	0.162	0.084	0.057
fluorene	86-73-7	E641A	0.050	mg/kg	0.214	0.395	0.947	0.476	0.320
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.050	mg/kg	<0.050	<0.050	0.059	<0.050	<0.050
methylnaphthalene, 1-	90-12-0	E641A	0.030	mg/kg	1.32	2.38	5.49	2.80	1.94
methylnaphthalene, 1+2-	----	E641A	0.050	mg/kg	3.87	7.03	16.3	8.32	5.75
methylnaphthalene, 2-	91-57-6	E641A	0.030	mg/kg	2.55	4.65	10.8	5.52	3.81
naphthalene	91-20-3	E641A	0.010	mg/kg	0.858	1.57	3.74	1.84	1.28
phenanthrene	85-01-8	E641A	0.050	mg/kg	0.982	1.79	4.09	2.15	1.47
pyrene	129-00-0	E641A	0.050	mg/kg	0.105	0.180	0.386	0.210	0.148
quinoline	91-22-5	E641A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.065	mg/kg	0.074	0.130	0.310	0.138	0.085
IACR (CCME)	----	E641A	0.60	-	1.38	2.53	5.48	2.74	1.92
IACR AB (coarse)	----	E641A	0.10	-	<0.10	<0.10	0.19	<0.10	<0.10
IACR AB (fine)	----	E641A	0.10	-	0.10	0.16	0.36	0.18	0.13
PAHs, total (BC Sched 3.4)	n/a	E641A	0.20	mg/kg	5.10	9.51	22.1	11.2	7.72
PAHs, total (EPA 16)	n/a	E641A	0.20	mg/kg	2.74	5.20	12.1	6.08	4.16
Polycyclic Aromatic Hydrocarbons Surrogates									
acridine-d9	34749-75-2	E641A	0.1	%	98.8	98.0	93.2	96.7	98.4
chrysene-d12	1719-03-5	E641A	0.1	%	122	119	116	120	121
naphthalene-d8	1146-65-2	E641A	0.1	%	116	112	113	112	113
phenanthrene-d10	1517-22-2	E641A	0.1	%	113	111	112	110	112

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	RG_GAUT_SE-1_2022-09-14_N	RG_GAUT_SE-2_2022-09-14_N	RG_GAUT_SE-3_2022-09-14_N	RG_GAUT_SE-4_2022-09-14_N	RG_GAUT_SE-5_2022-09-14_N
Client sampling date / time					14-Sep-2022 09:10	14-Sep-2022 10:40	14-Sep-2022 11:45	14-Sep-2022 13:00	14-Sep-2022 13:42
					CG2213623-001	CG2213623-002	CG2213623-003	CG2213623-004	CG2213623-005
					Result	Result	Result	Result	Result
Exchangeable & Adsorbed Metals									
aluminum, leachable	7429-90-5	E450	50	mg/kg	<50	<50	<50	<50	<50
antimony, leachable	7440-36-0	E450	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
barium, leachable	7440-39-3	E450	0.50	mg/kg	44.2	46.1	55.9	48.6	46.8
beryllium, leachable	7440-41-7	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
bismuth, leachable	7440-69-9	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450	0.050	mg/kg	0.152	0.173	0.201	0.166	0.177
calcium, leachable	7440-70-2	E450	50	mg/kg	3750	3800	5520	4470	4530
chromium, leachable	7440-47-3	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
cobalt, leachable	7440-48-4	E450	0.10	mg/kg	0.17	0.24	0.30	0.22	0.17
copper, leachable	7440-50-8	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
iron, leachable	7439-89-6	E450	50	mg/kg	<50	<50	<50	<50	<50
lead, leachable	7439-92-1	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
lithium, leachable	7439-93-2	E450	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450	1.0	mg/kg	36.1	56.7	109	59.6	40.4
molybdenum, leachable	7439-98-7	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
phosphorus, leachable	7723-14-0	E450	50	mg/kg	<50	<50	<50	<50	<50
potassium, leachable	7440-09-7	E450	100	mg/kg	140	130	140	150	140
selenium, leachable	7782-49-2	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
silver, leachable	7440-22-4	E450	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
sodium, leachable	7440-23-5	E450	100	mg/kg	<100	<100	<100	<100	<100
strontium, leachable	7440-24-6	E450	0.50	mg/kg	12.9	12.6	16.8	15.0	14.6
thallium, leachable	7440-28-0	E450	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
uranium, leachable	7440-61-1	E450	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
vanadium, leachable	7440-62-2	E450	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
zinc, leachable	7440-66-6	E450	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Carbonate Metals									

Analytical Results

Sub-Matrix: **Sediment**

(Matrix: **Soil/Solid)**

				Client sample ID	RG_GAUT_SE-1 _2022-09-14_N	RG_GAUT_SE-2 _2022-09-14_N	RG_GAUT_SE-3 _2022-09-14_N	RG_GAUT_SE-4 _2022-09-14_N	RG_GAUT_SE-5 _2022-09-14_N
				Client sampling date / time	14-Sep-2022 09:10	14-Sep-2022 10:40	14-Sep-2022 11:45	14-Sep-2022 13:00	14-Sep-2022 13:42
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	CG2213623-001	CG2213623-002	CG2213623-003	CG2213623-004	CG2213623-005
					Result	Result	Result	Result	Result
Carbonate Metals									
aluminum, leachable	7429-90-5	E450A	50	mg/kg	<50	<50	<50	<50	<50
antimony, leachable	7440-36-0	E450A	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450A	0.050	mg/kg	0.054	0.058	0.105	0.068	<0.050
barium, leachable	7440-39-3	E450A	2.0	mg/kg	35.7	35.0	31.3	36.2	34.7
beryllium, leachable	7440-41-7	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
bismuth, leachable	7440-69-9	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450A	0.050	mg/kg	0.166	0.190	0.190	0.193	0.175
calcium, leachable	7440-70-2	E450A	50	mg/kg	2760	3010	2990	2870	3010
chromium, leachable	7440-47-3	E450A	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
cobalt, leachable	7440-48-4	E450A	0.10	mg/kg	0.70	0.71	0.79	0.80	0.60
copper, leachable	7440-50-8	E450A	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
iron, leachable	7439-89-6	E450A	50	mg/kg	<50	<50	<50	<50	<50
lead, leachable	7439-92-1	E450A	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
lithium, leachable	7439-93-2	E450A	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450A	5.0	mg/kg	101	96.6	107	111	97.1
molybdenum, leachable	7439-98-7	E450A	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450A	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
phosphorus, leachable	7723-14-0	E450A	50	mg/kg	<50	<50	<50	<50	<50
selenium, leachable	7782-49-2	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
silver, leachable	7440-22-4	E450A	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
strontium, leachable	7440-24-6	E450A	5.0	mg/kg	5.4	5.8	5.6	5.7	5.6
thallium, leachable	7440-28-0	E450A	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450A	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450A	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
uranium, leachable	7440-61-1	E450A	0.050	mg/kg	<0.050	0.051	0.076	0.059	0.067
vanadium, leachable	7440-62-2	E450A	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
zinc, leachable	7440-66-6	E450A	1.0	mg/kg	5.0	4.7	4.6	5.3	4.7
Easily Reducible Metals and Iron Oxides									
aluminum, leachable	7429-90-5	E450B	50	mg/kg	595	609	579	628	592
antimony, leachable	7440-36-0	E450B	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid)**

Analyte	CAS Number	Method	LOR	Unit	RG_GAUT_SE-1 _2022-09-14_N	RG_GAUT_SE-2 _2022-09-14_N	RG_GAUT_SE-3 _2022-09-14_N	RG_GAUT_SE-4 _2022-09-14_N	RG_GAUT_SE-5 _2022-09-14_N
				Client sampling date / time	14-Sep-2022 09:10	14-Sep-2022 10:40	14-Sep-2022 11:45	14-Sep-2022 13:00	14-Sep-2022 13:42
					CG2213623-001	CG2213623-002	CG2213623-003	CG2213623-004	CG2213623-005
					Result	Result	Result	Result	Result
Easily Reducible Metals and Iron Oxides									
arsenic, leachable	7440-38-2	E450B	0.050	mg/kg	0.516	0.556	0.686	0.550	0.535
barium, leachable	7440-39-3	E450B	0.50	mg/kg	51.3	50.8	50.9	53.6	54.6
beryllium, leachable	7440-41-7	E450B	0.20	mg/kg	0.30	0.29	0.35	0.30	0.27
bismuth, leachable	7440-69-9	E450B	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450B	0.050	mg/kg	0.385	0.445	0.560	0.489	0.422
calcium, leachable	7440-70-2	E450B	50	mg/kg	3020	3320	3460	3300	3270
chromium, leachable	7440-47-3	E450B	0.50	mg/kg	0.80	0.90	0.75	0.75	0.71
cobalt, leachable	7440-48-4	E450B	0.10	mg/kg	4.46	4.17	3.18	4.08	3.72
copper, leachable	7440-50-8	E450B	0.50	mg/kg	0.69	0.65	0.53	0.57	0.55
iron, leachable	7439-89-6	E450B	50	mg/kg	3810	3680	3310	3680	3560
lead, leachable	7439-92-1	E450B	0.50	mg/kg	3.26	3.19	2.82	3.05	2.86
lithium, leachable	7439-93-2	E450B	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450B	1.0	mg/kg	218	191	118	195	262
molybdenum, leachable	7439-98-7	E450B	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450B	0.50	mg/kg	11.3	10.6	9.49	10.8	10.8
phosphorus, leachable	7723-14-0	E450B	50	mg/kg	183	142	180	132	143
selenium, leachable	7782-49-2	E450B	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
silver, leachable	7440-22-4	E450B	0.10	mg/kg	0.10	0.10	<0.10	<0.10	<0.10
strontium, leachable	7440-24-6	E450B	0.50	mg/kg	6.18	6.63	6.87	6.72	6.59
thallium, leachable	7440-28-0	E450B	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450B	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450B	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
uranium, leachable	7440-61-1	E450B	0.050	mg/kg	0.161	0.178	0.217	0.188	0.195
vanadium, leachable	7440-62-2	E450B	0.20	mg/kg	2.78	2.90	2.42	2.63	2.64
zinc, leachable	7440-66-6	E450B	1.0	mg/kg	26.5	26.4	26.1	26.8	24.4
Organic Bound Metals									
aluminum, leachable	7429-90-5	E450C	50	mg/kg	1850	1740	2260	2000	1950
antimony, leachable	7440-36-0	E450C	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
arsenic, leachable	7440-38-2	E450C	0.050	mg/kg	0.408	0.495	0.886	0.596	0.723
barium, leachable	7440-39-3	E450C	0.50	mg/kg	25.3	23.7	25.6	25.3	25.1

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	RG_GAUT_SE-1_2022-09-14_N	RG_GAUT_SE-2_2022-09-14_N	RG_GAUT_SE-3_2022-09-14_N	RG_GAUT_SE-4_2022-09-14_N	RG_GAUT_SE-5_2022-09-14_N
				Client sampling date / time	14-Sep-2022 09:10	14-Sep-2022 10:40	14-Sep-2022 11:45	14-Sep-2022 13:00	14-Sep-2022 13:42
					CG2213623-001	CG2213623-002	CG2213623-003	CG2213623-004	CG2213623-005
					Result	Result	Result	Result	Result
Organic Bound Metals									
beryllium, leachable	7440-41-7	E450C	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
bismuth, leachable	7440-69-9	E450C	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450C	0.050	mg/kg	0.080	0.085	0.118	0.094	0.080
calcium, leachable	7440-70-2	E450C	50	mg/kg	1040	1050	1140	1140	1120
chromium, leachable	7440-47-3	E450C	0.50	mg/kg	3.66	3.77	5.43	4.21	4.05
cobalt, leachable	7440-48-4	E450C	0.10	mg/kg	1.10	1.03	1.40	1.24	1.18
copper, leachable	7440-50-8	E450C	0.50	mg/kg	6.38	7.32	12.9	8.60	8.14
iron, leachable	7439-89-6	E450C	50	mg/kg	1890	1960	2960	2380	2490
lead, leachable	7439-92-1	E450C	0.50	mg/kg	0.80	0.88	1.90	1.14	1.22
lithium, leachable	7439-93-2	E450C	5.0	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0
manganese, leachable	7439-96-5	E450C	1.0	mg/kg	19.9	17.1	15.0	19.4	23.4
molybdenum, leachable	7439-98-7	E450C	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
nickel, leachable	7440-02-0	E450C	0.50	mg/kg	6.08	6.02	8.69	6.96	6.78
selenium, leachable	7782-49-2	E450C	0.20	mg/kg	0.90	1.01	1.64	1.17	1.11
silver, leachable	7440-22-4	E450C	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
strontium, leachable	7440-24-6	E450C	0.50	mg/kg	4.75	4.64	4.86	4.95	4.97
thallium, leachable	7440-28-0	E450C	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
tin, leachable	7440-31-5	E450C	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450C	1.0	mg/kg	1.7	2.2	3.9	2.3	2.4
uranium, leachable	7440-61-1	E450C	0.050	mg/kg	0.255	0.279	0.432	0.329	0.338
vanadium, leachable	7440-62-2	E450C	0.20	mg/kg	4.26	4.45	6.59	5.37	5.32
zinc, leachable	7440-66-6	E450C	1.0	mg/kg	8.9	9.1	14.6	10.5	10.2
Residual Metals									
aluminum, leachable	7429-90-5	E450D	50	mg/kg	8080	7710	5480	6410	7120
antimony, leachable	7440-36-0	E450D	0.10	mg/kg	0.70	0.76	0.73	0.69	0.74
arsenic, leachable	7440-38-2	E450D	5.00	mg/kg	<5.00	<5.00	<5.00	<5.00	<5.00
barium, leachable	7440-39-3	E450D	2.0	mg/kg	120	126	114	126	130
beryllium, leachable	7440-41-7	E450D	0.20	mg/kg	0.38	0.33	0.32	0.31	0.36
bismuth, leachable	7440-69-9	E450D	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
cadmium, leachable	7440-43-9	E450D	0.050	mg/kg	0.074	0.074	0.060	0.073	0.079

Analytical Results

Sub-Matrix: **Sediment**

(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	RG_GAUT_SE-1_2022-09-14_N	RG_GAUT_SE-2_2022-09-14_N	RG_GAUT_SE-3_2022-09-14_N	RG_GAUT_SE-4_2022-09-14_N	RG_GAUT_SE-5_2022-09-14_N
				Client sampling date / time	14-Sep-2022 09:10	14-Sep-2022 10:40	14-Sep-2022 11:45	14-Sep-2022 13:00	14-Sep-2022 13:42
					CG2213623-001	CG2213623-002	CG2213623-003	CG2213623-004	CG2213623-005
					Result	Result	Result	Result	Result
Residual Metals									
calcium, leachable	7440-70-2	E450D	50	mg/kg	678	518	173	348	403
chromium, leachable	7440-47-3	E450D	5.0	mg/kg	11.4	11.0	7.9	9.2	10.0
cobalt, leachable	7440-48-4	E450D	0.10	mg/kg	2.85	2.78	2.18	2.70	2.54
copper, leachable	7440-50-8	E450D	0.50	mg/kg	12.3	12.6	10.8	11.9	11.0
iron, leachable	7439-89-6	E450D	50	mg/kg	11600	10400	6430	9620	8610
lead, leachable	7439-92-1	E450D	0.50	mg/kg	7.04	6.99	6.04	6.94	6.40
lithium, leachable	7439-93-2	E450D	5.0	mg/kg	7.0	6.4	<5.0	5.4	5.6
manganese, leachable	7439-96-5	E450D	5.0	mg/kg	43.4	39.9	26.5	38.0	34.5
molybdenum, leachable	7439-98-7	E450D	0.50	mg/kg	0.96	1.07	0.86	0.90	0.94
nickel, leachable	7440-02-0	E450D	2.0	mg/kg	11.4	11.4	8.3	10.4	9.9
selenium, leachable	7782-49-2	E450D	0.20	mg/kg	0.46	0.35	0.43	0.48	0.46
silver, leachable	7440-22-4	E450D	0.10	mg/kg	0.12	0.14	0.28	0.18	0.16
strontium, leachable	7440-24-6	E450D	5.0	mg/kg	19.1	20.8	19.1	18.1	19.2
thallium, leachable	7440-28-0	E450D	0.050	mg/kg	0.137	0.145	0.118	0.122	0.155
tin, leachable	7440-31-5	E450D	2.0	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
titanium, leachable	7440-32-6	E450D	5.0	mg/kg	16.8	24.8	24.6	19.4	25.2
uranium, leachable	7440-61-1	E450D	0.050	mg/kg	0.346	0.339	0.281	0.291	0.325
vanadium, leachable	7440-62-2	E450D	0.20	mg/kg	28.9	28.6	23.0	24.3	26.9
zinc, leachable	7440-66-6	E450D	1.0	mg/kg	62.7	59.9	45.8	57.7	54.4

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Sediment**

(Matrix: **Soil/Solid)**

				Client sample ID	RG_RIVER_SE-2_2022-09-14_N	----	----	----	----
				Client sampling date / time	14-Sep-2022 10:40	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	CG2213623-006	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
moisture	----	E144	0.25	%	38.6	----	----	----	----
pH (1:2 soil:water)	----	E108	0.10	pH units	8.35	----	----	----	----
Particle Size									
grain size curve	----	E185A	-	-	See Attached	----	----	----	----
clay (<0.004mm)	----	EC184A	1.0	%	5.0	----	----	----	----
silt (0.063mm - 0.0312mm)	----	EC184A	1.0	%	21.7	----	----	----	----
silt (0.0312mm - 0.004mm)	----	EC184A	1.0	%	24.2	----	----	----	----
sand (0.125mm - 0.063mm)	----	EC184A	1.0	%	21.9	----	----	----	----
sand (0.25mm - 0.125mm)	----	EC184A	1.0	%	13.7	----	----	----	----
sand (0.5mm - 0.25mm)	----	EC184A	1.0	%	4.7	----	----	----	----
sand (1.0mm - 0.50mm)	----	EC184A	1.0	%	2.2	----	----	----	----
sand (2.0mm - 1.0mm)	----	EC184A	1.0	%	3.6	----	----	----	----
gravel (>2mm)	----	EC184A	1.0	%	3.0	----	----	----	----
Organic / Inorganic Carbon									
carbon, total [TC]	----	E351	0.050	%	3.58	----	----	----	----
carbon, inorganic [IC]	----	E354	0.050	%	0.981	----	----	----	----
carbon, inorganic [IC], (as CaCO3 equivalent)	----	E354	0.40	%	8.18	----	----	----	----
carbon, total organic [TOC]	----	EC356	0.050	%	2.60	----	----	----	----
Metals									
aluminum	7429-90-5	E440	50	mg/kg	16200	----	----	----	----
antimony	7440-36-0	E440	0.10	mg/kg	0.40	----	----	----	----
arsenic	7440-38-2	E440	0.10	mg/kg	7.82	----	----	----	----
barium	7440-39-3	E440	0.50	mg/kg	700	----	----	----	----
beryllium	7440-41-7	E440	0.10	mg/kg	0.86	----	----	----	----
bismuth	7440-69-9	E440	0.20	mg/kg	0.23	----	----	----	----
boron	7440-42-8	E440	5.0	mg/kg	17.9	----	----	----	----
cadmium	7440-43-9	E440	0.020	mg/kg	0.844	----	----	----	----
calcium	7440-70-2	E440	50	mg/kg	25500	----	----	----	----
chromium	7440-47-3	E440	0.50	mg/kg	19.0	----	----	----	----

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	RG_RIVER_SE-2_2022-09-14_N	----	----	----	----
				Client sampling date / time	14-Sep-2022 10:40	----	----	----	----
					CG2213623-006	--------	--------	--------	--------
					Result	----	----	----	----
Metals									
cobalt	7440-48-4	E440	0.10	mg/kg	8.11	----	----	----	----
copper	7440-50-8	E440	0.50	mg/kg	19.9	----	----	----	----
iron	7439-89-6	E440	50	mg/kg	23500	----	----	----	----
lead	7439-92-1	E440	0.50	mg/kg	13.6	----	----	----	----
lithium	7439-93-2	E440	2.0	mg/kg	25.4	----	----	----	----
magnesium	7439-95-4	E440	20	mg/kg	8220	----	----	----	----
manganese	7439-96-5	E440	1.0	mg/kg	324	----	----	----	----
mercury	7439-97-6	E510	0.0050	mg/kg	0.0286	----	----	----	----
molybdenum	7439-98-7	E440	0.10	mg/kg	2.19	----	----	----	----
nickel	7440-02-0	E440	0.50	mg/kg	24.8	----	----	----	----
phosphorus	7723-14-0	E440	50	mg/kg	1560	----	----	----	----
potassium	7440-09-7	E440	100	mg/kg	3380	----	----	----	----
selenium	7782-49-2	E440	0.20	mg/kg	0.67	----	----	----	----
silver	7440-22-4	E440	0.10	mg/kg	0.13	----	----	----	----
sodium	7440-23-5	E440	50	mg/kg	273	----	----	----	----
strontium	7440-24-6	E440	0.50	mg/kg	97.7	----	----	----	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----	----	----	----
thallium	7440-28-0	E440	0.050	mg/kg	0.423	----	----	----	----
tin	7440-31-5	E440	2.0	mg/kg	<2.0	----	----	----	----
titanium	7440-32-6	E440	1.0	mg/kg	20.8	----	----	----	----
tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	----	----	----	----
uranium	7440-61-1	E440	0.050	mg/kg	0.712	----	----	----	----
vanadium	7440-62-2	E440	0.20	mg/kg	31.2	----	----	----	----
zinc	7440-66-6	E440	2.0	mg/kg	101	----	----	----	----
zirconium	7440-67-7	E440	1.0	mg/kg	1.0	----	----	----	----
Polycyclic Aromatic Hydrocarbons									
acenaphthene	83-32-9	E641A	0.050	mg/kg	<0.050	----	----	----	----
acenaphthylene	208-96-8	E641A	0.050	mg/kg	<0.050	----	----	----	----
acridine	260-94-6	E641A	0.050	mg/kg	<0.050	----	----	----	----
anthracene	120-12-7	E641A	0.050	mg/kg	<0.050	----	----	----	----

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	RG_RIVER_SE-2_2022-09-14_N	----	----	----	----
				Client sampling date / time	14-Sep-2022 10:40	----	----	----	----
					CG2213623-006	--------	--------	--------	--------
					Result	----	----	----	----
Polycyclic Aromatic Hydrocarbons									
benz(a)anthracene	56-55-3	E641A	0.050	mg/kg	<0.050	----	----	----	----
benzo(a)pyrene	50-32-8	E641A	0.050	mg/kg	<0.050	----	----	----	----
benzo(b+j)fluoranthene	n/a	E641A	0.050	mg/kg	<0.050	----	----	----	----
benzo(b+j+k)fluoranthene	n/a	E641A	0.075	mg/kg	<0.075	----	----	----	----
benzo(g,h,i)perylene	191-24-2	E641A	0.050	mg/kg	<0.050	----	----	----	----
benzo(k)fluoranthene	207-08-9	E641A	0.050	mg/kg	<0.050	----	----	----	----
chrysene	218-01-9	E641A	0.050	mg/kg	<0.050	----	----	----	----
dibenz(a,h)anthracene	53-70-3	E641A	0.050	mg/kg	<0.050	----	----	----	----
fluoranthene	206-44-0	E641A	0.050	mg/kg	<0.050	----	----	----	----
fluorene	86-73-7	E641A	0.050	mg/kg	<0.050	----	----	----	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.050	mg/kg	<0.050	----	----	----	----
methylnaphthalene, 1-	90-12-0	E641A	0.030	mg/kg	0.031	----	----	----	----
methylnaphthalene, 1+2-	----	E641A	0.050	mg/kg	0.077	----	----	----	----
methylnaphthalene, 2-	91-57-6	E641A	0.030	mg/kg	0.046	----	----	----	----
naphthalene	91-20-3	E641A	0.010	mg/kg	0.037	----	----	----	----
phenanthrene	85-01-8	E641A	0.050	mg/kg	0.069	----	----	----	----
pyrene	129-00-0	E641A	0.050	mg/kg	<0.050	----	----	----	----
quinoline	91-22-5	E641A	0.050	mg/kg	<0.050	----	----	----	----
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.065	mg/kg	<0.065	----	----	----	----
IACR (CCME)	----	E641A	0.60	-	<0.60	----	----	----	----
IACR AB (coarse)	----	E641A	0.10	-	<0.10	----	----	----	----
IACR AB (fine)	----	E641A	0.10	-	<0.10	----	----	----	----
PAHs, total (BC Sched 3.4)	n/a	E641A	0.20	mg/kg	<0.20	----	----	----	----
PAHs, total (EPA 16)	n/a	E641A	0.20	mg/kg	<0.20	----	----	----	----
Polycyclic Aromatic Hydrocarbons Surrogates									
acridine-d9	34749-75-2	E641A	0.1	%	103	----	----	----	----
chrysene-d12	1719-03-5	E641A	0.1	%	128	----	----	----	----
naphthalene-d8	1146-65-2	E641A	0.1	%	111	----	----	----	----
phenanthrene-d10	1517-22-2	E641A	0.1	%	111	----	----	----	----
Exchangeable & Adsorbed Metals									

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid)**

Analyte	CAS Number	Method	LOR	Unit	RG_RIVER_SE-2_2022-09-14_N	----	----	----	----
				Client sampling date / time	14-Sep-2022 10:40	----	----	----	----
					CG2213623-006	--------	--------	--------	--------
					Result	----	----	----	----
Exchangeable & Adsorbed Metals									
aluminum, leachable	7429-90-5	E450	50	mg/kg	<50	----	----	----	----
antimony, leachable	7440-36-0	E450	0.10	mg/kg	<0.10	----	----	----	----
arsenic, leachable	7440-38-2	E450	0.050	mg/kg	0.052	----	----	----	----
barium, leachable	7440-39-3	E450	0.50	mg/kg	224	----	----	----	----
beryllium, leachable	7440-41-7	E450	0.20	mg/kg	<0.20	----	----	----	----
bismuth, leachable	7440-69-9	E450	0.20	mg/kg	<0.20	----	----	----	----
cadmium, leachable	7440-43-9	E450	0.050	mg/kg	<0.050	----	----	----	----
calcium, leachable	7440-70-2	E450	50	mg/kg	2500	----	----	----	----
chromium, leachable	7440-47-3	E450	0.50	mg/kg	<0.50	----	----	----	----
cobalt, leachable	7440-48-4	E450	0.10	mg/kg	<0.10	----	----	----	----
copper, leachable	7440-50-8	E450	0.50	mg/kg	<0.50	----	----	----	----
iron, leachable	7439-89-6	E450	50	mg/kg	<50	----	----	----	----
lead, leachable	7439-92-1	E450	0.50	mg/kg	<0.50	----	----	----	----
lithium, leachable	7439-93-2	E450	5.0	mg/kg	<5.0	----	----	----	----
manganese, leachable	7439-96-5	E450	1.0	mg/kg	32.3	----	----	----	----
molybdenum, leachable	7439-98-7	E450	0.50	mg/kg	<0.50	----	----	----	----
nickel, leachable	7440-02-0	E450	0.50	mg/kg	<0.50	----	----	----	----
phosphorus, leachable	7723-14-0	E450	50	mg/kg	<50	----	----	----	----
potassium, leachable	7440-09-7	E450	100	mg/kg	190	----	----	----	----
selenium, leachable	7782-49-2	E450	0.20	mg/kg	<0.20	----	----	----	----
silver, leachable	7440-22-4	E450	0.10	mg/kg	<0.10	----	----	----	----
sodium, leachable	7440-23-5	E450	100	mg/kg	350	----	----	----	----
strontium, leachable	7440-24-6	E450	0.50	mg/kg	42.4	----	----	----	----
thallium, leachable	7440-28-0	E450	0.050	mg/kg	<0.050	----	----	----	----
tin, leachable	7440-31-5	E450	2.0	mg/kg	<2.0	----	----	----	----
titanium, leachable	7440-32-6	E450	1.0	mg/kg	<1.0	----	----	----	----
uranium, leachable	7440-61-1	E450	0.050	mg/kg	<0.050	----	----	----	----
vanadium, leachable	7440-62-2	E450	0.20	mg/kg	<0.20	----	----	----	----
zinc, leachable	7440-66-6	E450	1.0	mg/kg	<1.0	----	----	----	----
Carbonate Metals									

Analytical Results

Sub-Matrix: Sediment (Matrix: Soil/Solid)				Client sample ID	RG_RIVER_SE-2_2022-09-14_N	----	----	----	----
				Client sampling date / time	14-Sep-2022 10:40	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2213623-006	--------	--------	--------	--------
					Result	----	----	----	----
Carbonate Metals									
aluminum, leachable	7429-90-5	E450A	50	mg/kg	<50	----	----	----	----
antimony, leachable	7440-36-0	E450A	0.10	mg/kg	<0.10	----	----	----	----
arsenic, leachable	7440-38-2	E450A	0.050	mg/kg	0.164	----	----	----	----
barium, leachable	7440-39-3	E450A	2.0	mg/kg	123	----	----	----	----
beryllium, leachable	7440-41-7	E450A	0.20	mg/kg	<0.20	----	----	----	----
bismuth, leachable	7440-69-9	E450A	0.20	mg/kg	<0.20	----	----	----	----
cadmium, leachable	7440-43-9	E450A	0.050	mg/kg	0.245	----	----	----	----
calcium, leachable	7440-70-2	E450A	50	mg/kg	13800	----	----	----	----
chromium, leachable	7440-47-3	E450A	5.0	mg/kg	<5.0	----	----	----	----
cobalt, leachable	7440-48-4	E450A	0.10	mg/kg	1.42	----	----	----	----
copper, leachable	7440-50-8	E450A	0.50	mg/kg	<0.50	----	----	----	----
iron, leachable	7439-89-6	E450A	50	mg/kg	563	----	----	----	----
lead, leachable	7439-92-1	E450A	0.50	mg/kg	1.19	----	----	----	----
lithium, leachable	7439-93-2	E450A	5.0	mg/kg	<5.0	----	----	----	----
manganese, leachable	7439-96-5	E450A	5.0	mg/kg	126	----	----	----	----
molybdenum, leachable	7439-98-7	E450A	0.50	mg/kg	<0.50	----	----	----	----
nickel, leachable	7440-02-0	E450A	2.0	mg/kg	2.1	----	----	----	----
phosphorus, leachable	7723-14-0	E450A	50	mg/kg	<50	----	----	----	----
selenium, leachable	7782-49-2	E450A	0.20	mg/kg	<0.20	----	----	----	----
silver, leachable	7440-22-4	E450A	0.10	mg/kg	<0.10	----	----	----	----
strontium, leachable	7440-24-6	E450A	5.0	mg/kg	27.7	----	----	----	----
thallium, leachable	7440-28-0	E450A	0.050	mg/kg	<0.050	----	----	----	----
tin, leachable	7440-31-5	E450A	2.0	mg/kg	<2.0	----	----	----	----
titanium, leachable	7440-32-6	E450A	5.0	mg/kg	<5.0	----	----	----	----
uranium, leachable	7440-61-1	E450A	0.050	mg/kg	0.055	----	----	----	----
vanadium, leachable	7440-62-2	E450A	0.20	mg/kg	<0.20	----	----	----	----
zinc, leachable	7440-66-6	E450A	1.0	mg/kg	9.1	----	----	----	----
Easily Reducible Metals and Iron Oxides									
aluminum, leachable	7429-90-5	E450B	50	mg/kg	655	----	----	----	----
antimony, leachable	7440-36-0	E450B	0.10	mg/kg	<0.10	----	----	----	----

Analytical Results

Sub-Matrix: **Sediment**
(Matrix: **Soil/Solid)**

				Client sample ID	RG_RIVER_SE-2 _2022-09-14_N	----	----	----	----
				Client sampling date / time	14-Sep-2022 10:40	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2213623-006	--------	--------	--------	--------
					Result	----	----	----	----
Easily Reducible Metals and Iron Oxides									
arsenic, leachable	7440-38-2	E450B	0.050	mg/kg	0.865	----	----	----	----
barium, leachable	7440-39-3	E450B	0.50	mg/kg	82.6	----	----	----	----
beryllium, leachable	7440-41-7	E450B	0.20	mg/kg	0.24	----	----	----	----
bismuth, leachable	7440-69-9	E450B	0.20	mg/kg	<0.20	----	----	----	----
cadmium, leachable	7440-43-9	E450B	0.050	mg/kg	0.358	----	----	----	----
calcium, leachable	7440-70-2	E450B	50	mg/kg	8360	----	----	----	----
chromium, leachable	7440-47-3	E450B	0.50	mg/kg	1.50	----	----	----	----
cobalt, leachable	7440-48-4	E450B	0.10	mg/kg	2.37	----	----	----	----
copper, leachable	7440-50-8	E450B	0.50	mg/kg	0.90	----	----	----	----
iron, leachable	7439-89-6	E450B	50	mg/kg	4140	----	----	----	----
lead, leachable	7439-92-1	E450B	0.50	mg/kg	4.56	----	----	----	----
lithium, leachable	7439-93-2	E450B	5.0	mg/kg	<5.0	----	----	----	----
manganese, leachable	7439-96-5	E450B	1.0	mg/kg	90.3	----	----	----	----
molybdenum, leachable	7439-98-7	E450B	0.50	mg/kg	<0.50	----	----	----	----
nickel, leachable	7440-02-0	E450B	0.50	mg/kg	5.43	----	----	----	----
phosphorus, leachable	7723-14-0	E450B	50	mg/kg	74	----	----	----	----
selenium, leachable	7782-49-2	E450B	0.20	mg/kg	<0.20	----	----	----	----
silver, leachable	7440-22-4	E450B	0.10	mg/kg	<0.10	----	----	----	----
strontium, leachable	7440-24-6	E450B	0.50	mg/kg	12.0	----	----	----	----
thallium, leachable	7440-28-0	E450B	0.050	mg/kg	<0.050	----	----	----	----
tin, leachable	7440-31-5	E450B	2.0	mg/kg	<2.0	----	----	----	----
titanium, leachable	7440-32-6	E450B	1.0	mg/kg	<1.0	----	----	----	----
uranium, leachable	7440-61-1	E450B	0.050	mg/kg	0.123	----	----	----	----
vanadium, leachable	7440-62-2	E450B	0.20	mg/kg	2.88	----	----	----	----
zinc, leachable	7440-66-6	E450B	1.0	mg/kg	24.4	----	----	----	----
Organic Bound Metals									
aluminum, leachable	7429-90-5	E450C	50	mg/kg	1280	----	----	----	----
antimony, leachable	7440-36-0	E450C	0.10	mg/kg	<0.10	----	----	----	----
arsenic, leachable	7440-38-2	E450C	0.050	mg/kg	0.075	----	----	----	----
barium, leachable	7440-39-3	E450C	0.50	mg/kg	18.8	----	----	----	----

Analytical Results

Sub-Matrix: **Sediment**

(Matrix: **Soil/Solid**)

				Client sample ID	RG_RIVER_SE-2 _2022-09-14_N	----	----	----	----
				Client sampling date / time	14-Sep-2022 10:40	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2213623-006	--------	--------	--------	--------
					Result	----	----	----	----
Organic Bound Metals									
beryllium, leachable	7440-41-7	E450C	0.20	mg/kg	<0.20	----	----	----	----
bismuth, leachable	7440-69-9	E450C	0.20	mg/kg	<0.20	----	----	----	----
cadmium, leachable	7440-43-9	E450C	0.050	mg/kg	<0.050	----	----	----	----
calcium, leachable	7440-70-2	E450C	50	mg/kg	864	----	----	----	----
chromium, leachable	7440-47-3	E450C	0.50	mg/kg	2.40	----	----	----	----
cobalt, leachable	7440-48-4	E450C	0.10	mg/kg	0.75	----	----	----	----
copper, leachable	7440-50-8	E450C	0.50	mg/kg	3.82	----	----	----	----
iron, leachable	7439-89-6	E450C	50	mg/kg	1090	----	----	----	----
lead, leachable	7439-92-1	E450C	0.50	mg/kg	0.64	----	----	----	----
lithium, leachable	7439-93-2	E450C	5.0	mg/kg	<5.0	----	----	----	----
manganese, leachable	7439-96-5	E450C	1.0	mg/kg	8.2	----	----	----	----
molybdenum, leachable	7439-98-7	E450C	0.50	mg/kg	<0.50	----	----	----	----
nickel, leachable	7440-02-0	E450C	0.50	mg/kg	3.59	----	----	----	----
selenium, leachable	7782-49-2	E450C	0.20	mg/kg	0.36	----	----	----	----
silver, leachable	7440-22-4	E450C	0.10	mg/kg	<0.10	----	----	----	----
strontium, leachable	7440-24-6	E450C	0.50	mg/kg	3.51	----	----	----	----
thallium, leachable	7440-28-0	E450C	0.050	mg/kg	<0.050	----	----	----	----
tin, leachable	7440-31-5	E450C	2.0	mg/kg	<2.0	----	----	----	----
titanium, leachable	7440-32-6	E450C	1.0	mg/kg	<1.0	----	----	----	----
uranium, leachable	7440-61-1	E450C	0.050	mg/kg	0.099	----	----	----	----
vanadium, leachable	7440-62-2	E450C	0.20	mg/kg	1.53	----	----	----	----
zinc, leachable	7440-66-6	E450C	1.0	mg/kg	5.9	----	----	----	----
Residual Metals									
aluminum, leachable	7429-90-5	E450D	50	mg/kg	13700	----	----	----	----
antimony, leachable	7440-36-0	E450D	0.10	mg/kg	0.32	----	----	----	----
arsenic, leachable	7440-38-2	E450D	5.00	mg/kg	6.60	----	----	----	----
barium, leachable	7440-39-3	E450D	2.0	mg/kg	109	----	----	----	----
beryllium, leachable	7440-41-7	E450D	0.20	mg/kg	0.47	----	----	----	----
bismuth, leachable	7440-69-9	E450D	0.20	mg/kg	<0.20	----	----	----	----
cadmium, leachable	7440-43-9	E450D	0.050	mg/kg	0.068	----	----	----	----

Analytical Results

Sub-Matrix: **Sediment**

(Matrix: **Soil/Solid)**

				Client sample ID	RG_RIVER_SE-2_2022-09-14_N	----	----	----	----
				Client sampling date / time	14-Sep-2022 10:40	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2213623-006	--------	--------	--------	--------
					Result	----	----	----	----
Residual Metals									
calcium, leachable	7440-70-2	E450D	50	mg/kg	1650	----	----	----	----
chromium, leachable	7440-47-3	E450D	5.0	mg/kg	16.1	----	----	----	----
cobalt, leachable	7440-48-4	E450D	0.10	mg/kg	2.64	----	----	----	----
copper, leachable	7440-50-8	E450D	0.50	mg/kg	13.4	----	----	----	----
iron, leachable	7439-89-6	E450D	50	mg/kg	17200	----	----	----	----
lead, leachable	7439-92-1	E450D	0.50	mg/kg	5.13	----	----	----	----
lithium, leachable	7439-93-2	E450D	5.0	mg/kg	15.7	----	----	----	----
manganese, leachable	7439-96-5	E450D	5.0	mg/kg	45.5	----	----	----	----
molybdenum, leachable	7439-98-7	E450D	0.50	mg/kg	1.79	----	----	----	----
nickel, leachable	7440-02-0	E450D	2.0	mg/kg	12.4	----	----	----	----
selenium, leachable	7782-49-2	E450D	0.20	mg/kg	0.24	----	----	----	----
silver, leachable	7440-22-4	E450D	0.10	mg/kg	<0.10	----	----	----	----
strontium, leachable	7440-24-6	E450D	5.0	mg/kg	11.3	----	----	----	----
thallium, leachable	7440-28-0	E450D	0.050	mg/kg	0.282	----	----	----	----
tin, leachable	7440-31-5	E450D	2.0	mg/kg	<2.0	----	----	----	----
titanium, leachable	7440-32-6	E450D	5.0	mg/kg	27.6	----	----	----	----
uranium, leachable	7440-61-1	E450D	0.050	mg/kg	0.371	----	----	----	----
vanadium, leachable	7440-62-2	E450D	0.20	mg/kg	29.1	----	----	----	----
zinc, leachable	7440-66-6	E450D	1.0	mg/kg	57.1	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **CG2213623**	Page	: 1 of 25
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	:	Telephone	: +1 403 407 1800
Project	: Regional Effects Program	Date Samples Received	: 04-Oct-2022 09:00
PO	: VPO00816101	Date Analysis Commenced	: 05-Oct-2022
C-O-C number	: REP_LAEMP_GC_2022-09_ALS	Issue Date	: 20-Oct-2022 18:27
Sampler	: Jennifer Ings ----		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Calgary Metals, Calgary, Alberta
Hedy Lai	Team Leader - Inorganics	Saskatoon Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Saskatoon Sask Soils, Saskatoon, Saskatchewan
Jeanie Mark	Laboratory Analyst	Calgary Organics, Calgary, Alberta
Robin Weeks	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia
Sorina Motea	Laboratory Analyst	Calgary Organics, Calgary, Alberta
Vishnu Patel		Calgary Inorganics, Calgary, Alberta
Xihua Yao	Laboratory Analyst	Saskatoon Inorganics, Saskatoon, Saskatchewan
Xihua Yao	Laboratory Analyst	Saskatoon Sask Soils, Saskatoon, Saskatchewan

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Physical Tests (QC Lot: 696197)											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	pH (1:2 soil:water)	----	E108	0.10	pH units	8.25	8.30	0.604%	5%	----
Physical Tests (QC Lot: 698658)											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	moisture	----	E144	0.25	%	22.7	21.9	3.58%	20%	----
Organic / Inorganic Carbon (QC Lot: 685726)											
CG2213306-001	Anonymous	carbon, inorganic [IC]	----	E354	0.050	%	2.86	2.88	0.679%	20%	----
Organic / Inorganic Carbon (QC Lot: 686559)											
FJ2202326-001	Anonymous	carbon, total [TC]	----	E351	0.050	%	0.569	0.473	18.5%	20%	----
Metals (QC Lot: 695754)											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	mercury	7439-97-6	E510	0.0050	mg/kg	0.0623	0.0586	6.16%	40%	----
Metals (QC Lot: 695755)											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	aluminum	7429-90-5	E440	50	mg/kg	9440	9160	2.93%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	0.90	0.83	8.79%	30%	----
		arsenic	7440-38-2	E440	0.10	mg/kg	6.89	6.68	3.09%	30%	----
		barium	7440-39-3	E440	0.50	mg/kg	318	300	5.89%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.83	0.76	9.04%	30%	----
		bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	7.6	6.8	0.8	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.809	0.806	0.382%	30%	----
		calcium	7440-70-2	E440	50	mg/kg	11800	11200	5.39%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	13.3	12.6	5.84%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	11.5	11.4	1.09%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	19.8	18.9	4.65%	30%	----
		iron	7439-89-6	E440	50	mg/kg	20400	20600	0.506%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	14.0	13.6	2.41%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	13.5	13.6	0.706%	30%	----
		magnesium	7439-95-4	E440	20	mg/kg	4410	3790	14.9%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	548	514	6.31%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	1.40	1.34	4.61%	40%	----

Sub-Matrix: **Soil/Solid**

Laboratory Duplicate (DUP) Report

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Metals (QC Lot: 695755) - continued											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	nickel	7440-02-0	E440	0.50	mg/kg	33.8	33.0	2.44%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	1340	1350	0.757%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	1850	1750	5.38%	40%	----
		selenium	7782-49-2	E440	0.20	mg/kg	1.18	1.12	0.07	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	0.25	0.22	0.03	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	63	59	4	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.50	mg/kg	51.0	47.7	6.76%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	0.178	0.152	0.026	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	17.1	12.7	29.1%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	0.825	0.810	1.88%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	29.4	29.0	1.09%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	114	112	1.96%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	1.3	1.1	0.2	Diff <2x LOR	----
Polycyclic Aromatic Hydrocarbons (QC Lot: 698656)											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	acenaphthene	83-32-9	E641A	0.050	mg/kg	0.092	0.096	0.004	Diff <2x LOR	----
		acenaphthylene	208-96-8	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		acridine	260-94-6	E641A	0.050	mg/kg	0.140	0.166	0.027	Diff <2x LOR	----
		anthracene	120-12-7	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		benz(a)anthracene	56-55-3	E641A	0.050	mg/kg	<0.050	0.053	0.003	Diff <2x LOR	----
		benzo(a)pyrene	50-32-8	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		benzo(b+j)fluoranthene	n/a	E641A	0.050	mg/kg	0.130	0.160	0.030	Diff <2x LOR	----
		benzo(g,h,i)perylene	191-24-2	E641A	0.050	mg/kg	0.056	0.063	0.007	Diff <2x LOR	----
		benzo(k)fluoranthene	207-08-9	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		chrysene	218-01-9	E641A	0.050	mg/kg	0.303	0.352	15.0%	50%	----
		dibenz(a,h)anthracene	53-70-3	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		fluoranthene	206-44-0	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		fluorene	86-73-7	E641A	0.050	mg/kg	0.214	0.228	6.18%	50%	----
		indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		methylnaphthalene, 1-	90-12-0	E641A	0.030	mg/kg	1.32	1.42	7.31%	50%	----
		methylnaphthalene, 2-	91-57-6	E641A	0.030	mg/kg	2.55	2.69	5.28%	50%	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Polycyclic Aromatic Hydrocarbons (QC Lot: 698656) - continued											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	naphthalene	91-20-3	E641A	0.010	mg/kg	0.858	0.911	6.05%	50%	----
		phenanthrene	85-01-8	E641A	0.050	mg/kg	0.982	1.08	9.42%	50%	----
		pyrene	129-00-0	E641A	0.050	mg/kg	0.105	0.116	0.011	Diff <2x LOR	----
		quinoline	91-22-5	E641A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
Exchangeable & Adsorbed Metals (QC Lot: 695314)											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	aluminum, leachable	7429-90-5	E450	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		antimony, leachable	7440-36-0	E450	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		arsenic, leachable	7440-38-2	E450	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		barium, leachable	7440-39-3	E450	0.50	mg/kg	44.2	41.7	5.62%	30%	----
		beryllium, leachable	7440-41-7	E450	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450	0.050	mg/kg	0.152	0.146	0.006	Diff <2x LOR	----
		calcium, leachable	7440-70-2	E450	50	mg/kg	3750	3710	0.948%	30%	----
		chromium, leachable	7440-47-3	E450	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		cobalt, leachable	7440-48-4	E450	0.10	mg/kg	0.17	0.17	0.004	Diff <2x LOR	----
		copper, leachable	7440-50-8	E450	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		iron, leachable	7439-89-6	E450	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		lead, leachable	7439-92-1	E450	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		lithium, leachable	7439-93-2	E450	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450	1.0	mg/kg	36.1	32.8	9.48%	30%	----
		molybdenum, leachable	7439-98-7	E450	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		phosphorus, leachable	7723-14-0	E450	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		potassium, leachable	7440-09-7	E450	100	mg/kg	140	110	20	Diff <2x LOR	----
		selenium, leachable	7782-49-2	E450	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		sodium, leachable	7440-23-5	E450	100	mg/kg	<100	<100	0	Diff <2x LOR	----
		strontium, leachable	7440-24-6	E450	0.50	mg/kg	12.9	12.9	0.0825%	30%	----
		thallium, leachable	7440-28-0	E450	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		vanadium, leachable	7440-62-2	E450	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	**Client sample ID**	**Analyte**	**CAS Number**	**Method**	**LOR**	**Unit**	**Original Result**	**Duplicate Result**	**RPD(%) or Difference**	**Duplicate Limits**	**Qualifier**
Exchangeable & Adsorbed Metals (QC Lot: 695314) - continued											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	zinc, leachable	7440-66-6	E450	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
Carbonate Metals (QC Lot: 697168)											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	aluminum, leachable	7429-90-5	E450A	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		antimony, leachable	7440-36-0	E450A	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		arsenic, leachable	7440-38-2	E450A	0.050	mg/kg	0.054	0.056	0.002	Diff <2x LOR	----
		barium, leachable	7440-39-3	E450A	2.0	mg/kg	35.7	34.9	2.34%	30%	----
		beryllium, leachable	7440-41-7	E450A	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450A	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450A	0.050	mg/kg	0.166	0.169	0.004	Diff <2x LOR	----
		calcium, leachable	7440-70-2	E450A	50	mg/kg	2760	2920	5.83%	30%	----
		chromium, leachable	7440-47-3	E450A	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		cobalt, leachable	7440-48-4	E450A	0.10	mg/kg	0.70	0.64	8.88%	30%	----
		copper, leachable	7440-50-8	E450A	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		iron, leachable	7439-89-6	E450A	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		lead, leachable	7439-92-1	E450A	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		lithium, leachable	7439-93-2	E450A	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450A	5.0	mg/kg	101	100	0.987%	30%	----
		molybdenum, leachable	7439-98-7	E450A	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450A	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		phosphorus, leachable	7723-14-0	E450A	50	mg/kg	<50	<50	0	Diff <2x LOR	----
		selenium, leachable	7782-49-2	E450A	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450A	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		strontium, leachable	7440-24-6	E450A	5.0	mg/kg	5.4	5.7	0.4	Diff <2x LOR	----
		thallium, leachable	7440-28-0	E450A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450A	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450A	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450A	0.050	mg/kg	<0.050	0.051	0.0009	Diff <2x LOR	----
		vanadium, leachable	7440-62-2	E450A	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		zinc, leachable	7440-66-6	E450A	1.0	mg/kg	5.0	5.2	0.2	Diff <2x LOR	----
Easily Reducible Metals and Iron Oxides (QC Lot: 697833)											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	aluminum, leachable	7429-90-5	E450B	50	mg/kg	595	596	0.176%	30%	----
		antimony, leachable	7440-36-0	E450B	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		arsenic, leachable	7440-38-2	E450B	0.050	mg/kg	0.516	0.603	15.5%	30%	----

Sub-Matrix: **Soil/Solid**

Laboratory Duplicate (DUP) Report

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Easily Reducible Metals and Iron Oxides (QC Lot: 697833) - continued											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	barium, leachable	7440-39-3	E450B	0.50	mg/kg	51.3	50.5	1.49%	30%	----
		beryllium, leachable	7440-41-7	E450B	0.20	mg/kg	0.30	0.27	0.03	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450B	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450B	0.050	mg/kg	0.385	0.411	6.54%	30%	----
		calcium, leachable	7440-70-2	E450B	50	mg/kg	3020	3320	9.62%	30%	----
		chromium, leachable	7440-47-3	E450B	0.50	mg/kg	0.80	0.83	0.03	Diff <2x LOR	----
		cobalt, leachable	7440-48-4	E450B	0.10	mg/kg	4.46	4.21	5.73%	30%	----
		copper, leachable	7440-50-8	E450B	0.50	mg/kg	0.69	0.64	0.05	Diff <2x LOR	----
		iron, leachable	7439-89-6	E450B	50	mg/kg	3810	3570	6.46%	30%	----
		lead, leachable	7439-92-1	E450B	0.50	mg/kg	3.26	3.19	0.07	Diff <2x LOR	----
		lithium, leachable	7439-93-2	E450B	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450B	1.0	mg/kg	218	193	11.9%	30%	----
		molybdenum, leachable	7439-98-7	E450B	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450B	0.50	mg/kg	11.3	11.2	0.818%	30%	----
		phosphorus, leachable	7723-14-0	E450B	50	mg/kg	183	147	35	Diff <2x LOR	----
		selenium, leachable	7782-49-2	E450B	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450B	0.10	mg/kg	0.10	<0.10	0.006	Diff <2x LOR	----
		strontium, leachable	7440-24-6	E450B	0.50	mg/kg	6.18	6.58	6.24%	30%	----
		thallium, leachable	7440-28-0	E450B	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450B	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450B	1.0	mg/kg	<1.0	<1.0	0	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450B	0.050	mg/kg	0.161	0.176	0.015	Diff <2x LOR	----
		vanadium, leachable	7440-62-2	E450B	0.20	mg/kg	2.78	2.76	0.736%	30%	----
		zinc, leachable	7440-66-6	E450B	1.0	mg/kg	26.5	27.9	5.24%	30%	----
Organic Bound Metals (QC Lot: 702272)											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	aluminum, leachable	7429-90-5	E450C	50	mg/kg	1850	1790	3.64%	30%	----
		antimony, leachable	7440-36-0	E450C	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		arsenic, leachable	7440-38-2	E450C	0.050	mg/kg	0.408	0.463	12.6%	30%	----
		barium, leachable	7440-39-3	E450C	0.50	mg/kg	25.3	22.8	10.4%	30%	----
		beryllium, leachable	7440-41-7	E450C	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450C	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450C	0.050	mg/kg	0.080	0.082	0.002	Diff <2x LOR	----
		calcium, leachable	7440-70-2	E450C	50	mg/kg	1040	1030	1.28%	30%	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Organic Bound Metals (QC Lot: 702272) - continued											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	chromium, leachable	7440-47-3	E450C	0.50	mg/kg	3.66	3.62	0.996%	30%	----
		cobalt, leachable	7440-48-4	E450C	0.10	mg/kg	1.10	1.01	8.37%	30%	----
		copper, leachable	7440-50-8	E450C	0.50	mg/kg	6.38	6.65	4.16%	30%	----
		iron, leachable	7439-89-6	E450C	50	mg/kg	1890	1910	1.12%	30%	----
		lead, leachable	7439-92-1	E450C	0.50	mg/kg	0.80	0.88	0.08	Diff <2x LOR	----
		lithium, leachable	7439-93-2	E450C	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		manganese, leachable	7439-96-5	E450C	1.0	mg/kg	19.9	16.8	16.9%	30%	----
		molybdenum, leachable	7439-98-7	E450C	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450C	0.50	mg/kg	6.08	6.11	0.543%	30%	----
		selenium, leachable	7782-49-2	E450C	0.20	mg/kg	0.90	0.94	0.04	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450C	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		strontium, leachable	7440-24-6	E450C	0.50	mg/kg	4.75	4.63	2.63%	30%	----
		thallium, leachable	7440-28-0	E450C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450C	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450C	1.0	mg/kg	1.7	2.1	0.4	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450C	0.050	mg/kg	0.255	0.271	0.017	Diff <2x LOR	----
		vanadium, leachable	7440-62-2	E450C	0.20	mg/kg	4.26	4.46	4.63%	30%	----
		zinc, leachable	7440-66-6	E450C	1.0	mg/kg	8.9	8.9	0.125%	30%	----
Residual Metals (QC Lot: 704532)											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	aluminum, leachable	7429-90-5	E450D	50	mg/kg	8080	7600	6.07%	30%	----
		antimony, leachable	7440-36-0	E450D	0.10	mg/kg	0.70	0.77	9.57%	30%	----
		arsenic, leachable	7440-38-2	E450D	5.00	mg/kg	<5.00	<5.00	0	Diff <2x LOR	----
		barium, leachable	7440-39-3	E450D	2.0	mg/kg	120	131	8.45%	30%	----
		beryllium, leachable	7440-41-7	E450D	0.20	mg/kg	0.38	0.37	0.008	Diff <2x LOR	----
		bismuth, leachable	7440-69-9	E450D	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		cadmium, leachable	7440-43-9	E450D	0.050	mg/kg	0.074	0.081	0.008	Diff <2x LOR	----
		calcium, leachable	7440-70-2	E450D	50	mg/kg	678	592	13.6%	30%	----
		chromium, leachable	7440-47-3	E450D	5.0	mg/kg	11.4	10.8	0.6	Diff <2x LOR	----
		cobalt, leachable	7440-48-4	E450D	0.10	mg/kg	2.85	2.75	3.73%	30%	----
		copper, leachable	7440-50-8	E450D	0.50	mg/kg	12.3	12.1	2.08%	30%	----
		iron, leachable	7439-89-6	E450D	50	mg/kg	11600	10200	13.0%	30%	----
		lead, leachable	7439-92-1	E450D	0.50	mg/kg	7.04	7.14	1.38%	30%	----
		lithium, leachable	7439-93-2	E450D	5.0	mg/kg	7.0	6.4	0.5	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Residual Metals (QC Lot: 704532) - continued											
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	manganese, leachable	7439-96-5	E450D	5.0	mg/kg	43.4	40.0	8.05%	30%	----
		molybdenum, leachable	7439-98-7	E450D	0.50	mg/kg	0.96	0.98	0.02	Diff <2x LOR	----
		nickel, leachable	7440-02-0	E450D	2.0	mg/kg	11.4	10.8	0.6	Diff <2x LOR	----
		selenium, leachable	7782-49-2	E450D	0.20	mg/kg	0.46	0.40	0.06	Diff <2x LOR	----
		silver, leachable	7440-22-4	E450D	0.10	mg/kg	0.12	0.15	0.03	Diff <2x LOR	----
		strontium, leachable	7440-24-6	E450D	5.0	mg/kg	19.1	21.8	2.7	Diff <2x LOR	----
		thallium, leachable	7440-28-0	E450D	0.050	mg/kg	0.137	0.159	0.022	Diff <2x LOR	----
		tin, leachable	7440-31-5	E450D	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium, leachable	7440-32-6	E450D	5.0	mg/kg	16.8	22.1	5.3	Diff <2x LOR	----
		uranium, leachable	7440-61-1	E450D	0.050	mg/kg	0.346	0.366	5.52%	30%	----
		vanadium, leachable	7440-62-2	E450D	0.20	mg/kg	28.9	27.3	5.76%	30%	----
		zinc, leachable	7440-66-6	E450D	1.0	mg/kg	62.7	60.7	3.31%	30%	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 698658)						
moisture	----	E144	0.25	%	<0.25	----
Organic / Inorganic Carbon (QCLot: 685726)						
carbon, inorganic [IC]	----	E354	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 686559)						
carbon, total [TC]	----	E351	0.05	%	<0.050	----
Metals (QCLot: 695754)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 695755)						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 695755) - continued						
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Polycyclic Aromatic Hydrocarbons (QCLot: 698656)						
acenaphthene	83-32-9	E641A	0.05	mg/kg	<0.050	----
acenaphthylene	208-96-8	E641A	0.05	mg/kg	<0.050	----
acridine	260-94-6	E641A	0.05	mg/kg	<0.050	----
anthracene	120-12-7	E641A	0.05	mg/kg	<0.050	----
benz(a)anthracene	56-55-3	E641A	0.05	mg/kg	<0.050	----
benzo(a)pyrene	50-32-8	E641A	0.05	mg/kg	<0.050	----
benzo(b+j)fluoranthene	n/a	E641A	0.05	mg/kg	<0.050	----
benzo(g,h,i)perylene	191-24-2	E641A	0.05	mg/kg	<0.050	----
benzo(k)fluoranthene	207-08-9	E641A	0.05	mg/kg	<0.050	----
chrysene	218-01-9	E641A	0.05	mg/kg	<0.050	----
dibenz(a,h)anthracene	53-70-3	E641A	0.05	mg/kg	<0.050	----
fluoranthene	206-44-0	E641A	0.05	mg/kg	<0.050	----
fluorene	86-73-7	E641A	0.05	mg/kg	<0.050	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.05	mg/kg	<0.050	----
methylnaphthalene, 1-	90-12-0	E641A	0.03	mg/kg	<0.030	----
methylnaphthalene, 2-	91-57-6	E641A	0.03	mg/kg	<0.030	----
naphthalene	91-20-3	E641A	0.01	mg/kg	<0.010	----
phenanthrene	85-01-8	E641A	0.05	mg/kg	<0.050	----
pyrene	129-00-0	E641A	0.05	mg/kg	<0.050	----
quinoline	91-22-5	E641A	0.05	mg/kg	<0.050	----
Exchangeable & Adsorbed Metals (QCLot: 695314)						
aluminum, leachable	7429-90-5	E450	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450	0.05	mg/kg	<0.050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Exchangeable & Adsorbed Metals (QCLot: 695314) - continued						
barium, leachable	7440-39-3	E450	0.5	mg/kg	# 0.63	B
beryllium, leachable	7440-41-7	E450	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450	50	mg/kg	<50	----
chromium, leachable	7440-47-3	E450	0.5	mg/kg	<0.50	----
cobalt, leachable	7440-48-4	E450	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450	1	mg/kg	<1.0	----
molybdenum, leachable	7439-98-7	E450	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450	0.5	mg/kg	<0.50	----
phosphorus, leachable	7723-14-0	E450	50	mg/kg	<50	----
potassium, leachable	7440-09-7	E450	100	mg/kg	<100	----
selenium, leachable	7782-49-2	E450	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450	0.1	mg/kg	<0.10	----
sodium, leachable	7440-23-5	E450	100	mg/kg	<100	----
strontium, leachable	7440-24-6	E450	0.5	mg/kg	<0.50	----
thallium, leachable	7440-28-0	E450	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450	2	mg/kg	<2.0	----
titanium, leachable	7440-32-6	E450	1	mg/kg	<1.0	----
uranium, leachable	7440-61-1	E450	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450	1	mg/kg	<1.0	----
Carbonate Metals (QCLot: 697168)						
aluminum, leachable	7429-90-5	E450A	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450A	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450A	0.05	mg/kg	<0.050	----
barium, leachable	7440-39-3	E450A	2	mg/kg	<2.0	----
beryllium, leachable	7440-41-7	E450A	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450A	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450A	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450A	50	mg/kg	<50	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Carbonate Metals (QCLot: 697168) - continued						
chromium, leachable	7440-47-3	E450A	5	mg/kg	<5.0	----
cobalt, leachable	7440-48-4	E450A	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450A	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450A	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450A	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450A	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450A	5	mg/kg	<5.0	----
molybdenum, leachable	7439-98-7	E450A	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450A	2	mg/kg	<2.0	----
phosphorus, leachable	7723-14-0	E450A	50	mg/kg	<50	----
selenium, leachable	7782-49-2	E450A	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450A	0.1	mg/kg	<0.10	----
strontium, leachable	7440-24-6	E450A	5	mg/kg	<5.0	----
thallium, leachable	7440-28-0	E450A	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450A	2	mg/kg	<2.0	----
titanium, leachable	7440-32-6	E450A	5	mg/kg	<5.0	----
uranium, leachable	7440-61-1	E450A	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450A	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450A	1	mg/kg	<1.0	----
Easily Reducible Metals and Iron Oxides (QCLot: 697833)						
aluminum, leachable	7429-90-5	E450B	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450B	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450B	0.05	mg/kg	<0.050	----
barium, leachable	7440-39-3	E450B	0.5	mg/kg	<0.50	----
beryllium, leachable	7440-41-7	E450B	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450B	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450B	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450B	50	mg/kg	<50	----
chromium, leachable	7440-47-3	E450B	0.5	mg/kg	<0.50	----
cobalt, leachable	7440-48-4	E450B	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450B	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450B	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450B	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450B	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450B	1	mg/kg	<1.0	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Easily Reducible Metals and Iron Oxides (QCLot: 697833) - continued						
molybdenum, leachable	7439-98-7	E450B	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450B	0.5	mg/kg	<0.50	----
phosphorus, leachable	7723-14-0	E450B	50	mg/kg	<50	----
selenium, leachable	7782-49-2	E450B	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450B	0.1	mg/kg	<0.10	----
strontium, leachable	7440-24-6	E450B	0.5	mg/kg	<0.50	----
thallium, leachable	7440-28-0	E450B	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450B	2	mg/kg	<2.0	----
titanium, leachable	7440-32-6	E450B	1	mg/kg	<1.0	----
uranium, leachable	7440-61-1	E450B	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450B	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450B	1	mg/kg	<1.0	----
Organic Bound Metals (QCLot: 702272)						
aluminum, leachable	7429-90-5	E450C	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450C	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450C	0.05	mg/kg	<0.050	----
barium, leachable	7440-39-3	E450C	0.5	mg/kg	<0.50	----
beryllium, leachable	7440-41-7	E450C	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450C	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450C	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450C	50	mg/kg	<50	----
chromium, leachable	7440-47-3	E450C	0.5	mg/kg	<0.50	----
cobalt, leachable	7440-48-4	E450C	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450C	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450C	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450C	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450C	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450C	1	mg/kg	<1.0	----
molybdenum, leachable	7439-98-7	E450C	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450C	0.5	mg/kg	<0.50	----
selenium, leachable	7782-49-2	E450C	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450C	0.1	mg/kg	<0.10	----
strontium, leachable	7440-24-6	E450C	0.5	mg/kg	<0.50	----
thallium, leachable	7440-28-0	E450C	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450C	2	mg/kg	<2.0	----

Sub-Matrix: **Soil/Solid**

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Result*	*Qualifier*
Organic Bound Metals (QCLot: 702272) - continued						
titanium, leachable	7440-32-6	E450C	1	mg/kg	<1.0	----
uranium, leachable	7440-61-1	E450C	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450C	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450C	1	mg/kg	<1.0	----
Residual Metals (QCLot: 704532)						
aluminum, leachable	7429-90-5	E450D	50	mg/kg	<50	----
antimony, leachable	7440-36-0	E450D	0.1	mg/kg	<0.10	----
arsenic, leachable	7440-38-2	E450D	0.5	mg/kg	<0.50	----
barium, leachable	7440-39-3	E450D	2	mg/kg	<2.0	----
beryllium, leachable	7440-41-7	E450D	0.2	mg/kg	<0.20	----
bismuth, leachable	7440-69-9	E450D	0.2	mg/kg	<0.20	----
cadmium, leachable	7440-43-9	E450D	0.05	mg/kg	<0.050	----
calcium, leachable	7440-70-2	E450D	50	mg/kg	<50	----
chromium, leachable	7440-47-3	E450D	5	mg/kg	<5.0	----
cobalt, leachable	7440-48-4	E450D	0.1	mg/kg	<0.10	----
copper, leachable	7440-50-8	E450D	0.5	mg/kg	<0.50	----
iron, leachable	7439-89-6	E450D	50	mg/kg	<50	----
lead, leachable	7439-92-1	E450D	0.5	mg/kg	<0.50	----
lithium, leachable	7439-93-2	E450D	5	mg/kg	<5.0	----
manganese, leachable	7439-96-5	E450D	5	mg/kg	<5.0	----
molybdenum, leachable	7439-98-7	E450D	0.5	mg/kg	<0.50	----
nickel, leachable	7440-02-0	E450D	2	mg/kg	<2.0	----
selenium, leachable	7782-49-2	E450D	0.2	mg/kg	<0.20	----
silver, leachable	7440-22-4	E450D	0.1	mg/kg	<0.10	----
strontium, leachable	7440-24-6	E450D	5	mg/kg	<5.0	----
thallium, leachable	7440-28-0	E450D	0.05	mg/kg	<0.050	----
tin, leachable	7440-31-5	E450D	2	mg/kg	<2.0	----
titanium, leachable	7440-32-6	E450D	5	mg/kg	<5.0	----
uranium, leachable	7440-61-1	E450D	0.05	mg/kg	<0.050	----
vanadium, leachable	7440-62-2	E450D	0.2	mg/kg	<0.20	----
zinc, leachable	7440-66-6	E450D	1	mg/kg	<1.0	----

Qualifiers

Qualifier	*Description*
B	*Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.*

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 696197)									
pH (1:2 soil:water)	----	E108	----	pH units	7 pH units	100	97.0	103	----
Physical Tests (QCLot: 698658)									
moisture	----	E144	0.25	%	50 %	97.0	90.0	110	----
Organic / Inorganic Carbon (QCLot: 685726)									
carbon, inorganic [IC]	----	E354	0.05	%	0.5 %	110	90.0	110	----
Organic / Inorganic Carbon (QCLot: 686559)									
carbon, total [TC]	----	E351	0.05	%	48 %	99.9	90.0	110	----
Metals (QCLot: 695754)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	107	80.0	120	----
Metals (QCLot: 695755)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	101	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	95.2	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	96.5	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	95.9	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	89.7	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	92.2	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	90.6	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	95.5	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	88.5	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	94.5	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	94.7	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	94.2	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	106	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	95.4	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	97.5	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	101	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	98.5	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	93.5	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	93.1	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	96.3	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	98.2	80.0	120	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 695755) - continued									
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	95.4	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	89.8	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	100	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	96.9	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	82.5	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	96.7	80.0	120	----
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	96.6	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	95.8	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	111	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	98.8	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	95.3	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	96.2	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	93.7	80.0	120	----
Polycyclic Aromatic Hydrocarbons (QCLot: 698656)									
acenaphthene	83-32-9	E641A	0.05	mg/kg	0.5 mg/kg	112	60.0	130	----
acenaphthylene	208-96-8	E641A	0.05	mg/kg	0.5 mg/kg	109	60.0	130	----
acridine	260-94-6	E641A	0.05	mg/kg	0.5 mg/kg	104	60.0	130	----
anthracene	120-12-7	E641A	0.05	mg/kg	0.5 mg/kg	106	60.0	130	----
benz(a)anthracene	56-55-3	E641A	0.05	mg/kg	0.5 mg/kg	97.1	60.0	130	----
benzo(a)pyrene	50-32-8	E641A	0.05	mg/kg	0.5 mg/kg	107	60.0	130	----
benzo(b+j)fluoranthene	n/a	E641A	0.05	mg/kg	0.5 mg/kg	114	60.0	130	----
benzo(g,h,i)perylene	191-24-2	E641A	0.05	mg/kg	0.5 mg/kg	106	60.0	130	----
benzo(k)fluoranthene	207-08-9	E641A	0.05	mg/kg	0.5 mg/kg	118	60.0	130	----
chrysene	218-01-9	E641A	0.05	mg/kg	0.5 mg/kg	118	60.0	130	----
dibenz(a,h)anthracene	53-70-3	E641A	0.05	mg/kg	0.5 mg/kg	97.0	60.0	130	----
fluoranthene	206-44-0	E641A	0.05	mg/kg	0.5 mg/kg	112	60.0	130	----
fluorene	86-73-7	E641A	0.05	mg/kg	0.5 mg/kg	109	60.0	130	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.05	mg/kg	0.5 mg/kg	100	60.0	130	----
methylnaphthalene, 1-	90-12-0	E641A	0.03	mg/kg	0.5 mg/kg	118	60.0	130	----
methylnaphthalene, 2-	91-57-6	E641A	0.03	mg/kg	0.5 mg/kg	113	60.0	130	----
naphthalene	91-20-3	E641A	0.01	mg/kg	0.5 mg/kg	108	50.0	130	----
phenanthrene	85-01-8	E641A	0.05	mg/kg	0.5 mg/kg	109	60.0	130	----
pyrene	129-00-0	E641A	0.05	mg/kg	0.5 mg/kg	110	60.0	130	----
quinoline	91-22-5	E641A	0.05	mg/kg	0.5 mg/kg	98.7	60.0	130	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Exchangeable & Adsorbed Metals (QCLot: 695314)									
aluminum, leachable	7429-90-5	E450	50	mg/kg	2 mg/kg	104	70.0	130	----
antimony, leachable	7440-36-0	E450	0.1	mg/kg	0.2 mg/kg	97.5	70.0	130	----
arsenic, leachable	7440-38-2	E450	0.05	mg/kg	0.2 mg/kg	96.4	70.0	130	----
barium, leachable	7440-39-3	E450	0.5	mg/kg	0.2 mg/kg	94.0	70.0	130	----
beryllium, leachable	7440-41-7	E450	0.2	mg/kg	0.4 mg/kg	99.9	70.0	130	----
bismuth, leachable	7440-69-9	E450	0.2	mg/kg	0.1 mg/kg	83.0	70.0	130	----
cadmium, leachable	7440-43-9	E450	0.05	mg/kg	0.04 mg/kg	99.5	70.0	130	----
calcium, leachable	7440-70-2	E450	50	mg/kg	40 mg/kg	99.5	70.0	130	----
chromium, leachable	7440-47-3	E450	0.5	mg/kg	0.4 mg/kg	98.3	70.0	130	----
cobalt, leachable	7440-48-4	E450	0.1	mg/kg	0.2 mg/kg	95.6	70.0	130	----
copper, leachable	7440-50-8	E450	0.5	mg/kg	0.2 mg/kg	92.4	70.0	130	----
iron, leachable	7439-89-6	E450	50	mg/kg	20 mg/kg	98.1	70.0	130	----
lead, leachable	7439-92-1	E450	0.5	mg/kg	0.2 mg/kg	87.5	70.0	130	----
lithium, leachable	7439-93-2	E450	5	mg/kg	1 mg/kg	100	70.0	130	----
manganese, leachable	7439-96-5	E450	1	mg/kg	0.2 mg/kg	103	70.0	130	----
molybdenum, leachable	7439-98-7	E450	0.5	mg/kg	0.2 mg/kg	101	70.0	130	----
nickel, leachable	7440-02-0	E450	0.5	mg/kg	0.4 mg/kg	92.8	70.0	130	----
phosphorus, leachable	7723-14-0	E450	50	mg/kg	100 mg/kg	111	70.0	130	----
potassium, leachable	7440-09-7	E450	100	mg/kg	40 mg/kg	98.5	70.0	130	----
selenium, leachable	7782-49-2	E450	0.2	mg/kg	0.4 mg/kg	98.6	70.0	130	----
silver, leachable	7440-22-4	E450	0.1	mg/kg	0.04 mg/kg	102	70.0	130	----
sodium, leachable	7440-23-5	E450	100	mg/kg	20 mg/kg	103	70.0	130	----
strontium, leachable	7440-24-6	E450	0.5	mg/kg	0.2 mg/kg	102	70.0	130	----
thallium, leachable	7440-28-0	E450	0.05	mg/kg	0.04 mg/kg	88.0	70.0	130	----
tin, leachable	7440-31-5	E450	2	mg/kg	0.2 mg/kg	96.0	70.0	130	----
titanium, leachable	7440-32-6	E450	1	mg/kg	0.4 mg/kg	97.7	70.0	130	----
uranium, leachable	7440-61-1	E450	0.05	mg/kg	0.04 mg/kg	86.8	70.0	130	----
vanadium, leachable	7440-62-2	E450	0.2	mg/kg	1 mg/kg	101	70.0	130	----
zinc, leachable	7440-66-6	E450	1	mg/kg	4 mg/kg	97.3	70.0	130	----
Carbonate Metals (QCLot: 697168)									
aluminum, leachable	7429-90-5	E450A	50	mg/kg	2 mg/kg	105	70.0	130	----
antimony, leachable	7440-36-0	E450A	0.1	mg/kg	0.2 mg/kg	100	70.0	130	----
arsenic, leachable	7440-38-2	E450A	0.05	mg/kg	0.2 mg/kg	104	70.0	130	----
barium, leachable	7440-39-3	E450A	2	mg/kg	0.2 mg/kg	102	70.0	130	----
beryllium, leachable	7440-41-7	E450A	0.2	mg/kg	0.4 mg/kg	100	70.0	130	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Carbonate Metals (QCLot: 697168) - continued									
bismuth, leachable	7440-69-9	E450A	0.2	mg/kg	0.1 mg/kg	86.0	70.0	130	----
cadmium, leachable	7440-43-9	E450A	0.05	mg/kg	0.04 mg/kg	102	70.0	130	----
calcium, leachable	7440-70-2	E450A	50	mg/kg	40 mg/kg	97.6	70.0	130	----
chromium, leachable	7440-47-3	E450A	5	mg/kg	0.4 mg/kg	100	70.0	130	----
cobalt, leachable	7440-48-4	E450A	0.1	mg/kg	0.2 mg/kg	100	70.0	130	----
copper, leachable	7440-50-8	E450A	0.5	mg/kg	0.2 mg/kg	98.1	70.0	130	----
iron, leachable	7439-89-6	E450A	50	mg/kg	20 mg/kg	97.0	70.0	130	----
lead, leachable	7439-92-1	E450A	0.5	mg/kg	0.2 mg/kg	91.5	70.0	130	----
lithium, leachable	7439-93-2	E450A	5	mg/kg	1 mg/kg	103	70.0	130	----
manganese, leachable	7439-96-5	E450A	5	mg/kg	0.2 mg/kg	104	70.0	130	----
molybdenum, leachable	7439-98-7	E450A	0.5	mg/kg	0.2 mg/kg	104	70.0	130	----
nickel, leachable	7440-02-0	E450A	2	mg/kg	0.4 mg/kg	98.2	70.0	130	----
phosphorus, leachable	7723-14-0	E450A	50	mg/kg	100 mg/kg	103	70.0	130	----
selenium, leachable	7782-49-2	E450A	0.2	mg/kg	0.4 mg/kg	99.3	70.0	130	----
silver, leachable	7440-22-4	E450A	0.1	mg/kg	0.04 mg/kg	102	70.0	130	----
strontium, leachable	7440-24-6	E450A	5	mg/kg	0.2 mg/kg	105	70.0	130	----
thallium, leachable	7440-28-0	E450A	0.05	mg/kg	0.04 mg/kg	91.9	70.0	130	----
tin, leachable	7440-31-5	E450A	2	mg/kg	0.2 mg/kg	100	70.0	130	----
titanium, leachable	7440-32-6	E450A	5	mg/kg	0.4 mg/kg	100	70.0	130	----
uranium, leachable	7440-61-1	E450A	0.05	mg/kg	0.04 mg/kg	91.7	70.0	130	----
vanadium, leachable	7440-62-2	E450A	0.2	mg/kg	1 mg/kg	104	70.0	130	----
zinc, leachable	7440-66-6	E450A	1	mg/kg	4 mg/kg	102	70.0	130	----
Easily Reducible Metals and Iron Oxides (QCLot: 697833)									
aluminum, leachable	7429-90-5	E450B	50	mg/kg	2 mg/kg	99.9	70.0	130	----
antimony, leachable	7440-36-0	E450B	0.1	mg/kg	0.2 mg/kg	100	70.0	130	----
arsenic, leachable	7440-38-2	E450B	0.05	mg/kg	0.2 mg/kg	106	70.0	130	----
barium, leachable	7440-39-3	E450B	0.5	mg/kg	0.2 mg/kg	97.9	70.0	130	----
beryllium, leachable	7440-41-7	E450B	0.2	mg/kg	0.4 mg/kg	102	70.0	130	----
bismuth, leachable	7440-69-9	E450B	0.2	mg/kg	0.1 mg/kg	91.0	70.0	130	----
cadmium, leachable	7440-43-9	E450B	0.05	mg/kg	0.04 mg/kg	102	70.0	130	----
calcium, leachable	7440-70-2	E450B	50	mg/kg	40 mg/kg	99.1	70.0	130	----
chromium, leachable	7440-47-3	E450B	0.5	mg/kg	0.4 mg/kg	102	70.0	130	----
cobalt, leachable	7440-48-4	E450B	0.1	mg/kg	0.2 mg/kg	104	70.0	130	----
copper, leachable	7440-50-8	E450B	0.5	mg/kg	0.2 mg/kg	102	70.0	130	----
iron, leachable	7439-89-6	E450B	50	mg/kg	20 mg/kg	101	70.0	130	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Easily Reducible Metals and Iron Oxides (QCLot: 697833) - continued									
lead, leachable	7439-92-1	E450B	0.5	mg/kg	0.2 mg/kg	95.7	70.0	130	----
lithium, leachable	7439-93-2	E450B	5	mg/kg	1 mg/kg	104	70.0	130	----
manganese, leachable	7439-96-5	E450B	1	mg/kg	0.2 mg/kg	103	70.0	130	----
molybdenum, leachable	7439-98-7	E450B	0.5	mg/kg	0.2 mg/kg	100	70.0	130	----
nickel, leachable	7440-02-0	E450B	0.5	mg/kg	0.4 mg/kg	102	70.0	130	----
phosphorus, leachable	7723-14-0	E450B	50	mg/kg	100 mg/kg	99.7	70.0	130	----
selenium, leachable	7782-49-2	E450B	0.2	mg/kg	0.4 mg/kg	118	70.0	130	----
silver, leachable	7440-22-4	E450B	0.1	mg/kg	0.04 mg/kg	104	70.0	130	----
strontium, leachable	7440-24-6	E450B	0.5	mg/kg	0.2 mg/kg	101	70.0	130	----
thallium, leachable	7440-28-0	E450B	0.05	mg/kg	0.04 mg/kg	98.8	70.0	130	----
tin, leachable	7440-31-5	E450B	2	mg/kg	0.2 mg/kg	99.5	70.0	130	----
titanium, leachable	7440-32-6	E450B	1	mg/kg	0.4 mg/kg	96.7	70.0	130	----
uranium, leachable	7440-61-1	E450B	0.05	mg/kg	0.04 mg/kg	95.0	70.0	130	----
vanadium, leachable	7440-62-2	E450B	0.2	mg/kg	1 mg/kg	103	70.0	130	----
zinc, leachable	7440-66-6	E450B	1	mg/kg	4 mg/kg	107	70.0	130	----
Organic Bound Metals (QCLot: 702272)									
aluminum, leachable	7429-90-5	E450C	50	mg/kg	2 mg/kg	104	70.0	130	----
antimony, leachable	7440-36-0	E450C	0.1	mg/kg	0.2 mg/kg	97.6	70.0	130	----
arsenic, leachable	7440-38-2	E450C	0.05	mg/kg	0.2 mg/kg	108	70.0	130	----
barium, leachable	7440-39-3	E450C	0.5	mg/kg	0.2 mg/kg	101	70.0	130	----
beryllium, leachable	7440-41-7	E450C	0.2	mg/kg	0.4 mg/kg	95.0	70.0	130	----
bismuth, leachable	7440-69-9	E450C	0.2	mg/kg	0.1 mg/kg	95.9	70.0	130	----
cadmium, leachable	7440-43-9	E450C	0.05	mg/kg	0.04 mg/kg	102	70.0	130	----
calcium, leachable	7440-70-2	E450C	50	mg/kg	40 mg/kg	93.0	70.0	130	----
chromium, leachable	7440-47-3	E450C	0.5	mg/kg	0.4 mg/kg	100	70.0	130	----
cobalt, leachable	7440-48-4	E450C	0.1	mg/kg	0.2 mg/kg	101	70.0	130	----
copper, leachable	7440-50-8	E450C	0.5	mg/kg	0.2 mg/kg	102	70.0	130	----
iron, leachable	7439-89-6	E450C	50	mg/kg	20 mg/kg	98.3	70.0	130	----
lead, leachable	7439-92-1	E450C	0.5	mg/kg	0.2 mg/kg	98.2	70.0	130	----
lithium, leachable	7439-93-2	E450C	5	mg/kg	1 mg/kg	94.9	70.0	130	----
manganese, leachable	7439-96-5	E450C	1	mg/kg	0.2 mg/kg	100	70.0	130	----
molybdenum, leachable	7439-98-7	E450C	0.5	mg/kg	0.2 mg/kg	98.2	70.0	130	----
nickel, leachable	7440-02-0	E450C	0.5	mg/kg	0.4 mg/kg	101	70.0	130	----
selenium, leachable	7782-49-2	E450C	0.2	mg/kg	0.4 mg/kg	106	70.0	130	----
silver, leachable	7440-22-4	E450C	0.1	mg/kg	0.04 mg/kg	104	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Organic Bound Metals (QCLot: 702272) - continued									
strontium, leachable	7440-24-6	E450C	0.5	mg/kg	0.2 mg/kg	99.7	70.0	130	----
thallium, leachable	7440-28-0	E450C	0.05	mg/kg	0.04 mg/kg	97.1	70.0	130	----
tin, leachable	7440-31-5	E450C	2	mg/kg	0.2 mg/kg	97.0	70.0	130	----
titanium, leachable	7440-32-6	E450C	1	mg/kg	0.4 mg/kg	99.4	70.0	130	----
uranium, leachable	7440-61-1	E450C	0.05	mg/kg	0.04 mg/kg	97.1	70.0	130	----
vanadium, leachable	7440-62-2	E450C	0.2	mg/kg	1 mg/kg	100	70.0	130	----
zinc, leachable	7440-66-6	E450C	1	mg/kg	4 mg/kg	103	70.0	130	----
Residual Metals (QCLot: 704532)									
aluminum, leachable	7429-90-5	E450D	50	mg/kg	2 mg/kg	98.3	70.0	130	----
antimony, leachable	7440-36-0	E450D	0.1	mg/kg	0.2 mg/kg	103	70.0	130	----
arsenic, leachable	7440-38-2	E450D	0.5	mg/kg	0.2 mg/kg	97.9	70.0	130	----
barium, leachable	7440-39-3	E450D	2	mg/kg	0.2 mg/kg	97.5	70.0	130	----
beryllium, leachable	7440-41-7	E450D	0.2	mg/kg	0.4 mg/kg	99.7	70.0	130	----
bismuth, leachable	7440-69-9	E450D	0.2	mg/kg	0.1 mg/kg	97.1	70.0	130	----
cadmium, leachable	7440-43-9	E450D	0.05	mg/kg	0.04 mg/kg	98.4	70.0	130	----
calcium, leachable	7440-70-2	E450D	50	mg/kg	40 mg/kg	102	70.0	130	----
chromium, leachable	7440-47-3	E450D	5	mg/kg	0.4 mg/kg	98.4	70.0	130	----
cobalt, leachable	7440-48-4	E450D	0.1	mg/kg	0.2 mg/kg	99.3	70.0	130	----
copper, leachable	7440-50-8	E450D	0.5	mg/kg	0.2 mg/kg	98.1	70.0	130	----
iron, leachable	7439-89-6	E450D	50	mg/kg	20 mg/kg	99.6	70.0	130	----
lead, leachable	7439-92-1	E450D	0.5	mg/kg	0.2 mg/kg	99.1	70.0	130	----
lithium, leachable	7439-93-2	E450D	5	mg/kg	1 mg/kg	103	70.0	130	----
manganese, leachable	7439-96-5	E450D	5	mg/kg	0.2 mg/kg	101	70.0	130	----
molybdenum, leachable	7439-98-7	E450D	0.5	mg/kg	0.2 mg/kg	95.2	70.0	130	----
nickel, leachable	7440-02-0	E450D	2	mg/kg	0.4 mg/kg	99.6	70.0	130	----
selenium, leachable	7782-49-2	E450D	0.2	mg/kg	0.4 mg/kg	98.7	70.0	130	----
silver, leachable	7440-22-4	E450D	0.1	mg/kg	0.04 mg/kg	102	70.0	130	----
strontium, leachable	7440-24-6	E450D	5	mg/kg	0.2 mg/kg	98.6	70.0	130	----
thallium, leachable	7440-28-0	E450D	0.05	mg/kg	0.04 mg/kg	101	70.0	130	----
tin, leachable	7440-31-5	E450D	2	mg/kg	0.2 mg/kg	97.0	70.0	130	----
titanium, leachable	7440-32-6	E450D	5	mg/kg	0.4 mg/kg	97.8	70.0	130	----
uranium, leachable	7440-61-1	E450D	0.05	mg/kg	0.04 mg/kg	99.2	70.0	130	----
vanadium, leachable	7440-62-2	E450D	0.2	mg/kg	1 mg/kg	99.7	70.0	130	----
zinc, leachable	7440-66-6	E450D	1	mg/kg	4 mg/kg	101	70.0	130	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 698656)										
CG2213623-001	RG_GAUT_SE-1_2022-09-14_N	acenaphthene	83-32-9	E641A	0.401 mg/kg	0.5 mg/kg	106	50.0	140	----
		acenaphthylene	208-96-8	E641A	0.384 mg/kg	0.5 mg/kg	102	50.0	140	----
		acridine	260-94-6	E641A	0.396 mg/kg	0.5 mg/kg	104	50.0	140	----
		anthracene	120-12-7	E641A	0.424 mg/kg	0.5 mg/kg	112	50.0	140	----
		benz(a)anthracene	56-55-3	E641A	0.392 mg/kg	0.5 mg/kg	104	50.0	140	----
		benzo(a)pyrene	50-32-8	E641A	0.383 mg/kg	0.5 mg/kg	101	50.0	140	----
		benzo(b+j)fluoranthene	n/a	E641A	0.420 mg/kg	0.5 mg/kg	111	50.0	140	----
		benzo(g,h,i)perylene	191-24-2	E641A	0.362 mg/kg	0.5 mg/kg	95.8	50.0	140	----
		benzo(k)fluoranthene	207-08-9	E641A	0.390 mg/kg	0.5 mg/kg	103	50.0	140	----
		chrysene	218-01-9	E641A	0.395 mg/kg	0.5 mg/kg	104	50.0	140	----
		dibenz(a,h)anthracene	53-70-3	E641A	0.349 mg/kg	0.5 mg/kg	92.3	50.0	140	----
		fluoranthene	206-44-0	E641A	0.418 mg/kg	0.5 mg/kg	111	50.0	140	----
		fluorene	86-73-7	E641A	0.395 mg/kg	0.5 mg/kg	104	50.0	140	----
		indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.355 mg/kg	0.5 mg/kg	93.8	50.0	140	----
		methylnaphthalene, 1-	90-12-0	E641A	ND mg/kg	0.5 mg/kg	ND	50.0	140	----
		methylnaphthalene, 2-	91-57-6	E641A	ND mg/kg	0.5 mg/kg	ND	50.0	140	----
		naphthalene	91-20-3	E641A	ND mg/kg	0.5 mg/kg	ND	50.0	140	----
		phenanthrene	85-01-8	E641A	ND mg/kg	0.5 mg/kg	ND	50.0	140	----
		pyrene	129-00-0	E641A	0.423 mg/kg	0.5 mg/kg	112	50.0	140	----
		quinoline	91-22-5	E641A	0.328 mg/kg	0.5 mg/kg	86.8	50.0	140	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Physical Tests (QCLot: 696197)									
	RM	pH (1:2 soil:water)	----	E108	8.06 pH units	99.9	96.0	104	----
Organic / Inorganic Carbon (QCLot: 685726)									
	RM	carbon, inorganic [IC]	----	E354	0.383 %	118	80.0	120	----
Organic / Inorganic Carbon (QCLot: 686559)									
	RM	carbon, total [TC]	----	E351	1.4 %	101	80.0	120	----
Metals (QCLot: 695754)									
	RM	mercury	7439-97-6	E510	0.062 mg/kg	106	70.0	130	----
Metals (QCLot: 695755)									
	RM	aluminum	7429-90-5	E440	9817 mg/kg	99.3	70.0	130	----
	RM	antimony	7440-36-0	E440	3.99 mg/kg	104	70.0	130	----
	RM	arsenic	7440-38-2	E440	3.73 mg/kg	91.1	70.0	130	----
	RM	barium	7440-39-3	E440	105 mg/kg	102	70.0	130	----
	RM	beryllium	7440-41-7	E440	0.349 mg/kg	102	70.0	130	----
	RM	boron	7440-42-8	E440	8.5 mg/kg	111	40.0	160	----
	RM	cadmium	7440-43-9	E440	0.91 mg/kg	97.5	70.0	130	----
	RM	calcium	7440-70-2	E440	31082 mg/kg	92.5	70.0	130	----
	RM	chromium	7440-47-3	E440	101 mg/kg	96.8	70.0	130	----
	RM	cobalt	7440-48-4	E440	6.9 mg/kg	97.0	70.0	130	----
	RM	copper	7440-50-8	E440	123 mg/kg	97.5	70.0	130	----
	RM	iron	7439-89-6	E440	23558 mg/kg	95.7	70.0	130	----
	RM	lead	7439-92-1	E440	267 mg/kg	104	70.0	130	----
	RM	lithium	7439-93-2	E440	9.5 mg/kg	101	70.0	130	----
	RM	magnesium	7439-95-4	E440	5509 mg/kg	103	70.0	130	----
	RM	manganese	7439-96-5	E440	269 mg/kg	100	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.03 mg/kg	97.4	70.0	130	----
	RM	nickel	7440-02-0	E440	26.7 mg/kg	97.3	70.0	130	----
	RM	phosphorus	7723-14-0	E440	752 mg/kg	101	70.0	130	----
	RM	potassium	7440-09-7	E440	1587 mg/kg	94.5	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 695755) - continued									
	RM	silver	7440-22-4	E440	4.06 mg/kg	92.4	70.0	130	----
	RM	sodium	7440-23-5	E440	797 mg/kg	91.3	70.0	130	----
	RM	strontium	7440-24-6	E440	86.1 mg/kg	97.9	70.0	130	----
	RM	thallium	7440-28-0	E440	0.0786 mg/kg	108	40.0	160	----
	RM	tin	7440-31-5	E440	10.6 mg/kg	99.7	70.0	130	----
	RM	titanium	7440-32-6	E440	839 mg/kg	104	70.0	130	----
	RM	uranium	7440-61-1	E440	0.52 mg/kg	105	70.0	130	----
	RM	vanadium	7440-62-2	E440	32.7 mg/kg	97.4	70.0	130	----
	RM	zinc	7440-66-6	E440	297 mg/kg	97.3	70.0	130	----
	RM	zirconium	7440-67-7	E440	5.73 mg/kg	100	70.0	130	----

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: CG2213623	Page	: 1 of 19
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Giovanna Diaz	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: Regional Effects Program	Date Samples Received	: 04-Oct-2022 09:00
PO	: VPO00816101	Issue Date	: 20-Oct-2022 18:28
C-O-C number	: REP_LAEMP_GC_2022-09_ALS		
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- Method Blank value outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Method Blank (MB) Values								
Exchangeable & Adsorbed Metals	QC-695314-001	----	barium, leachable	7440-39-3	E450	0.63 mg/kg B	0.5 mg/kg	Blank result exceeds permitted value

Result Qualifiers

Qualifier	*Description*
B	*Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-1_2022-09-14_N	E450A	14-Sep-2022	14-Oct-2022	----	----		15-Oct-2022	180 days	31 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-2_2022-09-14_N	E450A	14-Sep-2022	14-Oct-2022	----	----		15-Oct-2022	180 days	31 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-3_2022-09-14_N	E450A	14-Sep-2022	14-Oct-2022	----	----		15-Oct-2022	180 days	31 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-4_2022-09-14_N	E450A	14-Sep-2022	14-Oct-2022	----	----		15-Oct-2022	180 days	31 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-5_2022-09-14_N	E450A	14-Sep-2022	14-Oct-2022	----	----		15-Oct-2022	180 days	31 days	✓
Carbonate Metals : Metals by CRC ICPMS (Tessier Extraction #2)										
Glass soil jar/Teflon lined cap RG_RIVER_SE-2_2022-09-14_N	E450A	14-Sep-2022	14-Oct-2022	----	----		15-Oct-2022	180 days	31 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-1_2022-09-14_N	E450B	14-Sep-2022	15-Oct-2022	----	----		16-Oct-2022	180 days	32 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-2_2022-09-14_N	E450B	14-Sep-2022	15-Oct-2022	----	----		16-Oct-2022	180 days	32 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-3_2022-09-14_N	E450B	14-Sep-2022	15-Oct-2022	----	----		16-Oct-2022	180 days	32 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-4_2022-09-14_N	E450B	14-Sep-2022	15-Oct-2022	----	----		16-Oct-2022	180 days	32 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-5_2022-09-14_N	E450B	14-Sep-2022	15-Oct-2022	----	----		16-Oct-2022	180 days	32 days	✓
Easily Reducible Metals and Iron Oxides : Metals by CRC ICPMS (Tessier Extraction #3)										
Glass soil jar/Teflon lined cap RG_RIVER_SE-2_2022-09-14_N	E450B	14-Sep-2022	15-Oct-2022	----	----		16-Oct-2022	180 days	32 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-3_2022-09-14_N	E450	14-Sep-2022	13-Oct-2022	----	----		14-Oct-2022	180 days	30 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-4_2022-09-14_N	E450	14-Sep-2022	13-Oct-2022	----	----		14-Oct-2022	180 days	30 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-5_2022-09-14_N	E450	14-Sep-2022	13-Oct-2022	----	----		14-Oct-2022	180 days	30 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-1_2022-09-14_N	E450	14-Sep-2022	13-Oct-2022	----	----		14-Oct-2022	180 days	31 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-2_2022-09-14_N	E450	14-Sep-2022	13-Oct-2022	----	----		14-Oct-2022	180 days	31 days	✓
Exchangeable & Adsorbed Metals : Metals by CRC ICPMS (Tessier Extraction #1)										
Glass soil jar/Teflon lined cap RG_RIVER_SE-2_2022-09-14_N	E450	14-Sep-2022	13-Oct-2022	----	----		14-Oct-2022	180 days	31 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-1_2022-09-14_N	E510	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	28 days	30 days	× EHT
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-2_2022-09-14_N	E510	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	28 days	30 days	× EHT
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-3_2022-09-14_N	E510	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	28 days	30 days	× EHT
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-4_2022-09-14_N	E510	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	28 days	30 days	× EHT
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-5_2022-09-14_N	E510	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	28 days	30 days	× EHT
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap RG_RIVER_SE-2_2022-09-14_N	E510	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	28 days	30 days	× EHT
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-1_2022-09-14_N	E440	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	180 days	30 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-2_2022-09-14_N	E440	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	180 days	30 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-3_2022-09-14_N	E440	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	180 days	30 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-4_2022-09-14_N	E440	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	180 days	30 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-5_2022-09-14_N	E440	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	180 days	30 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap RG_RIVER_SE-2_2022-09-14_N	E440	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	180 days	30 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GAUT_SE-1_2022-09-14_N	E351	14-Sep-2022	08-Oct-2022	----	----		08-Oct-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GAUT_SE-2_2022-09-14_N	E351	14-Sep-2022	08-Oct-2022	----	----		08-Oct-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GAUT_SE-3_2022-09-14_N	E351	14-Sep-2022	08-Oct-2022	----	----		08-Oct-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GAUT_SE-4_2022-09-14_N	E351	14-Sep-2022	08-Oct-2022	----	----		08-Oct-2022	180 days	0 days	✓

Work Order : CG2213623
Client : Teck Coal Limited
Project : Regional Effects Program

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_GAUT_SE-5_2022-09-14_N	E351	14-Sep-2022	08-Oct-2022	----	----		08-Oct-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag RG_RIVER_SE-2_2022-09-14_N	E351	14-Sep-2022	08-Oct-2022	----	----		08-Oct-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GAUT_SE-1_2022-09-14_N	E354	14-Sep-2022	----	----	----		07-Oct-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GAUT_SE-2_2022-09-14_N	E354	14-Sep-2022	----	----	----		07-Oct-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GAUT_SE-3_2022-09-14_N	E354	14-Sep-2022	----	----	----		07-Oct-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GAUT_SE-4_2022-09-14_N	E354	14-Sep-2022	----	----	----		07-Oct-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_GAUT_SE-5_2022-09-14_N	E354	14-Sep-2022	----	----	----		07-Oct-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag RG_RIVER_SE-2_2022-09-14_N	E354	14-Sep-2022	----	----	----		07-Oct-2022	----	----	
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-1_2022-09-14_N	E450C	14-Sep-2022	18-Oct-2022	----	----		19-Oct-2022	180 days	35 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-2_2022-09-14_N	E450C	14-Sep-2022	18-Oct-2022	----	----		19-Oct-2022	180 days	35 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-3_2022-09-14_N	E450C	14-Sep-2022	18-Oct-2022	----	----		19-Oct-2022	180 days	35 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-4_2022-09-14_N	E450C	14-Sep-2022	18-Oct-2022	----	----		19-Oct-2022	180 days	35 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-5_2022-09-14_N	E450C	14-Sep-2022	18-Oct-2022	----	----		19-Oct-2022	180 days	35 days	✓
Organic Bound Metals : Metals by CRC ICPMS (Tessier Extraction #4)										
Glass soil jar/Teflon lined cap RG_RIVER_SE-2_2022-09-14_N	E450C	14-Sep-2022	18-Oct-2022	----	----		19-Oct-2022	180 days	35 days	✓
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GAUT_SE-1_2022-09-14_N	E185A	14-Sep-2022	----	----	----		13-Oct-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GAUT_SE-2_2022-09-14_N	E185A	14-Sep-2022	----	----	----		13-Oct-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GAUT_SE-3_2022-09-14_N	E185A	14-Sep-2022	----	----	----		13-Oct-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GAUT_SE-4_2022-09-14_N	E185A	14-Sep-2022	----	----	----		13-Oct-2022	365 days	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_GAUT_SE-5_2022-09-14_N	E185A	14-Sep-2022	----	----	----		13-Oct-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Pipet/Sieve Method										
LDPE bag RG_RIVER_SE-2_2022-09-14_N	E185A	14-Sep-2022	----	----	----		13-Oct-2022	365 days	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap RG_GAUT_SE-1_2022-09-14_N	E144	14-Sep-2022	----	----	----		16-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap RG_GAUT_SE-2_2022-09-14_N	E144	14-Sep-2022	----	----	----		16-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap RG_GAUT_SE-3_2022-09-14_N	E144	14-Sep-2022	----	----	----		16-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap RG_GAUT_SE-4_2022-09-14_N	E144	14-Sep-2022	----	----	----		16-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap RG_GAUT_SE-5_2022-09-14_N	E144	14-Sep-2022	----	----	----		16-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap RG_RIVER_SE-2_2022-09-14_N	E144	14-Sep-2022	----	----	----		16-Oct-2022	----	----	
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-1_2022-09-14_N	E108	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	30 days	30 days	✓

Matrix: **Soil/Solid**

Evaluation: ✖ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-2_2022-09-14_N	E108	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	30 days	30 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-3_2022-09-14_N	E108	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	30 days	30 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-4_2022-09-14_N	E108	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	30 days	30 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-5_2022-09-14_N	E108	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	30 days	30 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap RG_RIVER_SE-2_2022-09-14_N	E108	14-Sep-2022	14-Oct-2022	----	----		14-Oct-2022	30 days	30 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-1_2022-09-14_N	E641A	14-Sep-2022	16-Oct-2022	14 days	32 days	✖ EHTR	17-Oct-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-2_2022-09-14_N	E641A	14-Sep-2022	16-Oct-2022	14 days	32 days	✖ EHTR	17-Oct-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-3_2022-09-14_N	E641A	14-Sep-2022	16-Oct-2022	14 days	32 days	✖ EHTR	17-Oct-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-4_2022-09-14_N	E641A	14-Sep-2022	16-Oct-2022	14 days	32 days	✖ EHTR	17-Oct-2022	40 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_GAUT_SE-5_2022-09-14_N	E641A	14-Sep-2022	16-Oct-2022	14 days	32 days	× EHTR	17-Oct-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS										
Glass soil jar/Teflon lined cap RG_RIVER_SE-2_2022-09-14_N	E641A	14-Sep-2022	16-Oct-2022	14 days	32 days	× EHTR	17-Oct-2022	40 days	1 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-1_2022-09-14_N	E450D	14-Sep-2022	19-Oct-2022	----	----		20-Oct-2022	180 days	36 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-2_2022-09-14_N	E450D	14-Sep-2022	19-Oct-2022	----	----		20-Oct-2022	180 days	36 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-3_2022-09-14_N	E450D	14-Sep-2022	19-Oct-2022	----	----		20-Oct-2022	180 days	36 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-4_2022-09-14_N	E450D	14-Sep-2022	19-Oct-2022	----	----		20-Oct-2022	180 days	36 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
Glass soil jar/Teflon lined cap RG_GAUT_SE-5_2022-09-14_N	E450D	14-Sep-2022	19-Oct-2022	----	----		20-Oct-2022	180 days	36 days	✓
Residual Metals : Metals by CRC ICPMS (Tessier Extraction RM)										
Glass soil jar/Teflon lined cap RG_RIVER_SE-2_2022-09-14_N	E450D	14-Sep-2022	19-Oct-2022	----	----		20-Oct-2022	180 days	36 days	✓

Legend & Qualifier Definitions

EHTR: Exceeded ALS recommended hold time prior to sample receipt.

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Soil/Solid by CVAAS	E510	695754	1	20	5.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #1)	E450	695314	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #2)	E450A	697168	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #3)	E450B	697833	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #4)	E450C	702272	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction RM)	E450D	704532	1	12	8.3	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	695755	1	20	5.0	5.0	✓
Moisture Content by Gravimetry	E144	698658	1	6	16.6	5.0	✓
PAHs by Hex:Ace GC-MS	E641A	698656	1	6	16.6	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	696197	1	20	5.0	5.0	✓
Total Carbon by Combustion	E351	686559	1	16	6.2	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	685726	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Soil/Solid by CVAAS	E510	695754	2	20	10.0	10.0	✓
Metals by CRC ICPMS (Tessier Extraction #1)	E450	695314	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #2)	E450A	697168	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #3)	E450B	697833	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #4)	E450C	702272	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction RM)	E450D	704532	1	12	8.3	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	695755	2	20	10.0	10.0	✓
Moisture Content by Gravimetry	E144	698658	1	6	16.6	5.0	✓
PAHs by Hex:Ace GC-MS	E641A	698656	1	6	16.6	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	696197	2	20	10.0	10.0	✓
Total Carbon by Combustion	E351	686559	2	16	12.5	10.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	685726	2	20	10.0	10.0	✓
Method Blanks (MB)							
Mercury in Soil/Solid by CVAAS	E510	695754	1	20	5.0	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #1)	E450	695314	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #2)	E450A	697168	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #3)	E450B	697833	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction #4)	E450C	702272	1	12	8.3	5.0	✓
Metals by CRC ICPMS (Tessier Extraction RM)	E450D	704532	1	12	8.3	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	695755	1	20	5.0	5.0	✓
Moisture Content by Gravimetry	E144	698658	1	6	16.6	5.0	✓
PAHs by Hex:Ace GC-MS	E641A	698656	1	6	16.6	5.0	✓

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
Total Carbon by Combustion	E351	686559	1	16	6.2	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	685726	1	20	5.0	5.0	✓
Matrix Spikes (MS)							
PAHs by Hex:Ace GC-MS	E641A	698656	1	6	16.6	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
pH by Meter (1:2 Soil:Water Extraction)	E108 Calgary - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
Moisture Content by Gravimetry	E144 Calgary - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Grain Size Report (Attachment) Pipet/Sieve Method	E185A Saskatoon - Environmental	Soil/Solid	SSIR-51 Method 3.2.1	A grain size curve is a graphical representation of the particle sizing of a sample representing the percent passing against the effective particle size.
Total Carbon by Combustion	E351 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2 (mod)	Total Carbon is determined by the high temperature combustion method with measurement by an infrared detector.
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 20.2	Total Inorganic Carbon is determined by acetic acid pH standard curve, where a known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.
Metals in Soil/Solid by CRC ICPMS	E440 Calgary - Environmental	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals by CRC ICPMS (Tessier Extraction #1)	E450 Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by Collision/Reaction Cell ICPMS. Note: For Extraction #1, the extraction solution is 1M Magnesium Chloride and is intended to extract the "Exchangeable and Adsorbed" metals.
Metals by CRC ICPMS (Tessier Extraction #2)	E450A Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by collision cell ICPMS. Note: For Extraction #2, the extraction solution is 1M Sodium Acetate adjusted to pH 5 and is intended to extract the "Carbonate" metals.
Metals by CRC ICPMS (Tessier Extraction #3)	E450B Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by CRC ICPMS.Note: For Extraction #3, the extraction solution is 0.1 M Hydroxylamine Hydro- Chloride in 25% v/v Acetic Acid and is intended to extract the Easily Reducible Metals and Iron Oxides.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals by CRC ICPMS (Tessier Extraction #4)	E450C Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by Collision Reaction Cell ICPMS. Note: For Extraction #4, the extraction solution is 0.02 M Nitric Acid followed by 3.2M Ammonium Acetate and is intended to extract the Organic Bound metals.
Metals by CRC ICPMS (Tessier Extraction RM)	E450D Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B (mod)	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with up to 6 different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by CRC ICPMS. Note: For the Tessier "RM" Extraction, the extraction solution is 50/50 mix of 1:1 Nitric Acid along with 1:1 Hydrochloric Acid, and is hot block digested as per the BC SALM procedure. This is intended to extract the Residual metals.
Mercury in Soil/Solid by CVAAS	E510 Calgary - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
PAHs by Hex:Ace GC-MS	E641A Calgary - Environmental	Soil/Solid	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are extracted with hexane/acetone and analyzed by GC-MS. If reported, IACR (index of additive cancer risk, unitless) and B(a)P toxic potency equivalent (in soil concentration units) are calculated as per CCME PAH Soil Quality Guidelines fact sheet (2010) or ABT1.
Particle Size Analysis (Pipette) - Wentworth Classification	EC184A Saskatoon - Environmental	Soil/Solid	Modified Wentworth	The particle size determination is performed by various methods to generate a Grain Size curve. The data from the curve is then used to produce particle size ranges based on the Modified Wentworth Classification system.
Total Organic Carbon (Calculated) in soil	EC356 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2	Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon (TIC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Calgary - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Digestion for Metals and Mercury	EP440 Calgary - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available.
Extraction of Metals for CRC ICPMS (Tessier - EA)	EP450 Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by Collision/Reaction Cell ICPMS. Note: For Extraction #1, the extraction solution is 1M Magnesium Chloride and is intended to extract the "Exchangeable and Adsorbed" metals.
Extraction of Metals for CRC ICPMS (Tessier - CM)	EP450A Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by collision cell ICPMS. Note: For Extraction #2, the extraction solution is 1M Sodium Acetate adjusted to pH 5 and is intended to extract the "Carbonate" metals.
Extraction of Metals for CRC ICPMS (Tessier-FEO)	EP450B Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by CRC ICPMS.Note: For Extraction #3, the extraction solution is 0.1 M Hydroxylamine Hydro- Chloride in 25% v/v Acetic Acid and is intended to extract the Easily Reducible Metals and Iron Oxides.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Extraction of Metals for CRC ICPMS (Tessier - OB)	EP450C Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	"This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with 5 or 6 (if a pre-liminary water extraction is included) different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by Collision Reaction Cell ICPMS. Note: For Extraction #4, the extraction solution is 0.02 M Nitric Acid followed by 3.2M Ammonium Acetate and is intended to extract the Organic Bound metals.
Extraction of Metals for CRC ICPMS (Tessier - RM)	EP450D Vancouver - Environmental	Soil/Solid	Tessier Extraction 1979/EPA 6020B	"This analysis is modified from the extraction procedure outlined in the "Sequential Extraction Procedure for the Speciation of Particulate Trace Metals" Analytical Chemistry, (A. Tessier, P.G.C. Campbell, and M. Bisson, June 1979). Initially, the sample is manually homogenized, dried at <60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed for extraction. In summary, the sample is sequentially extracted with up to 6 different extraction solutions. The extract is then centrifuged for 30 minutes and the supernatant is subsequently removed and analysed. Instrumental analysis of the digested extract is by CRC ICPMS. Note: For the Tessier "RM" Extraction, the extraction solution is 50/50 mix of 1:1 Nitric Acid along with 1:1 Hydrochloric Acid, and is hot block digested as per the BC SALM procedure. This is intended to extract the Residual metals.
PHCs and PAHs Hexane-Acetone Tumbler Extraction	EP601 Calgary - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1 (mod)	Samples are subsampled and Petroleum Hydrocarbons (PHC) and PAHs are extracted with 1:1 hexane:acetone using a rotary extractor.
Dry and Grind in Soil/Solid <60°C	EPP442 Saskatoon - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

Teck

Page 1 of 1

COC ID:	REP_LAEMP_GC_2022-09_ALS	TURNAROUND TIME:	2-3 Business Days	RUSH:	Priorty

PROJECT/CLIENT INFO

Facility Name / Job#	Regional Effects Program
Project Manager	Giovanna Diaz
Email	Giovanna.Diaz@Teck.com
Address	421 Pine Avenue
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	1-250-865-3048

LABORATORY

Lab Name	ALS Calgary
Lab Contact	Lyudmyla Shvets
Email	Lyudmyla.Shvets@ALSGlobal.com
Address	2559 29 Street NE
City	Calgary
Province	AB
Postal Code	T1Y 7B5
Country	Canada
Phone Number	403 407 1794

OTHER INFO

Report Forr
Email 1:
Email 2:
Email 3:
Email 4:
Email 5:
Email 6:
PO number

Environmental Division
Calgary
Work Order Reference
CG2213623

Telephone : + 1 403 407 1800

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Lab, N: None

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	C-TOC-SK	MET-CCME+FULL-CL	MOISTURE-CL - % Moisture	PSA-PIPET-DETAIL-SK Particle Size	PAH-TMB-D/A-MS-CL-PAHs	MET-TESS-STD-VA
FILTERED								N	N	N	N	N	
PRESERV.								NONE	NONE	NONE	NONE	NONE	
RG_GAUT_SE-1_2022-09-14_N	RG_GAUT	SE		2022/09/14	9: 10	G	2	1	1	1	1	1	1
RG_GAUT_SE-2_2022-09-14_N	RG_GAUT	SE		2022/09/14	10 :40	G	2	1	1	1	1	1	1
RG_GAUT_SE-3_2022-09-14_N	RG_GAUT	SE		2022/09/14	1 :45	G	2	1	1	1	1	1	1
RG_GAUT_SE-4_2022-09-14_N	RG_GAUT	SE		2022/09/14	13 :00	G	2	1	1	1	1	1	1
RG_GAUT_SE-5_2022-09-14_N	RG_GAUT	SE		2022/09/14	1 :42	G	2	1	1	1	1	1	1
RG_RIVER_SE-2_2022-09-14_N	RG_RIVER	SE		2022/09/14	10 :40	G	2	1	1	1	1	1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Jennifer Ings/Minnow	##############		10/9 9:00

SERVICE REQUEST (rush - subject to availability)

Regular (default)	
Priority (2-3 business days) - 50% surcharge	X
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jennifer Ings	5195003444	
Sampler's Signature		Date/Time	September 16, 2022

10

BROOKS - SELENIUM SPECIATION

BROOKS APPLIED LABS
18804 North Creek Parkway, Ste 100, Bothell, WA 98011 • USA • T: 206 632 6206 F: 206 632 6017 • info@brooksapplied.com

March 31, 2022

Teck Resources Limited - Vancouver
Giovanna Diaz
421 Pine Avenue
Sparwood, B.C. CANADA V0B2G0
giovanna.diaz@teck.com

Re: Regional Effects Program

Dear Giovanna Diaz,

On March 10, 2022, Brooks Applied Labs (BAL) received four (4) aqueous samples. The samples were logged-in for total recoverable selenium [*Se*], dissolved Se [*Se*], and Se speciation analyses, according to the chain-of-custody (COC) form.

The sample fractions for total recoverable Se and dissolved Se were not preserved in the field. The samples were preserved (pH < 2) upon receipt at BAL. All samples were preserved within the (14 calendar day) preservation holding time.

The sample fractions logged in for Se speciation and dissolved Se had been field-filtered prior to receipt at BAL. All samples were stored according to BAL SOPs.

Total Recoverable and Dissolved Se
Each aqueous sample fraction for total recoverable or dissolved Se was digested in a closed vessel (bomb) with nitric and hydrochloric acids. The resulting digests were analyzed for Se content via inductively coupled plasma triple quadrupole mass spectrometry (ICP-QQQ-MS). The ICP-QQQ-MS instrumentation uses advanced interference removal techniques to ensure accuracy of the sample results. For more information, please visit the *Interference Reduction Technology* section on our website, brooksapplied.com.

Selenium Speciation
Each aqueous sample was analyzed for selenium speciation using ion chromatography inductively coupled plasma collision reaction cell mass spectrometry (IC-ICP-CRC-MS). Selenium species are chromatographically separated on an ion exchange column and then quantified using inductively coupled plasma collision reaction cell mass spectrometry (ICP-CRC-MS); for more information on this determinative technique, please visit the *Interference Reduction Technology* section on our website. The chromatographic method applied for the analyses provides greater retention of methylseleninic acid and selenomethionine, allowing for more definitive quantitation of these species.

In accordance with the quotation issued for this project, selenium speciation was defined as dissolved selenite [Se(IV)], selenate [*Se(VI)*], selenocyanate [*SeCN*], methylseleninic acid [*MeSe(IV)*], methaneselenonic acid [*MeSe(VI)*], selenomethionine [*SeMet*], selenosulfate [*SeSO3*], and dimethylselenoxide [*DMSeO*]. Unknown Se species was defined as the total concentration of all unknown Se species observed during the analysis. This item is identified on the report as [*Unk Se Sp*].

DMSeO elutes early in the chromatographic run due to the nature of the molecule and the applied chromatographic separation method. Since this species elutes near the dead volume, additional selenium species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting selenium species.

Chromatographic interference, as indicated by an elevated baseline, or co-eluting peak, was observed for selenosulfate [SeSO3] in samples 2203152-01 and 2203152-04. Due to potential bias, the affected results have been qualified as estimated (**J-1**). Upon client request, Brooks Applied Labs can apply a higher dilution to these samples to potentially mitigate the chromatographic interferences, but a higher dilution would elevate the detection limit for SeMet above the client's requested limit of 0.010µg/L.

The results were not method blank corrected, as described in the calculations section of the relevant BAL SOPs and were evaluated using reporting limits adjusted to account for sample aliquot size. Please refer to the *Sample Results* page for sample-specific MDLs, MRLs, and other details.

In instances where a matrix spike/matrix spike duplicate (MS/MSD) set was spiked at a level less than the native sample concentration, the recoveries, and the relative percent difference (RPD) values are not considered valid indicators of data quality. In such instances, the recoveries of the laboratory fortified blanks (BS) and/or standard reference materials (SRM) demonstrate the accuracy of the applied methods. When the spiking level was less than 25% of the native sample concentration, the spike recovery was not reported (NR) and the relative percent difference (RPD) of the MS/MSD set was not calculated (N/C).

Except for concentration qualifiers and items noted above, all data were reported without qualification. All associated quality control sample results met the acceptance criteria.

BAL, an accredited laboratory, certifies that the reported results of all analyses for which BAL is NELAP accredited meet all NELAP requirements. For more information, please see the *Report Information* page.

Please feel free to contact us if you have any questions regarding this report.

Sincerely,

Jeremy Maute
Senior Project Manager
Jeremy@brooksapplied.com

Report Information

Laboratory Accreditation

BAL is accredited by the *National Environmental Laboratory Accreditation Program* (NELAP) through the State of Florida Department of Health, Bureau of Laboratories (E87982) and is certified to perform many environmental analyses. BAL is also certified by many other states to perform environmental analyses. For a current list of our accreditations/certifications, please visit our website at <http://www.brooksapplied.com/resources/certificates-permits/> or review Tables 1 and 2 in our Accreditation Information. Results reported relate only to the samples listed in the report.

Field Quality Control Samples

Please be notified that certain EPA methods require the collection of field quality control samples of an appropriate type and frequency; failure to do so is considered a deviation from some methods and for compliance purposes should only be done with the approval of regulatory authorities. Please see the specific EPA methods for details regarding required field quality control samples.

Common Abbreviations

AR	as received	**MS**	matrix spike
BAL	Brooks Applied Labs	**MSD**	matrix spike duplicate
BLK	method blank	**ND**	non-detect
BS	blank spike	**NR**	non-reportable
CAL	calibration standard	**N/C**	not calculated
CCB	continuing calibration blank	**PS**	post preparation spike
CCV	continuing calibration verification	**REC**	percent recovery
COC	chain of custody record	**RPD**	relative percent difference
D	dissolved fraction	**SCV**	secondary calibration verification
DUP	duplicate	**SOP**	standard operating procedure
IBL	instrument blank	**SRM**	reference material
ICV	initial calibration verification	**T**	total fraction
MDL	method detection limit	**TR**	total recoverable fraction
MRL	method reporting limit		

Definition of Data Qualifiers

(Effective 3/23/2020)

E	An estimated value due to the presence of interferences. A full explanation is presented in the narrative.
H	Holding time and/or preservation requirements not met. Please see narrative for explanation.
J	Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.
J-1	Estimated value. A full explanation is presented in the narrative.
M	Duplicate precision (RPD) was not within acceptance criteria. Please see narrative for explanation.
N	Spike recovery was not within acceptance criteria. Please see narrative for explanation.
R	Rejected, unusable value. A full explanation is presented in the narrative.
U	Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.
X	Result is not BLK-corrected and is within 10x the absolute value of the highest detectable BLK in the batch. Result is estimated.
Z	Holding time and/or preservation requirements not established for this method; however, BAL recommendations for holding time were not followed. Please see narrative for explanation.

These qualifiers are based on those previously utilized by Brooks Applied Labs, those found in the EPA SOW ILM03.0, Exhibit B, Section III, pg. B-18, and the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review; USEPA; January 2010. These supersede all previous qualifiers ever employed by BAL.

Accreditation Information

Table 1. Accredited method/matrix/analytes for TNI

Issued by: State of Florida Dept. of Health (The NELAC Institute 2016 Standard)
Issued on: July 1, 2021; Valid to: June 30, 2022
Certificate Number: E87982-37

Method	Matrix	TNI Accredited Analyte(s)
EPA 1638	Non-Potable Waters	Ag, Cd, Cu, Ni, Pb, Sb, Se, Tl, Zn
EPA 200.8	Non-Potable Waters	Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
EPA 6020	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn
BAL-5000	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn, Hardness
	Solids/Chemicals	Ag, As, B, Be, Cd, Co, Cr, Cu, Pb, Mo, Ni, Sb, Se, Sn, Sr, Tl, V, Zn
	Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn
EPA 1640	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn
EPA 1631E	Non-Potable Waters, Solids/Chemicals & Biological	Total Mercury
EPA 1630	Non-Potable Waters	Methyl Mercury
BAL-3200	Solids/Chemicals & Biological	Methyl Mercury
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
BAL-4201	Non-Potable Waters	Se(IV), Se(VI)
BAL-4300	Non-Potable Waters Solid/Chemicals	Cr(VI)
SM2340B	Non-Potable Waters	Hardness

Accreditation Information

Table 2. Accredited method/matrix/analytes for ISO (1), Non-Governmental TNI (2)

Issued by: ANAB

Issued on: September 21, 2021; Valid to: March 30, 2024

Method	Matrix	ISO and Non-Gov. TNI Accredited Analyte(s)
EPA 1638 Mod EPA 200.8 Mod EPA 6020 Mod BAL-5000	Non-Potable Waters	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, V, Zn Hg (Biological Only)
EPA 1640 Mod	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn Ag, As, Cr, Co, Se, Tl, V (ISO Only)
EPA 1631E Mod BAL-3100	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic (ISO Only)
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)
AOAC 2015.01 Mod BAL-5000	Food	As, Cd, Hg, Pb
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
	Biological by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4101	Food by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)
SM2340B	Non-Potable Waters	Hardness
SM 2540G BAL-0501	Solids/Chemicals & Biological	% Dry Weight

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
RG_GHBP_WS_GGCAMP_2022-02_NP	2203152-01	WS	Sample	02/28/2022	03/10/2022
RG_GHBP_WS_GGCAMP_2022-02_NP-NAL	2203152-02	WS	Sample	02/28/2022	03/10/2022
RG_GHBP_WS_GGCAMP_2022-02_NP-NAL	2203152-03	WS	Sample	02/28/2022	03/10/2022
RG_RIVER_WS_GGCAMP_2022-02_NP	2203152-04	WS	Sample	02/28/2022	03/10/2022
RG_RIVER_WS_GGCAMP_2022-02_NP-NAL	2203152-05	WS	Sample	02/28/2022	03/10/2022
RG_RIVER_WS_GGCAMP_2022-02_NP-NAL	2203152-06	WS	Sample	02/28/2022	03/10/2022

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201	03/17/2022	03/19/2022	B220611	S220338
MeSe(IV)	Water	SOP BAL-4201	03/17/2022	03/19/2022	B220611	S220338
MeSe(VI)	Water	SOP BAL-4201	03/17/2022	03/19/2022	B220611	S220338
Se	Water	EPA 1638 Mod	03/14/2022	03/16/2022	B220573	S220322
Se(IV)	Water	SOP BAL-4201	03/17/2022	03/19/2022	B220611	S220338
Se(VI)	Water	SOP BAL-4201	03/17/2022	03/19/2022	B220611	S220338
SeCN	Water	SOP BAL-4201	03/17/2022	03/19/2022	B220611	S220338
SeMet	Water	SOP BAL-4201	03/17/2022	03/19/2022	B220611	S220338
SeSO3	Water	SOP BAL-4201	03/17/2022	03/19/2022	B220611	S220338
Unk Se Sp	Water	SOP BAL-4201	03/17/2022	03/19/2022	B220611	S220338

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_GHBP_WS_GGCAMP_2022-02_NP										
2203152-01	DMSeO	WS	D	0.040		0.010	0.025	µg/L	B220611	S220338
2203152-01	MeSe(IV)	WS	D	0.052		0.010	0.025	µg/L	B220611	S220338
2203152-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B220611	S220338
2203152-01	Se(IV)	WS	D	1.33		0.010	0.075	µg/L	B220611	S220338
2203152-01	Se(VI)	WS	D	132		0.010	0.055	µg/L	B220611	S220338
2203152-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B220611	S220338
2203152-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B220611	S220338
2203152-01	SeSO3	WS	D	≤ 0.010	J-1 U	0.010	0.055	µg/L	B220611	S220338
2203152-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B220611	S220338
RG_GHBP_WS_GGCAMP_2022-02_NP-NAL										
2203152-02	Se	WS	TR	134		0.165	0.528	µg/L	B220573	S220322
RG_GHBP_WS_GGCAMP_2022-02_NP-NAL										
2203152-03	Se	WS	D	130		0.165	0.528	µg/L	B220573	S220322
RG_RIVER_WS_GGCAMP_2022-02_NP										
2203152-04	DMSeO	WS	D	0.040		0.010	0.025	µg/L	B220611	S220338
2203152-04	MeSe(IV)	WS	D	0.051		0.010	0.025	µg/L	B220611	S220338
2203152-04	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B220611	S220338
2203152-04	Se(IV)	WS	D	1.32		0.010	0.075	µg/L	B220611	S220338
2203152-04	Se(VI)	WS	D	130		0.010	0.055	µg/L	B220611	S220338
2203152-04	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B220611	S220338
2203152-04	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B220611	S220338
2203152-04	SeSO3	WS	D	≤ 0.010	J-1 U	0.010	0.055	µg/L	B220611	S220338
2203152-04	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B220611	S220338
RG_RIVER_WS_GGCAMP_2022-02_NP-NAL										
2203152-05	Se	WS	TR	130		0.165	0.528	µg/L	B220573	S220322
RG_RIVER_WS_GGCAMP_2022-02_NP-NAL										
2203152-06	Se	WS	D	132		0.165	0.528	µg/L	B220573	S220322

Accuracy & Precision Summary

Batch: B220573
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B220573-BS1	**Blank Spike, (2128022)**								
	Se		200.0	195.2	µg/L	98%	75-125		
B220573-BS2	**Blank Spike, (2128022)**								
	Se		200.0	195.0	µg/L	98%	75-125		
B220573-SRM1	**Reference Material (2145006, TMDA 51.5 Reference Standard - Bottle 5 - SRM)**								
	Se		14.30	14.37	µg/L	101%	75-125		
B220573-SRM2	**Reference Material (2145006, TMDA 51.5 Reference Standard - Bottle 5 - SRM)**								
	Se		14.30	13.96	µg/L	98%	75-125		
B220573-DUP4	**Duplicate, (2203152-02)**								
	Se	133.5		125.8	µg/L			6%	20
B220573-MS4	**Matrix Spike, (2203152-02)**								
	Se	133.5	220.0	339.7	µg/L	94%	75-125		
B220573-MSD4	**Matrix Spike Duplicate, (2203152-02)**								
	Se	133.5	220.0	346.4	µg/L	97%	75-125	2%	20

Accuracy & Precision Summary

Batch: B220611
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B220611-BS1	**Blank Spike, (2124033)**								
	MeSe(IV)		5.095	5.263	µg/L	103%	75-125		
	Se(IV)		5.000	4.888	µg/L	98%	75-125		
	Se(VI)		5.000	4.690	µg/L	94%	75-125		
	SeCN		5.015	4.832	µg/L	96%	75-125		
	SeMet		4.932	4.758	µg/L	96%	75-125		
B220611-DUP6	**Duplicate, (2203142-12)**								
	DMSeO	ND		ND	µg/L			N/C	25
	MeSe(IV)	ND		ND	µg/L			N/C	25
	MeSe(VI)	ND		ND	µg/L			N/C	25
	Se(IV)	3.034		3.075	µg/L			1%	25
	Se(VI)	0.039		0.053	µg/L			*31%*	25
	SeCN	ND		ND	µg/L			N/C	25
	SeMet	ND		ND	µg/L			N/C	25
	SeSO3	ND		ND	µg/L			N/C	25
	Unk Se Sp	ND		ND	µg/L			N/C	25
B220611-MS6	**Matrix Spike, (2203142-12)**								
	Se(IV)	3.034	4.900	7.665	µg/L	95%	75-125		
	Se(VI)	0.039	5.100	5.311	µg/L	103%	75-125		
	SeCN	ND	1.962	1.800	µg/L	92%	75-125		
	SeMet	ND	1.977	1.860	µg/L	94%	75-125		
B220611-MSD6	**Matrix Spike Duplicate, (2203142-12)**								
	Se(IV)	3.034	4.900	7.636	µg/L	94%	75-125	0.4%	25
	Se(VI)	0.039	5.100	5.332	µg/L	104%	75-125	0.4%	25
	SeCN	ND	1.962	1.787	µg/L	91%	75-125	0.7%	25
	SeMet	ND	1.977	1.817	µg/L	92%	75-125	2%	25

Method Blanks & Reporting Limits

Batch: B220573
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B220573-BLK1	0.453	µg/L
B220573-BLK2	0.347	µg/L
B220573-BLK3	0.327	µg/L
B220573-BLK4	0.445	µg/L
Average:	0.393	
Limit:	0.480	

MDL: 0.150
MRL: 0.480

Method Blanks & Reporting Limits

Batch: B220611
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B220611-BLK1	0.00	µg/L
B220611-BLK2	0.00	µg/L
B220611-BLK3	0.00	µg/L
B220611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B220611-BLK1	0.00	µg/L
B220611-BLK2	0.00	µg/L
B220611-BLK3	0.00	µg/L
B220611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B220611-BLK1	0.00	µg/L
B220611-BLK2	0.00	µg/L
B220611-BLK3	0.00	µg/L
B220611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: Se(IV)

Sample	Result	Units
B220611-BLK1	0.00	µg/L
B220611-BLK2	0.00	µg/L
B220611-BLK3	0.00	µg/L
B220611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B220611-BLK1	0.00	µg/L
B220611-BLK2	0.00	µg/L
B220611-BLK3	0.00	µg/L
B220611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B220611-BLK1	0.00	µg/L
B220611-BLK2	0.00	µg/L
B220611-BLK3	0.00	µg/L
B220611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B220611-BLK1	0.00	µg/L
B220611-BLK2	0.00	µg/L
B220611-BLK3	0.00	µg/L
B220611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: SeSO3

Sample	Result	Units
B220611-BLK1	0.00	µg/L
B220611-BLK2	0.00	µg/L
B220611-BLK3	0.00	µg/L
B220611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: Unk Se Sp

Sample	Result	Units
B220611-BLK1	0.00	µg/L
B220611-BLK2	0.00	µg/L
B220611-BLK3	0.00	µg/L
B220611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Sample Containers

Lab ID: 2203152-01
Sample: RG_GHBP_WS_GGCAMP_2022-02_NP
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/28/2022
Received: 03/10/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 1 - 2203152
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 1 - 2203152
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 1 - 2203152

Lab ID: 2203152-02
Sample: RG_GHBP_WS_GGCAMP_2022-02_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/28/2022
Received: 03/10/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2142029	<2	Cooler 1 - 2203152

Lab ID: 2203152-03
Sample: RG_GHBP_WS_GGCAMP_2022-02_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/28/2022
Received: 03/10/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2142029	<2	Cooler 1 - 2203152

Lab ID: 2203152-04
Sample: RG_RIVER_WS_GGCAMP_2022-02_NP
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/28/2022
Received: 03/10/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 1 - 2203152
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 1 - 2203152
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 1 - 2203152

Sample Containers

Lab ID: 2203152-05
Sample: RG_RIVER_WS_GGCAMP_2022-02_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/28/2022
Received: 03/10/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2142029	<2	Cooler 1 - 2203152

Lab ID: 2203152-06
Sample: RG_RIVER_WS_GGCAMP_2022-02_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/28/2022
Received: 03/10/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2142029	<2	Cooler 1 - 2203152

Shipping Containers

Cooler 1 - 2203152

Received: March 10, 2022 7:00
Tracking No: PAPS#RWHV89789 via Courier
Coolant Type: Blue Ice
Temperature: 1.6 °C

Description: Cooler 1
Damaged in transit? No
Returned to client? No
Comments: IR #31

Custody seals present? No
Custody seals intact? No
COC present? Yes

Teck

Page 1 of

COC ID:	REP_GGCAMP_2022_FEB_Brooks	TURNAROUND TIME:		RUSH:

PROJECT/CLIENT INFO

Facility Name / Job#	Regional Effects Program
Project Manager	Giovanna Diaz
Email	giovanna.diaz@teck.com
Address	421 Pine Ave
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	587-215-8447

LABORATORY

Lab Name	Brooks Applied Labs
Lab Contact	Ben Wozniak
Email	Ben@brooksapplied.com
Address	18804 North Creek Parkway, Suite 100
City	Bothell
Province	WA
Postal Code	98011
Country	United S
Phone Number	(206) 753-6158

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	monica.bartha@teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	AquaSciLab@teck.com	X	X	X
Email 5:	lbowron@minnow.ca	X	X	X
Email 6:	awiebe@minnow.ca	X	X	X
PO number	748540			

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont	Brooks_Se_Speciation	Brooks_Se_D	Brooks_Se_T
FIL								F	F	N
PRESERV								N	N	N
RG_GHBP_WS_GGCAMP_2022-02_NP	RG_GHBP	WS		2022/02/28	10:00	G	1	1		
RG_GHBP_WS_GGCAMP_2022-02_NP-NAL	RG_GHBP	WS		2022/02/28	10:00	G	2		1	1
RG_RIVER_WS_GGCAMP_2022-02_NP	RG_RIVER	WS		2022/02/28	10:00	G	1	1		
RG_RIVER_WS_GGCAMP_2022-02_NP-NAL	RG_RIVER	WS		2022/02/28	10:00	G	2		1	1

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
		ASG / BAL	3/10/22 7:00

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	MADDY STOKES	Mobile #	(647) 527-0672
Sampler's Signature	MS	Date/Time	

RW HOT SHOT SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

No. 89789

Sparwood, BC
Terrace, BC
Red Deer, AB

Vancouver, BC
Calgary, AB
Montreal, QC

Prince George, BC
Edmonton, AB
Spokane, WA

Elkford, BC
Ft. McMurray, AB
Shelby, MT

Tumbler Ridge, BC
Hinton, AB
Gillette, WY

DATE

INVOICE TO
PURCHASE ORDER NUMBER
BILL OF LADING #
CONSIGNEE (TO)
SHIPPER (FROM)
STREET
STREET
POSTAL CODE
CITY/PROVINCE
POSTAL CODE
CITY/PROVINCE
SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
4		
	PAPS# RWHV89789	

FREIGHT CHARGES
SHIPPER TO CHECK
☐ PREPAID ☐ COLLECT
If not indicated, shipping will automatically move collect

FEE
WAITING
XPU
CHARGES
FSC
US
SUB TOTAL
GST
TOTAL $

UNIT # 174

DECLARED VALUATION: Maximum liability of carrier is $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise. $

DRIVER'S SIGNATURE - PICK UP BY
PICK UP TIME 5:20pm
DRIVER'S SIGNATURE - DELIVERY BY
FINISH TIME

NOTICE OF CLAIM: (a) No carrier is liable for loss, damage or delay of any goods under the Bill of Lading unless notice, therefor setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed in respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, or in the case of failure to make delivery within nine (9) months from the date of shipment. (b) The final statement of the claim must be filed within nine (9) months from the date of shipment, together with a copy of the paid freight bill. RECEIVED at the point of origin on the date specified from the consignor mentioned herein the property herein described, in apparent good order, except as noted (contents and condition of contents of package unknown) marked, consigned and destined as indicated below, which the carrier agrees to carry and to deliver to the consignee at the said destination, subject to the rates and classification in effect on the date of shipment. It is mutually agreed, as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time interested in all or any of the goods, that every service to be performed hereunder shall be subject to all the conditions standard Bill of Lading, in power at the date of issuing, which are hereto agreed by the consignor and accepted for himself and his assigns. Printed or written, including conditions set aside by the standard Bill of Lading in power at the date of issuing, which are hereby agreed by the consignor and accepted for himself and his assigns. The Contract for the carriage of the goods listed in the Bill of Lading is governed by regulation in force in the jurisdiction at the time and place of shipment and is subject to the conditions set out in such regulation.

IF AT OWNER'S RISK, WRITE ORD HERE

SHIPPER PRINT
CONSIGNEE PRINT
DATE
TIME
SHIPPER SIGN
CONSIGNEE SIGN
NUMBER OF PIECES RECEIVED 4

GST # 864540398RT0001

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROAD: Shipper

AMIGOS PRINTING

Cooler 1
(Y/N) Temperature: 1.6 IR: 31

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations:	RG		F2		EV					
Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:	40ml glass	125ml plastic 60ml plastic	40ml glass	60ml plastic	40ml glass	125ml plastic				

Opened By: ASG Date: 3/10/22

2203152

COPY

Effective 7/29/20

BROOKS APPLIED LABS
13751 Lake City Way NE, Ste 108, Seattle, WA 98125 • USA • T:206-632-6206 • info@brooksapplied.com

September 21, 2022

Teck Resources Limited - Vancouver
Giovanna Diaz
421 Pine Avenue
Sparwood, B.C. CANADA V0B2G0
giovanna.diaz@teck.com

Re: Regional Effects Program

Dear Giovanna Diaz,

On September 15, 2022, Brooks Applied Labs (BAL) received four (4) aqueous samples. The samples were logged-in for total recoverable selenium [*Se*], dissolved Se [*Se*], and Se speciation analyses, according to the chain-of-custody (COC) form.

The **Sample ID** values listed on the chain-of-custody (COC) form did not exactly match the corresponding **Sample ID** listed on container label for 2209189-01. The discrepancy is described in the table below.

Sample ID Agreement Issues

Laboratory ID	**Sample ID** *(From COC)*	**Sample ID** *(From Container Label)*
2209189-01	RG_GHFF_WS_LAEMP_GC_2022-09_N	RG_GHFF_WS_LAEMP_GC_2022-08_N

2209189-01 was logged in and reported using the **Sample ID** listed on the COC form (*column 2 in the table above*).

Date/Time Collected values listed on the chain-of-custody (COC) form did not exactly match the corresponding **Date/Time Collected** values on the container labels for 2209189-04, 2209189-05, and 2209189-06. The discrepancies are described in the table below.

Date/Time Collected Discrepancies

Laboratory ID	**Sample ID**	**Date/Time Collected (on COC form)**	**Date/Time Collected (on container label)**
2209189-04	RG_GHNF_WS_LAEMP_GC_2022-09_N	09/09/2022 13:05	09/09/2022 13:10
2209189-05	RG_GHNF_WS_LAEMP_GC_2022-09_NP-NAL	09/09/2022 13:05	09/09/2022 13:10
2209189-06	RG_GHNF_WS_LAEMP_GC_2022-09_NP-NAL	09/09/2022 13:05	09/09/2022 13:10

2209189-04, 2209189-05, and 2209189-06 were logged in and reported using the **Date/Time Collected** values listed on the COC form (*column 3 in the table above*).

The sample fractions for total recoverable Se and dissolved Se were not preserved in the field. The samples were preserved (pH < 2) upon receipt at BAL. All sample fractions for total recoverable Se and dissolved Se were preserved within the (14 calendar day) preservation holding time.

The sample fractions logged in for Se speciation and dissolved Se had been field-filtered prior to receipt at BAL. All samples were stored according to BAL SOPs.

Total Recoverable Se and Dissolved Se

Each aqueous sample fraction for dissolved Se was digested in a closed vessel (bomb) with nitric and hydrochloric acids. The resulting digests were analyzed for Se content via inductively coupled plasma triple quadrupole mass spectrometry (ICP-QQQ-MS). The ICP-QQQ-MS instrumentation uses advanced interference removal techniques to ensure accuracy of the sample results. For more information, please visit the *Interference Reduction Technology* section on our website, brooksapplied.com.

Selenium Speciation

Each aqueous sample was analyzed for selenium speciation using ion chromatography inductively coupled plasma collision reaction cell mass spectrometry (IC-ICP-CRC-MS). Selenium species are chromatographically separated on an ion exchange column and then quantified using inductively coupled plasma collision reaction cell mass spectrometry (ICP-CRC-MS); for more information on this determinative technique, please visit the *Interference Reduction Technology* section on our website. The chromatographic method applied for the analyses provides greater retention of methylseleninic acid and selenomethionine, allowing for more definitive quantitation of these species.

In accordance with the quotation issued for this project, selenium speciation was defined as dissolved selenite [*Se(IV)*], selenate [*Se(VI)*], selenocyanate [*SeCN*], methylseleninic acid [*MeSe(IV)*], methaneselenonic acid [*MeSe(VI)*], selenomethionine [*SeMet*], selenosulfate [$SeSO_3$], and dimethylselenoxide [*DMSeO*]. Unknown Se species was defined as the total concentration of all unknown Se species observed during the analysis. This item is identified on the report as [*Unk Se Sp*].

DMSeO elutes early in the chromatographic run due to the nature of the molecule and the applied chromatographic separation method. Since this species elutes near the dead volume, additional selenium species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting selenium species.

Chromatographic interference, as indicated by an elevated baseline, or co-eluting peak, was observed for selenosulfate [SeSO3] in samples 2209189-01 and 2209189-04. Due to potential bias, the affected results have been qualified as estimated (**J-1**). Upon client request, Brooks Applied Labs can apply a higher dilution to these samples to potentially mitigate the chromatographic interferences, but a higher dilution would elevate the detection limit for SeMet above the client’s requested limit of 0.010µg/L.

The results were not method blank corrected, as described in the calculations section of the relevant BAL SOPs and were evaluated using reporting limits adjusted to account for sample aliquot size. Please refer to the *Sample Results* page for sample-specific MDLs, MRLs, and other details.

In instances where a matrix spike/matrix spike duplicate (MS/MSD) set was spiked at a level less than the native sample concentration, the recoveries and the relative percent difference (RPD) are not considered valid indicators of data quality. In such instances, the recoveries of the laboratory fortified blanks (BS) and/or standard reference materials (SRM) demonstrate the accuracy of the applied methods. When the spiking level was less than 25% of the native sample concentration, the spike recovery was not reported (**NR**) and the relative percent difference (RPD) of the MS/MSD set was not calculated (**N/C**).

In cases when either the native sample concentration was non-detectable (reported as less than or equal to the MDL) and/or the corresponding DUP result was also non-detectable, the RPD between the two values was not calculated (**N/C**).

Except for concentration qualifiers and items noted above, all data were reported without qualification. All associated quality control sample results met the acceptance criteria.

BAL, an accredited laboratory, certifies that the reported results of all analyses for which BAL is NELAP accredited meet all NELAP requirements. For more information, please see the *Report Information* page.

Please feel free to contact us if you have any questions regarding this report.

Sincerely,

Jeremy Maute
Senior Project Manager
Jeremy@brooksapplied.com

Report Information

Laboratory Accreditation

BAL is accredited by the *National Environmental Laboratory Accreditation Program* (NELAP) through the State of Florida Department of Health, Bureau of Laboratories (E87982) and is certified to perform many environmental analyses. BAL is also certified by many other states to perform environmental analyses. For a current list of our accreditations/certifications, please visit our website at <http://www.brooksapplied.com/resources/certificates-permits/> or review Tables 1 and 2 in our Accreditation Information. Results reported relate only to the samples listed in the report.

Field Quality Control Samples

Please be notified that certain EPA methods require the collection of field quality control samples of an appropriate type and frequency; failure to do so is considered a deviation from some methods and for compliance purposes should only be done with the approval of regulatory authorities. Please see the specific EPA methods for details regarding required field quality control samples.

Common Abbreviations

AR	as received	**MS**	matrix spike
BAL	Brooks Applied Labs	**MSD**	matrix spike duplicate
BLK	method blank	**ND**	non-detect
BS	blank spike	**NR**	non-reportable
CAL	calibration standard	**N/C**	not calculated
CCB	continuing calibration blank	**PS**	post preparation spike
CCV	continuing calibration verification	**REC**	percent recovery
COC	chain of custody record	**RPD**	relative percent difference
D	dissolved fraction	**SCV**	secondary calibration verification
DUP	duplicate	**SOP**	standard operating procedure
IBL	instrument blank	**SRM**	reference material
ICV	initial calibration verification	**T**	total fraction
MDL	method detection limit	**TR**	total recoverable fraction
MRL	method reporting limit		

Definition of Data Qualifiers

(Effective 3/23/2020)

E	An estimated value due to the presence of interferences. A full explanation is presented in the narrative.
H	Holding time and/or preservation requirements not met. Please see narrative for explanation.
J	Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.
J-1	Estimated value. A full explanation is presented in the narrative.
M	Duplicate precision (RPD) was not within acceptance criteria. Please see narrative for explanation.
N	Spike recovery was not within acceptance criteria. Please see narrative for explanation.
R	Rejected, unusable value. A full explanation is presented in the narrative.
U	Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.
X	Result is not BLK-corrected and is within 10x the absolute value of the highest detectable BLK in the batch. Result is estimated.
Z	Holding time and/or preservation requirements not established for this method; however, BAL recommendations for holding time were not followed. Please see narrative for explanation.

These qualifiers are based on those previously utilized by Brooks Applied Labs, those found in the EPA SOW ILM03.0, Exhibit B, Section III, pg. B-18, and the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review; USEPA; January 2010. These supersede all previous qualifiers ever employed by BAL.

Accreditation Information

Table 1. Accredited method/matrix/analytes for TNI

Issued by: State of Florida Dept. of Health (The NELAC Institute 2016 Standard)
Issued on: July 1, 2021; Valid to: June 30, 2022
Certificate Number: E87982-37

Method	Matrix	TNI Accredited Analyte(s)
EPA 1638	Non-Potable Waters	Ag, Cd, Cu, Ni, Pb, Sb, Se, Tl, Zn
EPA 200.8	Non-Potable Waters	Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
EPA 6020	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn
BAL-5000	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn, Hardness
	Solids/Chemicals	Ag, As, B, Be, Cd, Co, Cr, Cu, Pb, Mo, Ni, Sb, Se, Sn, Sr, Tl, V, Zn
	Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn
EPA 1640	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn
EPA 1631E	Non-Potable Waters, Solids/Chemicals & Biological	Total Mercury
EPA 1630	Non-Potable Waters	Methyl Mercury
BAL-3200	Solids/Chemicals & Biological	Methyl Mercury
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
BAL-4201	Non-Potable Waters	Se(IV), Se(VI)
BAL-4300	Non-Potable Waters Solid/Chemicals	Cr(VI)
SM2340B	Non-Potable Waters	Hardness

Accreditation Information

Table 2. Accredited method/matrix/analytes for ISO (1), Non-Governmental TNI (2)

Issued by: ANAB

Issued on: September 21, 2021; Valid to: March 30, 2024

Method	Matrix	ISO and Non-Gov. TNI Accredited Analyte(s)
EPA 1638 Mod EPA 200.8 Mod EPA 6020 Mod BAL-5000	Non-Potable Waters	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, V, Zn Hg (Biological Only)
EPA 1640 Mod	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn Ag, As, Cr, Co, Se, Tl, V (ISO Only)
EPA 1631E Mod BAL-3100	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic (ISO Only)
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)
AOAC 2015.01 Mod BAL-5000	Food	As, Cd, Hg, Pb
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
	Biological by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4101	Food by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)
SM2340B	Non-Potable Waters	Hardness
SM 2540G BAL-0501	Solids/Chemicals & Biological	% Dry Weight

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
RG_GHFF_WS_LAEMP_GC_2022-09_N	2209189-01	WS	Sample	09/08/2022	09/15/2022
RG_GHFF_WS_LAEMP_GC_2022-09_NP-NAL	2209189-02	WS	Sample	09/08/2022	09/15/2022
RG_GHFF_WS_LAEMP_GC_2022-09_NP-NAL	2209189-03	WS	Sample	09/08/2022	09/15/2022
RG_GHNF_WS_LAEMP_GC_2022-09_N	2209189-04	WS	Sample	09/09/2022	09/15/2022
RG_GHNF_WS_LAEMP_GC_2022-09_NP-NAL	2209189-05	WS	Sample	09/09/2022	09/15/2022
RG_GHNF_WS_LAEMP_GC_2022-09_NP-NAL	2209189-06	WS	Sample	09/09/2022	09/15/2022

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201	09/14/2022	09/16/2022	B222056	S220953
MeSe(IV)	Water	SOP BAL-4201	09/14/2022	09/16/2022	B222056	S220953
MeSe(VI)	Water	SOP BAL-4201	09/14/2022	09/16/2022	B222056	S220953
Se	Water	EPA 1638 Mod	09/16/2022	09/20/2022	B222134	S220972
Se(IV)	Water	SOP BAL-4201	09/14/2022	09/16/2022	B222056	S220953
Se(VI)	Water	SOP BAL-4201	09/14/2022	09/16/2022	B222056	S220953
SeCN	Water	SOP BAL-4201	09/14/2022	09/16/2022	B222056	S220953
SeMet	Water	SOP BAL-4201	09/14/2022	09/16/2022	B222056	S220953
SeSO3	Water	SOP BAL-4201	09/14/2022	09/16/2022	B222056	S220953
Unk Se Sp	Water	SOP BAL-4201	09/14/2022	09/16/2022	B222056	S220953

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_GHFF_WS_LAEMP_GC_2022-09_N										
2209189-01	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222056	S220953
2209189-01	MeSe(IV)	WS	D	0.021	J	0.010	0.025	µg/L	B222056	S220953
2209189-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222056	S220953
2209189-01	Se(IV)	WS	D	0.922		0.020	0.075	µg/L	B222056	S220953
2209189-01	Se(VI)	WS	D	157		0.010	0.055	µg/L	B222056	S220953
2209189-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222056	S220953
2209189-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222056	S220953
2209189-01	SeSO3	WS	D	≤ 0.010	J-1 U	0.010	0.055	µg/L	B222056	S220953
2209189-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222056	S220953
RG_GHFF_WS_LAEMP_GC_2022-09_NP-NAL										
2209189-02	Se	WS	D	141		0.165	0.528	µg/L	B222134	S220972
RG_GHFF_WS_LAEMP_GC_2022-09_NP-NAL										
2209189-03	Se	WS	TR	150		0.165	0.528	µg/L	B222134	S220972
RG_GHNF_WS_LAEMP_GC_2022-09_N										
2209189-04	DMSeO	WS	D	0.013	J	0.010	0.025	µg/L	B222056	S220953
2209189-04	MeSe(IV)	WS	D	0.017	J	0.010	0.025	µg/L	B222056	S220953
2209189-04	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222056	S220953
2209189-04	Se(IV)	WS	D	1.17		0.020	0.075	µg/L	B222056	S220953
2209189-04	Se(VI)	WS	D	220		0.010	0.055	µg/L	B222056	S220953
2209189-04	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222056	S220953
2209189-04	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222056	S220953
2209189-04	SeSO3	WS	D	≤ 0.010	J-1 U	0.010	0.055	µg/L	B222056	S220953
2209189-04	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222056	S220953
RG_GHNF_WS_LAEMP_GC_2022-09_NP-NAL										
2209189-05	Se	WS	D	203		0.165	0.528	µg/L	B222134	S220972
RG_GHNF_WS_LAEMP_GC_2022-09_NP-NAL										
2209189-06	Se	WS	TR	204		0.165	0.528	µg/L	B222134	S220972

Accuracy & Precision Summary

Batch: B222056
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC	Limits	RPD	Limits
B222056-BS1	**Blank Spike, (2124033)**								
	MeSe(IV)		5.095	5.504	µg/L	108%	75-125		
	Se(IV)		5.000	4.917	µg/L	98%	75-125		
	Se(VI)		5.000	4.657	µg/L	93%	75-125		
	SeCN		5.015	4.709	µg/L	94%	75-125		
	SeMet		4.932	4.821	µg/L	98%	75-125		
B222056-DUP7	**Duplicate, (2209189-04)**								
	DMSeO	0.013		0.011	µg/L			13%	25
	MeSe(IV)	0.017		0.018	µg/L			11%	25
	MeSe(VI)	ND		ND	µg/L			N/C	25
	Se(IV)	1.167		1.183	µg/L			1%	25
	Se(VI)	220.0		221.4	µg/L			0.6%	25
	SeCN	ND		ND	µg/L			N/C	25
	SeMet	ND		ND	µg/L			N/C	25
	SeSO3	ND		ND	µg/L			N/C	25
	Unk Se Sp	ND		ND	µg/L			N/C	25
B222056-MS7	**Matrix Spike, (2209189-04)**								
	Se(IV)	1.167	4.900	5.299	µg/L	84%	75-125		
	Se(VI)	220.0	5.100	230.4	µg/L	NR	75-125		
	SeCN	ND	1.962	1.795	µg/L	92%	75-125		
	SeMet	ND	1.977	1.885	µg/L	95%	75-125		
B222056-MSD7	**Matrix Spike Duplicate, (2209189-04)**								
	Se(IV)	1.167	4.900	5.227	µg/L	83%	75-125	1%	25
	Se(VI)	220.0	5.100	227.5	µg/L	NR	75-125	N/C	25
	SeCN	ND	1.962	1.760	µg/L	90%	75-125	2%	25
	SeMet	ND	1.977	1.814	µg/L	92%	75-125	4%	25

Accuracy & Precision Summary

Batch: B222134
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B222134-BS1	**Blank Spike, (2128023)**								
	Se		200.0	163.3	µg/L	82%	75-125		
B222134-BS2	**Blank Spike, (2128023)**								
	Se		200.0	159.2	µg/L	80%	75-125		
B222134-BS3	**Blank Spike, (2128023)**								
	Se		200.0	160.1	µg/L	80%	75-125		
B222134-SRM1	**Reference Material (2214014, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**								
	Se		14.30	11.78	µg/L	82%	75-125		
B222134-SRM2	**Reference Material (2214014, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**								
	Se		14.30	12.50	µg/L	87%	75-125		
B222134-SRM3	**Reference Material (2214014, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**								
	Se		14.30	11.52	µg/L	81%	75-125		
B222134-DUP2	**Duplicate, (2209182-14)**								
	Se	85.48		84.60	µg/L			1%	20
B222134-MS2	**Matrix Spike, (2209182-14)**								
	Se	85.48	220.0	277.7	µg/L	87%	75-125		
B222134-MSD2	**Matrix Spike Duplicate, (2209182-14)**								
	Se	85.48	220.0	267.1	µg/L	83%	75-125	4%	20
B222134-DUP5	**Duplicate, (2209189-05)**								
	Se	203.0		207.3	µg/L			2%	20
B222134-MS5	**Matrix Spike, (2209189-05)**								
	Se	203.0	220.0	390.3	µg/L	85%	75-125		

Accuracy & Precision Summary

Batch: B222134
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B222134-MSD5	**Matrix Spike Duplicate, (2209189-05)**								
	Se	203.0	220.0	411.6	µg/L	95%	75-125	5%	20

Method Blanks & Reporting Limits

Batch: B222056
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: Se(IV)

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.004
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: SeSO3

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: Unk Se Sp

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Method Blanks & Reporting Limits

Batch: B222134
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B222134-BLK1	0.023	µg/L
B222134-BLK2	0.073	µg/L
B222134-BLK3	0.041	µg/L
B222134-BLK4	-0.013	µg/L

Average: 0.031
Limit: 0.480

MDL: 0.150
MRL: 0.480

Sample Containers

Lab ID: 2209189-01
Sample: RG_GHFF_WS_LAEMP_GC_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/08/2022
Received: 09/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 4 - 2209189
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 4 - 2209189
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 4 - 2209189

Lab ID: 2209189-02
Sample: RG_GHFF_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/08/2022
Received: 09/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	125 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 2 - 2209189

Lab ID: 2209189-03
Sample: RG_GHFF_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/08/2022
Received: 09/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	125 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 2 - 2209189

Lab ID: 2209189-04
Sample: RG_GHNF_WS_LAEMP_GC_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/09/2022
Received: 09/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 4 - 2209189
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 4 - 2209189
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 4 - 2209189

Sample Containers

Lab ID: 2209189-05
Sample: RG_GHNF_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/09/2022
Received: 09/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	125 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 2 - 2209189

Lab ID: 2209189-06
Sample: RG_GHNF_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/09/2022
Received: 09/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	125 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 2 - 2209189

Shipping Containers

Cooler 2 - 2209189

Received: September 15, 2022 7:10
Tracking No: RHWV95580 via Courier
Coolant Type: Ice
Temperature: 5.3 °C
Description: Styrofoam Cooler
Damaged in transit? No
Returned to client? No
Comments: IR#:1
Custody seals present? No
Custody seals intact? No
COC present? Yes

Cooler 4 - 2209189

Received: September 15, 2022 7:10
Tracking No: RHWV95580 via Courier
Coolant Type: Ice
Temperature: 2.4 °C
Description: Styrofoam Cooler
Damaged in transit? No
Returned to client? No
Comments: IR#:2
Custody seals present? No
Custody seals intact? No
COC present? Yes

Teck

COC ID:	REP_LAEMP_GC_2022-09_BROOKS	TURNAROUND TIME:	Rush	RUSH:	Priority

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Regional Effects Program			Lab Name	Brooks Applied Labs			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Giovanna Diaz			Lab Contact	Ben Wozniak			Email 1:	AquaSciLab@Teck.com	X	X	X
Email	Giovanna.Diaz@Teck.com			Email	Ben@brooksapplied.com			Email 2:	teckcoal@equisonline.com			X
Address	421 Pine Avenune			Address	13751 Lake City Way			Email 3:	Teck.Lab.Results@teck.com	X	X	X
					Suite 108			Email 4:	Lisa.Bowron@minnow.ca	X	X	X
City	Sparwood	Province	BC	City	Seattle	Province	WA	Email 5:	Aweibe@minnow.ca	X	X	X
Postal Code	V0B 2G1	Country	Canada	Postal Code	98125	Country	United S	Email 6:	Jessica.Ritz@Teck.com	X	X	X
Phone Number	1-250-865-3048			Phone Number	(206) 753-6158			PO number	VPO00817033			

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Brooks_Se_Speciation (F)	Brooks_Se_D (N)	Brooks_Se_T (N)
RG_GHFF_WS_LAEMP_GC_2022-09_N	RG_GHFF	WS		2022/09/08	10:45	G	1	1		
RG_GHFF_WS_LAEMP_GC_2022-09_NP-NAL	RG_GHFF	WS		2022/09/08	10:45	G	2		1	1
RG_GHNF_WS_LAEMP_GC_2022-09_N	RG_GHNF	WS		2022/09/09	13:05	G	1	1		
RG_GHNF_WS_LAEMP_GC_2022-09_NP-NAL	RG_GHNF	WS		2022/09/09	13:05	G	2		1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Jennifer Ings/Minnow	##############	UW / BAL	9/15/22 7:10

SERVICE REQUEST (rush - subject to availability)					
Regular (default)		Sampler's Name	Jennifer Ings	Mobile #	519-500-3444
Priority (2-3 business days) - 50% surcharge	X	Sampler's Signature		Date/Time	September 12, 2022
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

250-425-7447

No. 95580

Confidential

24 Hour Hot Shot Service

BAL Final Report 2209189

Sparwood, BC **Terrace, BC** **Red Deer, AB** | **Vancouver, BC** **Calgary, AB** **Montreal, QC** | **Prince George, BC** **Edmonton, AB** **Spokane, WA** | **Elkford, BC** **Ft. McMurray, AB** **Shelby, MT** | **Tumbler Ridge, BC** **Hinton, AB** **Gillette, WY**

INVOICE TO	DATE Sept 13/2022
BILL OF LADING #	PURCHASE ORDER NUMBER
SHIPPER (FROM) West Line Creek	CONSIGNEE (TO)
STREET	STREET
CITY/PROVINCE Sparwood BC	POSTAL CODE
CITY/PROVINCE	POSTAL CODE
SPECIAL INSTRUCTIONS	

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
3	Coolers Water Samples	105 lbs
	RWHV95580	

FREIGHT CHARGES
SHIPPER TO CHECK
☐PREPAID ☐COLLECT
If not indicated, shipping will automatically move collect.

FEE
WAITING
XPU
CHARGES
FSC
US
SUB TOTAL
GST
TOTAL $
IF AT OWNER'S RISK, WRITE ORD HERE

UNIT #

DECLARED VALUATION: Maximum liability of carrier is $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise. $

DRIVER'S SIGNATURE - PICK UP BY	PICK UP TIME	DRIVER'S SIGNATURE - DELIVERY BY	FINISH TIME

NOTICE OF CLAIM: (a) No carrier is liable for loss, damage or delay of any goods under the Bill of Lading unless notice, therefor setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, or in the case of failure to make delivery within nine (9) months from the date of shipment (b) The final statement of the claim must be filed within nine (9) months from the date of shipment together with a copy of the paid freight bill. RECEIVED at the point of origin on the date specified from the consignor mentioned herein, the property herein described in apparent good order except as noted (contents and condition of contents of package unknown) marked, consigned and destined as indicated below which the carrier agrees to carry and to deliver to the consignee at the said destination subject to the rates and classification in effect on the date of shipment. It is mutually agreed, as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time interested in all or any of the goods, that every service to be performed hereunder shall be subject to all the conditions standard Bill of Lading, in power at the date of issuing, which are hereby agreed by the consignor and accepted for himself and his assigns. Printed or written including conditions set aside by the standard Bill of Lading in power at the date of issuing which are hereby agreed by the consignor and accepted for himself and his assigns. The Contract for the carriage of the goods listed in the Bill of Lading is governed by regulation in force in the jurisdiction at the time and place of shipment and is subject to the conditions set out in such conditions.

SHIPPER PRINT	CONSIGNEE PRINT	DATE Sept 14
SHIPPER SIGN	CONSIGNEE SIGN	TIME
		NUMBER OF PIECES RECEIVED 3

WHITE: Office YELLOW Carrier PINK: Consignee GOLDENROAD: Shipper GST # 864540398RT0001

Cooler ID: Cooler 2 **COC** (Y/N) Y **Temperature:** 5.3 **IR:** 1

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations:

Sample Types:

Container Types:

EV		LC		RG					
T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
125mL	125mL	125mL		125mL					
glass	plastic	plastic		glass					

Opened By: ERL **Date:** 4/15/22

COPY

Effective 7/29/20

2209189

Revision 004

NOT NEGOTIABLE

250-425-7447

24 Hour Hot Shot Service

NO. 95580

Confidential

BAL Final Report 2209189

Sparwood, BC
Terrace, BC
Red Deer, AB

Vancouver, BC
Calgary, AB
Montreal, QC

Prince George, BC
Edmonton, AB
Spokane, WA

Elkford, BC
Ft. McMurray, AB
Shelby, MT

Tumbler Ridge, BC
Hinton, AB
Gillette, WY

INVOICE TO

DATE Sept 15/2022

BILL OF LADING #

PURCHASE ORDER NUMBER

SHIPPER (FROM) West Line Creek

CONSIGNEE (TO) Bureau Veritas Labs

STREET

STREET

CITY/PROVINCE Sparwood BC

POSTAL CODE

CITY/PROVINCE Calgary AB

POSTAL CODE

SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
3	Coolers with Samples	
	RWHV95580	

FREIGHT CHARGES
SHIPPER TO CHECK
☐PREPAID ☐COLLECT
If not indicated shipping will automatically move collect

FEE

WAITING

XPU

CHARGES

FSC

US

SUB TOTAL

GST

TOTAL $

IF AT OWNER'S RISK WRITE ORD HERE

UNIT #

DECLARED VALUATION: Maximum liability of carrier is $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise. $

DRIVER'S SIGNATURE - PICK UP BY

PICK UP TIME

DRIVER'S SIGNATURE - DELIVERY BY

FINISH TIME

NOTICE OF CLAIM: (a) No carrier is liable for loss, damage or delay of any goods under the Bill of Lading unless notice, therefor setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, om the case of failure to make delivery within nine (9) months from the date of shipment (b)The final statement of the claim must be filed within nine (9) months from the date of shipment together with a copy of the paid freight bill RECEIVED at the point of origin on the date specified from the consignor mentioned herein, the property herein described, in apparent good order, except as noted (contents and condition of contents of package unknown) marked, consigned and destined as indicated below, which the carrier agrees to carry and to deliver to the consigned at the said destination, subject to the rates and classification in effect on the date of shipment It is mutually agreed, as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time interested in all or any of the goods, that every service to be performed hereunder shall be subject to all the conditions standard Bill of Lading, in power at the date of issuing, which are hereto agreed by the consignor and accepted for himself and his assigns. Printed or written including conditions set aside by the standard Bill of Lading in power at the date of issuing, which are hereby agreed by the consignor and accepted for himself and his assigns

The Contract for the carriage of the goods listed in the Bill of Lading is governed by regulation in force in the jurisdiction at the time and place of shipment and is subject to the conditions set out in such conditions

SHIPPER PRINT

CONSIGNEE PRINT

SHIPPER SIGN

CONSIGNEE SIGN

DATE Sept 15

TIME

NUMBER OF PIECES RECEIVED 3

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROAD: Shipper

GST # 864540398RT0001

Cooler ID: Cooler 4

COC (Y/N)

Temperature: 2.4°C

IR: 2

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations:

Sample Types:

Container Types:

WL		EV		LC		RG			
T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
40 mL Glass	125 mL Plastic		60 mL Plastic 60 mL Plastic		125 mL Plastic 60 mL Plastic		60 mL Plastic		

Date: 9/15/22

125 mL Plastic

Opened By: AM

COPY

Revision 004

Effective 7/29/20

13751 Lake City Way NE, Ste 108, Seattle, WA 98125 • USA • T:206-632-6206 • info@brooksapplied.com

September 28, 2022

Teck Resources Limited - Vancouver
Giovanna Diaz
421 Pine Avenue
Sparwood, B.C. CANADA V0B2G0
giovanna.diaz@teck.com

Re: Regional Effects Program

Dear Giovanna Diaz,

On September 22, 2022, Brooks Applied Labs (BAL) received sixteen (16) aqueous samples. The samples were logged-in for total recoverable selenium [*Se*], dissolved Se [*Se*], and Se speciation analyses, according to the chain-of-custody (COC) forms.

Date/Time Collected values listed on the chain-of-custody (COC) form did not exactly match the corresponding **Date/Time Collected** values on the container labels for 2209284-11, 2209284-17, 2209284-18, and 2209284-21. The discrepancies are described in the table below.

Date/Time Collected Discrepancies

Laboratory ID	Sample ID	Date/Time Collected (on COC form)	Date/Time Collected (on container label)
2209284-11	RG_GHUT_WS_LAEMP_GC_2022-09_NP-NAL	09/15/22 8:05	09/15/22 8:12
2209284-17	RG_GHCKD_WS_LAEMP_GC_2022-09_NP-NAL	09/15/22 13:40	09/14/22 13:40
2209284-18	RG_GHCKD_WS_LAEMP_GC_2022-09_NP-NAL	09/15/22 13:40	09/1422 13:40
2209284-21	RG_FODGH_WS_LAEMP_GC_2022-09_NP-NAL	09/18/22 9:00	09/16/22 9:00

for 2209284-11, 2209284-17, 2209284-18, and 2209284-21 were logged in and reported using the **Date/Time Collected** values listed on the COC form (*column 3 in the table above*).

The sample fractions for total recoverable Se and dissolved Se were not preserved in the field. The samples were preserved (pH < 2) upon receipt at BAL. All sample fractions for total recoverable Se and dissolved Se were preserved within the (14 calendar day) preservation holding time.

The sample fractions logged in for Se speciation and dissolved Se had been field-filtered prior to receipt at BAL. All samples were stored according to BAL SOPs.

Total Recoverable Se and Dissolved Se

Each aqueous sample fraction for dissolved Se was digested in a closed vessel (bomb) with nitric and hydrochloric acids. The resulting digests were analyzed for Se content via inductively coupled plasma triple quadrupole mass spectrometry (ICP-QQQ-MS). The ICP-QQQ-MS instrumentation uses advanced interference removal techniques to ensure accuracy of the sample results. For more information, please visit the *Interference Reduction Technology* section on our website, brooksapplied.com.

Selenium Speciation

Each aqueous sample was analyzed for selenium speciation using ion chromatography inductively coupled plasma collision reaction cell mass spectrometry (IC-ICP-CRC-MS). Selenium species are chromatographically separated on an ion exchange column and then quantified using inductively coupled plasma collision reaction cell mass spectrometry (ICP-CRC-MS); for more information on this determinative technique, please visit the *Interference Reduction Technology* section on our website. The chromatographic method applied for the analyses provides greater retention of methylseleninic acid and selenomethionine, allowing for more definitive quantitation of these species.

In accordance with the quotation issued for this project, selenium speciation was defined as dissolved selenite [*Se(IV)*], selenate [*Se(VI)*], selenocyanate [*SeCN*], methylseleninic acid [*MeSe(IV)*], methaneselenonic acid [*MeSe(VI)*], selenomethionine [*SeMet*], selenosulfate [$SeSO_3$], and dimethylselenoxide [*DMSeO*]. Unknown Se species was defined as the total concentration of all unknown Se species observed during the analysis. This item is identified on the report as [*Unk Se Sp*].

DMSeO elutes early in the chromatographic run due to the nature of the molecule and the applied chromatographic separation method. Since this species elutes near the dead volume, additional selenium species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting selenium species.

Chromatographic interference, as indicated by an elevated baseline, or co-eluting peak, was observed for selenosulfate in 2209284-13. Due to potential bias, the affected result has been qualified as estimated (**J-1**). Brooks Applied Labs can apply a higher dilution to this sample to potentially mitigate the chromatographic interferences, but a higher dilution would elevate the detection limit for SeMet above the client's requested limit of 0.010µg/L.

The results were not method blank corrected, as described in the calculations section of the relevant BAL SOPs and were evaluated using reporting limits adjusted to account for sample aliquot size. Please refer to the *Sample Results* page for sample-specific MDLs, MRLs, and other details.

In instances where a matrix spike/matrix spike duplicate (MS/MSD) set was spiked at a level less than the native sample concentration, the recoveries and the relative percent difference (RPD) are not considered valid indicators of data quality. In such instances, the recoveries of the laboratory fortified blanks (BS) and/or standard reference materials (SRM) demonstrate the accuracy of the applied methods. When the spiking level was less than 25% of the native sample concentration, the spike recovery was not reported (**NR**) and the relative percent difference (RPD) of the MS/MSD set was not calculated (**N/C**).

In cases when either the native sample concentration was non-detectable (reported as less than or equal to the MDL) and/or the corresponding DUP result was also non-detectable, the RPD between the two values was not calculated (**N/C**).

Except for concentration qualifiers and the item noted above, all data were reported without qualification. All associated quality control sample results met the acceptance criteria.

BAL, an accredited laboratory, certifies that the reported results of all analyses for which BAL is NELAP accredited meet all NELAP requirements. For more information, please see the *Report Information* page.

Please feel free to contact us if you have any questions regarding this report.

Sincerely,

Jeremy Maute
Senior Project Manager
Jeremy@brooksapplied.com

Report Information

Laboratory Accreditation

BAL is accredited by the *National Environmental Laboratory Accreditation Program* (NELAP) through the State of Florida Department of Health, Bureau of Laboratories (E87982) and is certified to perform many environmental analyses. BAL is also certified by many other states to perform environmental analyses. For a current list of our accreditations/certifications, please visit our website at <http://www.brooksapplied.com/resources/certificates-permits/> or review Tables 1 and 2 in our Accreditation Information. Results reported relate only to the samples listed in the report.

Field Quality Control Samples

Please be notified that certain EPA methods require the collection of field quality control samples of an appropriate type and frequency; failure to do so is considered a deviation from some methods and for compliance purposes should only be done with the approval of regulatory authorities. Please see the specific EPA methods for details regarding required field quality control samples.

Common Abbreviations

AR	as received	**MS**	matrix spike
BAL	Brooks Applied Labs	**MSD**	matrix spike duplicate
BLK	method blank	**ND**	non-detect
BS	blank spike	**NR**	non-reportable
CAL	calibration standard	**N/C**	not calculated
CCB	continuing calibration blank	**PS**	post preparation spike
CCV	continuing calibration verification	**REC**	percent recovery
COC	chain of custody record	**RPD**	relative percent difference
D	dissolved fraction	**SCV**	secondary calibration verification
DUP	duplicate	**SOP**	standard operating procedure
IBL	instrument blank	**SRM**	reference material
ICV	initial calibration verification	**T**	total fraction
MDL	method detection limit	**TR**	total recoverable fraction
MRL	method reporting limit		

Definition of Data Qualifiers

(Effective 3/23/2020)

E An estimated value due to the presence of interferences. A full explanation is presented in the narrative.
H Holding time and/or preservation requirements not met. Please see narrative for explanation.
J Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.
J-1 Estimated value. A full explanation is presented in the narrative.
M Duplicate precision (RPD) was not within acceptance criteria. Please see narrative for explanation.
N Spike recovery was not within acceptance criteria. Please see narrative for explanation.
R Rejected, unusable value. A full explanation is presented in the narrative.
U Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.
X Result is not BLK-corrected and is within 10x the absolute value of the highest detectable BLK in the batch. Result is estimated.
Z Holding time and/or preservation requirements not established for this method; however, BAL recommendations for holding time were not followed. Please see narrative for explanation.

These qualifiers are based on those previously utilized by Brooks Applied Labs, those found in the EPA SOW ILM03.0, Exhibit B, Section III, pg. B-18, and the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review; USEPA; January 2010. These supersede all previous qualifiers ever employed by BAL.

Accreditation Information

Table 1. Accredited method/matrix/analytes for TNI
Issued by: State of Florida Dept. of Health (The NELAC Institute 2016 Standard)
Issued on: July 1, 2021; Valid to: June 30, 2022
Certificate Number: E87982-37

Method	Matrix	TNI Accredited Analyte(s)
EPA 1638	Non-Potable Waters	Ag, Cd, Cu, Ni, Pb, Sb, Se, Tl, Zn
EPA 200.8	Non-Potable Waters	Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
EPA 6020	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn
BAL-5000	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn, Hardness
	Solids/Chemicals	Ag, As, B, Be, Cd, Co, Cr, Cu, Pb, Mo, Ni, Sb, Se, Sn, Sr, Tl, V, Zn
	Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn
EPA 1640	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn
EPA 1631E	Non-Potable Waters, Solids/Chemicals & Biological	Total Mercury
EPA 1630	Non-Potable Waters	Methyl Mercury
BAL-3200	Solids/Chemicals & Biological	Methyl Mercury
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
BAL-4201	Non-Potable Waters	Se(IV), Se(VI)
BAL-4300	Non-Potable Waters Solid/Chemicals	Cr(VI)
SM2340B	Non-Potable Waters	Hardness

Accreditation Information

Table 2. Accredited method/matrix/analytes for ISO (1), Non-Governmental TNI (2)

Issued by: ANAB

Issued on: September 21, 2021; Valid to: March 30, 2024

Method	**Matrix**	**ISO and Non-Gov. TNI Accredited Analyte(s)**
EPA 1638 Mod EPA 200.8 Mod EPA 6020 Mod BAL-5000	Non-Potable Waters	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, V, Zn Hg (Biological Only)
EPA 1640 Mod	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn Ag, As, Cr, Co, Se, Tl, V (ISO Only)
EPA 1631E Mod BAL-3100	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic (ISO Only)
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)
AOAC 2015.01 Mod BAL-5000	Food	As, Cd, Hg, Pb
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
	Biological by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4101	Food by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)
SM2340B	Non-Potable Waters	Hardness
SM 2540G BAL-0501	Solids/Chemicals & Biological	% Dry Weight

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
RG_GHBP_WS_LAEMP_GC_2022-09_N	2209284-01	WS	Sample	09/12/2022	09/22/2022
RG_GHBP_WS_LAEMP_GC_2022-09_NP-NAL	2209284-02	WS	Sample	09/12/2022	09/22/2022
RG_GHBP_WS_LAEMP_GC_2022-09_NP-NAL	2209284-03	WS	Sample	09/12/2022	09/22/2022
RG_GANF_WS_LAEMP_GC_2022-09_N	2209284-04	WS	Sample	09/13/2022	09/22/2022
RG_GANF_WS_LAEMP_GC_2022-09_NP-NAL	2209284-05	WS	Sample	09/13/2022	09/22/2022
RG_GANF_WS_LAEMP_GC_2022-09_NP-NAL	2209284-06	WS	Sample	09/13/2022	09/22/2022
RG_GAUT_WS_LAEMP_GC_2022-09_N	2209284-07	WS	Sample	09/14/2022	09/22/2022
RG_GAUT_WS_LAEMP_GC_2022-09_NP-NAL	2209284-08	WS	Sample	09/14/2022	09/22/2022
RG_GAUT_WS_LAEMP_GC_2022-09_NP-NAL	2209284-09	WS	Sample	09/14/2022	09/22/2022
RG_GHUT_WS_LAEMP_GC_2022-09_N	2209284-10	WS	Sample	09/15/2022	09/22/2022
RG_GHUT_WS_LAEMP_GC_2022-09_NP-NAL	2209284-11	WS	Sample	09/15/2022	09/22/2022
RG_GHUT_WS_LAEMP_GC_2022-09_NP-NAL	2209284-12	WS	Sample	09/15/2022	09/22/2022
RG_GHDT_WS_LAEMP_GC_2022-09_N	2209284-13	WS	Sample	09/16/2022	09/22/2022
RG_GHDT_WS_LAEMP_GC_2022-09_NP-NAL	2209284-14	WS	Sample	09/16/2022	09/22/2022
RG_GHDT_WS_LAEMP_GC_2022-09_NP-NAL	2209284-15	WS	Sample	09/16/2022	09/22/2022
RG_GHCKD_WS_LAEMP_GC_2022-09_N	2209284-16	WS	Sample	09/15/2022	09/22/2022
RG_GHCKD_WS_LAEMP_GC_2022-09_NP-NAL	2209284-17	WS	Sample	09/15/2022	09/22/2022
RG_GHCKD_WS_LAEMP_GC_2022-09_NP-NAL	2209284-18	WS	Sample	09/15/2022	09/22/2022
RG_FODGH_WS_LAEMP_GC_2022-09_N	2209284-19	WS	Sample	09/18/2022	09/22/2022
RG_FODGH_WS_LAEMP_GC_2022-09_NP-NAL	2209284-20	WS	Sample	09/18/2022	09/22/2022
RG_FODGH_WS_LAEMP_GC_2022-09_NP-NAL	2209284-21	WS	Sample	09/18/2022	09/22/2022

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
RG_RIVER_WS_LAEMP_GC_2022-09_N	2209284-22	WS	Sample	09/12/2022	09/22/2022
RG_RIVER_WS_LAEMP_GC_2022-09_NP-NAL	2209284-23	WS	Sample	09/12/2022	09/22/2022
RG_RIVER_WS_LAEMP_GC_2022-09_NP-NAL	2209284-24	WS	Sample	09/12/2022	09/22/2022

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201	09/20/2022	09/23/2022	B222130	S220995
MeSe(IV)	Water	SOP BAL-4201	09/20/2022	09/23/2022	B222130	S220995
MeSe(VI)	Water	SOP BAL-4201	09/20/2022	09/23/2022	B222130	S220995
Se	Water	EPA 1638 Mod	09/23/2022	09/26/2022	B222203	S221000
Se(IV)	Water	SOP BAL-4201	09/20/2022	09/23/2022	B222130	S220995
Se(VI)	Water	SOP BAL-4201	09/20/2022	09/23/2022	B222130	S220995
SeCN	Water	SOP BAL-4201	09/20/2022	09/23/2022	B222130	S220995
SeMet	Water	SOP BAL-4201	09/20/2022	09/23/2022	B222130	S220995
SeSO3	Water	SOP BAL-4201	09/20/2022	09/23/2022	B222130	S220995
Unk Se Sp	Water	SOP BAL-4201	09/20/2022	09/23/2022	B222130	S220995

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_GHBP_WS_LAEMP_GC_2022-09_N										
2209284-01	DMSeO	WS	D	0.111		0.010	0.025	µg/L	B222130	S220995
2209284-01	MeSe(IV)	WS	D	0.061		0.010	0.025	µg/L	B222130	S220995
2209284-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-01	Se(IV)	WS	D	2.84		0.020	0.075	µg/L	B222130	S220995
2209284-01	Se(VI)	WS	D	137		0.010	0.055	µg/L	B222130	S220995
2209284-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222130	S220995
2209284-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-01	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222130	S220995
2209284-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222130	S220995
RG_GHBP_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-02	Se	WS	D	127		0.165	0.528	µg/L	B222203	S221000
RG_GHBP_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-03	Se	WS	TR	124		0.165	0.528	µg/L	B222203	S221000
RG_GANF_WS_LAEMP_GC_2022-09_N										
2209284-04	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-04	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-04	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-04	Se(IV)	WS	D	0.167		0.020	0.075	µg/L	B222130	S220995
2209284-04	Se(VI)	WS	D	5.24		0.010	0.055	µg/L	B222130	S220995
2209284-04	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222130	S220995
2209284-04	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-04	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222130	S220995
2209284-04	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222130	S220995
RG_GANF_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-05	Se	WS	D	5.00		0.165	0.528	µg/L	B222203	S221000
RG_GANF_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-06	Se	WS	TR	5.06		0.165	0.528	µg/L	B222203	S221000

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_GAUT_WS_LAEMP_GC_2022-09_N										
2209284-07	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-07	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-07	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-07	Se(IV)	WS	D	0.131		0.020	0.075	µg/L	B222130	S220995
2209284-07	Se(VI)	WS	D	0.510		0.010	0.055	µg/L	B222130	S220995
2209284-07	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222130	S220995
2209284-07	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-07	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222130	S220995
2209284-07	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222130	S220995
RG_GAUT_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-08	Se	WS	D	0.877		0.165	0.528	µg/L	B222203	S221000
RG_GAUT_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-09	Se	WS	TR	0.967		0.165	0.528	µg/L	B222203	S221000
RG_GHUT_WS_LAEMP_GC_2022-09_N										
2209284-10	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-10	MeSe(IV)	WS	D	0.012	J	0.010	0.025	µg/L	B222130	S220995
2209284-10	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-10	Se(IV)	WS	D	0.422		0.020	0.075	µg/L	B222130	S220995
2209284-10	Se(VI)	WS	D	244		0.010	0.055	µg/L	B222130	S220995
2209284-10	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222130	S220995
2209284-10	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-10	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222130	S220995
2209284-10	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222130	S220995
RG_GHUT_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-11	Se	WS	D	228		0.165	0.528	µg/L	B222203	S221000
RG_GHUT_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-12	Se	WS	TR	232		0.165	0.528	µg/L	B222203	S221000

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_GHDT_WS_LAEMP_GC_2022-09_N										
2209284-13	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-13	MeSe(IV)	WS	D	0.016	J	0.010	0.025	µg/L	B222130	S220995
2209284-13	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-13	Se(IV)	WS	D	1.25		0.020	0.075	µg/L	B222130	S220995
2209284-13	Se(VI)	WS	D	229		0.010	0.055	µg/L	B222130	S220995
2209284-13	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222130	S220995
2209284-13	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-13	SeSO3	WS	D	≤ 0.010	J-1 U	0.010	0.055	µg/L	B222130	S220995
2209284-13	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222130	S220995
RG_GHDT_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-14	Se	WS	D	200		0.165	0.528	µg/L	B222203	S221000
RG_GHDT_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-15	Se	WS	TR	199		0.165	0.528	µg/L	B222203	S221000
RG_GHCKD_WS_LAEMP_GC_2022-09_N										
2209284-16	DMSeO	WS	D	0.074		0.010	0.025	µg/L	B222130	S220995
2209284-16	MeSe(IV)	WS	D	0.069		0.010	0.025	µg/L	B222130	S220995
2209284-16	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-16	Se(IV)	WS	D	2.54		0.020	0.075	µg/L	B222130	S220995
2209284-16	Se(VI)	WS	D	117		0.010	0.055	µg/L	B222130	S220995
2209284-16	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222130	S220995
2209284-16	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-16	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222130	S220995
2209284-16	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222130	S220995
RG_GHCKD_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-17	Se	WS	D	126		0.165	0.528	µg/L	B222203	S221000
RG_GHCKD_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-18	Se	WS	TR	130		0.165	0.528	µg/L	B222203	S221000

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_FODGH_WS_LAEMP_GC_2022-09_N										
2209284-19	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-19	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-19	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-19	Se(IV)	WS	D	0.293		0.020	0.075	µg/L	B222130	S220995
2209284-19	Se(VI)	WS	D	48.1		0.010	0.055	µg/L	B222130	S220995
2209284-19	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222130	S220995
2209284-19	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-19	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222130	S220995
2209284-19	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222130	S220995
RG_FODGH_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-20	Se	WS	D	41.3		0.165	0.528	µg/L	B222203	S221000
RG_FODGH_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-21	Se	WS	TR	44.0		0.165	0.528	µg/L	B222203	S221000
RG_RIVER_WS_LAEMP_GC_2022-09_N										
2209284-22	DMSeO	WS	D	0.092		0.010	0.025	µg/L	B222130	S220995
2209284-22	MeSe(IV)	WS	D	0.068		0.010	0.025	µg/L	B222130	S220995
2209284-22	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-22	Se(IV)	WS	D	2.91		0.020	0.075	µg/L	B222130	S220995
2209284-22	Se(VI)	WS	D	138		0.010	0.055	µg/L	B222130	S220995
2209284-22	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222130	S220995
2209284-22	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222130	S220995
2209284-22	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222130	S220995
2209284-22	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222130	S220995
RG_RIVER_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-23	Se	WS	D	122		0.165	0.528	µg/L	B222203	S221000
RG_RIVER_WS_LAEMP_GC_2022-09_NP-NAL										
2209284-24	Se	WS	TR	134		0.165	0.528	µg/L	B222203	S221000

Accuracy & Precision Summary

Batch: B222130
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC	Limits	RPD	Limits
B222130-BS1	**Blank Spike, (2124033)**								
	MeSe(IV)		5.095	6.159	µg/L	121%	75-125		
	Se(IV)		5.000	5.689	µg/L	114%	75-125		
	Se(VI)		5.000	5.231	µg/L	105%	75-125		
	SeCN		5.015	5.177	µg/L	103%	75-125		
	SeMet		4.932	5.459	µg/L	111%	75-125		
B222130-DUP2	**Duplicate, (2209284-10)**								
	DMSeO	ND		ND	µg/L			N/C	25
	MeSe(IV)	0.012		ND	µg/L			N/C	25
	MeSe(VI)	ND		ND	µg/L			N/C	25
	Se(IV)	0.422		0.430	µg/L			2%	25
	Se(VI)	244.4		244.4	µg/L			0.01%	25
	SeCN	ND		ND	µg/L			N/C	25
	SeMet	ND		ND	µg/L			N/C	25
	SeSO3	ND		ND	µg/L			N/C	25
	Unk Se Sp	ND		ND	µg/L			N/C	25
B222130-MS2	**Matrix Spike, (2209284-10)**								
	Se(IV)	0.422	4.900	4.870	µg/L	91%	75-125		
	Se(VI)	244.4	5.100	249.8	µg/L	NR	75-125		
	SeCN	ND	1.962	1.814	µg/L	92%	75-125		
	SeMet	ND	1.977	1.982	µg/L	100%	75-125		
B222130-MSD2	**Matrix Spike Duplicate, (2209284-10)**								
	Se(IV)	0.422	4.900	4.994	µg/L	93%	75-125	3%	25
	Se(VI)	244.4	5.100	251.2	µg/L	NR	75-125	N/C	25
	SeCN	ND	1.962	1.836	µg/L	94%	75-125	1%	25
	SeMet	ND	1.977	1.999	µg/L	101%	75-125	0.8%	25

Accuracy & Precision Summary

Batch: B222203
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B222203-BS1	**Blank Spike, (2128023)**								
	Se		200.0	174.3	µg/L	87%	75-125		
B222203-BS2	**Blank Spike, (2128023)**								
	Se		200.0	178.8	µg/L	89%	75-125		
B222203-BS3	**Blank Spike, (2128023)**								
	Se		200.0	179.9	µg/L	90%	75-125		
B222203-BS4	**Blank Spike, (2128023)**								
	Se		200.0	173.4	µg/L	87%	75-125		
B222203-BS5	**Blank Spike, (2128023)**								
	Se		200.0	182.9	µg/L	91%	75-125		
B222203-SRM1	**Reference Material (2214016, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	12.81	µg/L	90%	75-125		
B222203-SRM2	**Reference Material (2214016, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	13.33	µg/L	93%	75-125		
B222203-SRM3	**Reference Material (2214016, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	13.09	µg/L	92%	75-125		
B222203-SRM4	**Reference Material (2214016, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	13.25	µg/L	93%	75-125		
B222203-SRM5	**Reference Material (2214016, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	13.11	µg/L	92%	75-125		
B222203-DUP1	**Duplicate, (2209283-06)**								
	Se	1.829		1.882	µg/L			3%	20

Accuracy & Precision Summary

Batch: B222203
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B222203-MS1	**Matrix Spike, (2209283-06)**								
	Se	1.829	220.0	198.2	µg/L	89%	75-125		
B222203-MSD1	**Matrix Spike Duplicate, (2209283-06)**								
	Se	1.829	220.0	202.7	µg/L	91%	75-125	2%	20
B222203-DUP2	**Duplicate, (2209284-09)**								
	Se	0.967		0.911	µg/L			6%	20
B222203-MS2	**Matrix Spike, (2209284-09)**								
	Se	0.967	220.0	204.6	µg/L	93%	75-125		
B222203-MSD2	**Matrix Spike Duplicate, (2209284-09)**								
	Se	0.967	220.0	203.1	µg/L	92%	75-125	0.8%	20

Method Blanks & Reporting Limits

Batch: B222130
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B222130-BLK1	0.00	µg/L
B222130-BLK2	0.00	µg/L
B222130-BLK3	0.00	µg/L
B222130-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B222130-BLK1	0.00	µg/L
B222130-BLK2	0.00	µg/L
B222130-BLK3	0.00	µg/L
B222130-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B222130-BLK1	0.00	µg/L
B222130-BLK2	0.00	µg/L
B222130-BLK3	0.00	µg/L
B222130-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: Se(IV)

Sample	Result	Units
B222130-BLK1	0.00	µg/L
B222130-BLK2	0.00	µg/L
B222130-BLK3	0.00	µg/L
B222130-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.004
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B222130-BLK1	0.00	µg/L
B222130-BLK2	0.00	µg/L
B222130-BLK3	0.00	µg/L
B222130-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B222130-BLK1	0.00	µg/L
B222130-BLK2	0.00	µg/L
B222130-BLK3	0.00	µg/L
B222130-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B222130-BLK1	0.00	µg/L
B222130-BLK2	0.00	µg/L
B222130-BLK3	0.00	µg/L
B222130-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: SeSO3

Sample	Result	Units
B222130-BLK1	0.00	µg/L
B222130-BLK2	0.00	µg/L
B222130-BLK3	0.00	µg/L
B222130-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: Unk Se Sp

Sample	Result	Units
B222130-BLK1	0.00	µg/L
B222130-BLK2	0.00	µg/L
B222130-BLK3	0.00	µg/L
B222130-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Method Blanks & Reporting Limits

Batch: B222203
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B222203-BLK1	-0.026	µg/L
B222203-BLK2	-0.076	µg/L
B222203-BLK3	-0.031	µg/L
B222203-BLK4	-0.040	µg/L
B222203-BLK5	-0.054	µg/L

Average: -0.045
Limit: 0.480

MDL: 0.150
MRL: 0.480

Sample Containers

Lab ID: 2209284-01
Sample: RG_GHBP_WS_LAEMP_GC_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/12/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 4 - 2209284
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 4 - 2209284
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 4 - 2209284

Lab ID: 2209284-02
Sample: RG_GHBP_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/12/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Lab ID: 2209284-03
Sample: RG_GHBP_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/12/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Lab ID: 2209284-04
Sample: RG_GANF_WS_LAEMP_GC_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/13/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 4 - 2209284
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 4 - 2209284
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 4 - 2209284

Sample Containers

Lab ID: 2209284-05
Sample: RG_GANF_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/13/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Lab ID: 2209284-06
Sample: RG_GANF_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/13/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Lab ID: 2209284-07
Sample: RG_GAUT_WS_LAEMP_GC_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/14/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 4 - 2209284
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 4 - 2209284
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 4 - 2209284

Lab ID: 2209284-08
Sample: RG_GAUT_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/14/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Lab ID: 2209284-09
Sample: RG_GAUT_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/14/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Sample Containers

Lab ID: 2209284-10
Sample: RG_GHUT_WS_LAEMP_GC_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/15/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 4 - 2209284
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 4 - 2209284
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 4 - 2209284

Lab ID: 2209284-11
Sample: RG_GHUT_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/15/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Lab ID: 2209284-12
Sample: RG_GHUT_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/15/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Lab ID: 2209284-13
Sample: RG_GHDT_WS_LAEMP_GC_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/16/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 4 - 2209284
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 4 - 2209284
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 4 - 2209284

Sample Containers

Lab ID: 2209284-14
Sample: RG_GHDT_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/16/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Lab ID: 2209284-15
Sample: RG_GHDT_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/16/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Lab ID: 2209284-16
Sample: RG_GHCKD_WS_LAEMP_GC_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/15/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 4 - 2209284
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 4 - 2209284
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 4 - 2209284

Lab ID: 2209284-17
Sample: RG_GHCKD_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/15/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Lab ID: 2209284-18
Sample: RG_GHCKD_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/15/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Sample Containers

Lab ID: 2209284-19
Sample: RG_FODGH_WS_LAEMP_GC_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/18/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 4 - 2209284
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 4 - 2209284
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 4 - 2209284

Lab ID: 2209284-20
Sample: RG_FODGH_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/18/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Lab ID: 2209284-21
Sample: RG_FODGH_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/18/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Lab ID: 2209284-22
Sample: RG_RIVER_WS_LAEMP_GC_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/12/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 4 - 2209284
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 4 - 2209284
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 4 - 2209284

Sample Containers

Lab ID: 2209284-23
Sample: RG_RIVER_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/12/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Lab ID: 2209284-24
Sample: RG_RIVER_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/12/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 3 - 2209284

Shipping Containers

Cooler 3 - 2209284

Received: September 22, 2022 7:37
Tracking No: RWHV95583 via Courier
Coolant Type: Blue Ice
Temperature: 9.6 °C
Description: Styrofoam Cooler
Damaged in transit? No
Returned to client? No
Comments: IR#:1
Custody seals present? No
Custody seals intact? No
COC present? Yes

Cooler 4 - 2209284

Received: September 22, 2022 7:37
Tracking No: RWHV95583 via Courier
Coolant Type: Blue Ice
Temperature: -0.3 °C
Description: Styrofoam Cooler
Damaged in transit? No
Returned to client? No
Comments: IR#:1
Custody seals present? No
Custody seals intact? No
COC present? No

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BAL Final Report 2209284

COC ID:	REP_LAEMP_GC_2022-09_BROOKS	TURNAROUND TIME:	Rush	RUSH:	Priority

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Regional Effects Program			Lab Name	Brooks Applied Labs			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Giovanna Diaz			Lab Contact	Ben Wozniak			Email 1:	AquaSciLab@Teck.com	X	X	X
Email	Giovanna.Diaz@Teck.com			Email	Ben@brooksapplied.com			Email 2:	teckcoal@equisonline.com			X
Address	421 Pine Avenune			Address	13751 Lake City Way			Email 3:	Teck.Lab.Results@teck.com	X	X	X
					Suite 108			Email 4:	Lisa.Bowron@minnow.ca	X	X	X
City	Sparwood	Province	BC	City	Seattle	Province	WA	Email 5:	Awelbe@minnow.ca	X	X	X
Postal Code	V0B 2G1	Country	Canada	Postal Code	98125	Country	United S	Email 6:	Jessica.Ritz@Teck.com	X	X	X
Phone Number	1-250-865-3048			Phone Number	(206) 753-6158			PO number	VPO00817033			

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Brooks_Se_Speciation (F)	Brooks_Se_D (N)	Brooks_Se_T (N)
RG_GHBP_WS_LAEMP_GC_2022-09_N	RG_GHBP	WS		2022/09/12	7:44	G	1	1		
RG_GHBP_WS_LAEMP_GC_2022-09_NP-NAL	RG_GHBP	WS		2022/09/12	7:44	G	2		1	1
RG_GANF_WS_LAEMP_GC_2022-09_N	RG_GANF	WS		2022/09/13	9:25	G	1	1		
RG_GANF_WS_LAEMP_GC_2022-09_NP-NAL	RG_GANF	WS		2022/09/13	9:25	G	2		1	1
RG_GAUT_WS_LAEMP_GC_2022-09_N	RG_GAUT	WS		2022/09/14	8:50	G	1	1		
RG_GAUT_WS_LAEMP_GC_2022-09_NP-NAL	RG_GAUT	WS		2022/09/14	8:50	G	2		1	1
RG_GHUT_WS_LAEMP_GC_2022-09_N	RG_GHUT	WS		2022/09/15	8:05	G	1	1		
RG_GHUT_WS_LAEMP_GC_2022-09_NP-NAL	RG_GHUT	WS		2022/09/15	8:05	G	2		1	1
RG_GHDT_WS_LAEMP_GC_2022-09_N	RG_GHDT	WS		2022/09/16	8:55	G	1	1		
RG_GHDT_WS_LAEMP_GC_2022-09_NP-NAL	RG_GHDT	WS		2022/09/16	8:55	G	2		1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Jennifer Ings/Minnow	##############	WW / BAL	9/22/22 7:37

SERVICE REQUEST (rush - subject to availability)					
Regular (default)		Sampler's Name	Jennifer Ings	Mobile #	519-500-3444
Priority (2-3 business days) - 50% surcharge	X				
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	September 19, 2022
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

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BAL Final Report 2209284

COC ID:	REP_LAEMP_GC_2022-09_BROOKS	TURNAROUND TIME:	Rush	RUSH:	Priority

PROJECT/CLIENT INFO				LABORATORY			
Facility Name / Job#	Regional Effects Program			Lab Name	Brooks Applied Labs		
Project Manager	Giovanna Diaz			Lab Contact	Ben Wozniak		
Email	Giovanna.Diaz@Teck.com			Email	Ben@brooksapplied.com		
Address	421 Pine Avenune			Address	13751 Lake City Way		
					Suite 108		
City	Sparwood	Province	BC	City	Seattle	Province	WA
Postal Code	V0B 2G1	Country	Canada	Postal Code	98125	Country	United S
Phone Number	1-250-865-3048			Phone Number	(206) 753-6158		

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	Lisa.Bowron@minnow.ca	X	X	X
Email 5:	Aweibe@minnow.ca	X	X	X
Email 6:	Jessica.Ritz@Teck.com	X	X	X
PO number	VPO00817033			

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Brooks_Se_Speciation (F)	Brooks_Se_D (N)	Brooks_Se_T (N)
RG_GHCKD_WS_LAEMP_GC_2022-09_N	RG_GHCKD	WS		2022/09/15	13:40	G	1	1		
RG_GHCKD_WS_LAEMP_GC_2022-09_NP-NAL	RG_GHCKD	WS		2022/09/15	13:40	G	2		1	1
RG_FODGH_WS_LAEMP_GC_2022-09_N	RG_FODGH	WS		2022/09/18	9:00	G	1	1		
RG_FODGH_WS_LAEMP_GC_2022-09_NP-NAL	RG_FODGH	WS		2022/09/18	9:00	G	2		1	1
RG_RIVER_WS_LAEMP_GC_2022-09_N	RG_RIVER	WS		2022/09/12	7:44	G	1	1		
RG_RIVER_WS_LAEMP_GC_2022-09_NP-NAL	RG_RIVER	WS		2022/09/12	7:44	G	2		1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Jennifer Ings/Minnow	##############	WW / BAL	9/22/22 7:37

SERVICE REQUEST (rush - subject to availability)

Regular (default)	
Priority (2-3 business days) - 50% surcharge	X
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jennifer Ings	Mobile #	519-500-3444
Sampler's Signature		Date/Time	September 19, 2022

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STRAIGHT BILL OF LADING
NOT NEGOTIABLE

RW HOT SHOT SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

BAL Final Report 2209284

No. 95583

Sparwood, BC	Vancouver, BC	Prince George, BC	Elkford, BC	Tumbler Ridge, BC
Terrace, BC	Calgary, AB	Edmonton, AB	Ft. McMurray, AB	Hinton, AB
Red Deer, AB	Montreal, QC	Spokane, WA	Shelby, MT	Gillette, WY

INVOICE TO: Cap 2209284270 — DATE: Sept 20/22

BILL OF LADING #: — PURCHASE ORDER NUMBER:

SHIPPER (FROM): ... Limited — CONSIGNEE (TO): Brooks Applied Labs

STREET: ... Line Creek — STREET: 18751 Lake City Way NE

CITY/PROVINCE: Sparwood, BC — POSTAL CODE: — CITY/PROVINCE: Seattle, WA — POSTAL CODE:

SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
7	Coolers - Water Samples	266 lbs
	RWHV95583	

FREIGHT CHARGES
SHIPPER TO CHECK
☐PREPAID ☐COLLECT
If not indicated, shipping will automatically move collect.

FEE ______
WAITING ______
XPU ______
CHARGES ______
FSC ______
US ______
SUB TOTAL ______
GST ______
TOTAL $ ______
IF AT OWNER'S RISK WRITE ORD HERE ______

UNIT #

DECLARED VALUATION: Maximum liability of carrier is $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise $ ______

DRIVER'S SIGNATURE - PICK UP BY | PICK UP TIME | DRIVER'S SIGNATURE - DELIVERY BY | FINISH TIME

NOTICE OF CLAIM: (a) No carrier is liable for loss, damage or delay of any goods under the Bill of Lading unless notice ... setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed in respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, or in the case of failure to make delivery within nine (9) months from the date of shipment. (b) The final statement of the claim must be filed within nine (9) months from the date of shipment together with a copy of the paid freight bill. RECEIVED at the point of origin on the date specified from the consignor mentioned herein, the property herein described, in apparent good order, except as noted (contents and condition of contents of package unknown) marked, consigned and destined as indicated below, which the carrier agrees to carry and to deliver to the consignee at the said destination, subject to the rates and classification in effect on the date of shipment. It is mutually agreed, as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time interested in all or any of the goods, that every service to be performed hereunder shall be subject to all the conditions standard Bill of Lading, in power at the date of issuing, which are hereto agreed by the consignor and accepted for himself and his assigns. Printed or written including conditions set aside by the standard Bill of Lading in power at the date of issuing, which are hereby agreed by the consignor and accepted for himself and his assigns. The Contract for the carriage of the goods listed in the Bill of Lading is governed by regulation in force in the jurisdiction at the time and place of shipment and is subject to the conditions set out in such conditions.

SHIPPER PRINT | CONSIGNEE PRINT | DATE
SHIPPER SIGN | CONSIGNEE SIGN | TIME

NUMBER OF PIECES RECEIVED: 7

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROD: Shipper GST # 864540398RT0001

AMIGOS PRINTING

Cooler ID: Cooler 3 **COC (Y/N)** Y **Temperature:** 9.6°C **IR:** 1

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations:	GH		EV		RG		U/L		EV	
Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	~~T/D~~ volatile	SP
Container Types:	125ml plastic		125ml glass		125ml glass		140ml glass		40ml glass	

Opened By: ASG **Date:** 9/22/22

③ LC	
T/D	SP
125ml plastic	~~125ml~~

② RG	
volatile 40ml glass	

① GH	
volatile 40ml glass	

Effective 7/29/20 Revision 004

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BAL Final Report 2209284

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

RW HOT SHOT SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

No. 95583

Sparwood, BC	Vancouver, BC	Prince George, BC	Elkford, BC	Tumbler Ridge, BC
Terrace, BC	Calgary, AB	Edmonton, AB	Ft. McMurray, AB	Hinton, AB
Red Deer, AB	Montreal, QC	Spokane, WA	Shelby, MT	Gillette, WY

INVOICE TO Cap 2209A4270

DATE Sept 21/22

BILL OF LADING #

PURCHASE ORDER NUMBER

SHIPPER (FROM) Teck Limited

CONSIGNEE (TO)

STREET Line Creek

STREET

CITY/PROVINCE Sparwood B.C.

POSTAL CODE

CITY/PROVINCE Seattle WA

POSTAL CODE

SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
7	Coolers - water samples	266 lbs
	RWHV95583	

FREIGHT CHARGES
SHIPPER TO CHECK
☐ PREPAID ☐ COLLECT
If not indicated shipping will automatically move collect.

FEE
WAITING
XPU
CHARGES
FSC
US
SUB TOTAL
GST
TOTAL $

UNIT #

DECLARED VALUATION: Maximum liability of carrier is $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise $

DRIVER'S SIGNATURE - PICK UP BY

PICK UP TIME

DRIVER'S SIGNATURE - DELIVERY BY

FINISH TIME

NOTICE OF CLAIM: (a) No carrier is liable for loss, damage or delay of any goods under the Bill of Lading unless notice, thereof setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed in respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, or in the case of failure to make delivery within nine (9) months from the date of shipment (b) The final statement of the claim must be filed within nine (9) months from the date of shipment together with a copy of the paid freight bill. RECEIVED at the point of origin on the date specified from the consignor mentioned herein, the property herein described, in apparent good order, except as noted (contents and condition of contents of package unknown) marked, consigned and destined as indicated below which the carrier agrees to carry and to deliver to the consignee at the said destination subject to the rates and classification in effect on the date of shipment. It is mutually agreed, as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time interested in all or any of the goods, that every service to be performed hereunder shall be subject to all the conditions standard Bill of Lading, in power at the date of issuing, which are hereto agreed by the consignor and accepted for himself and his assigns. Printed or written, including conditions set aside by the standard Bill of Lading in power at the date of issuing which are hereby agreed by the consignor and accepted for himself and his assigns. The Contract for the carriage of the goods listed in the Bill of Lading is governed by regulation in force in the jurisdiction at the time and place of shipment and is subject to the conditions set out in such conditions.

IF AT OWNER'S RISK, WRITE ORD HERE

SHIPPER PRINT

CONSIGNEE PRINT

DATE

SHIPPER SIGN

CONSIGNEE SIGN

TIME

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROAD: Shipper

GST # 864540398RT0001

NUMBER OF PIECES RECEIVED 7

KINGOS PRINTING

Cooler ID: Cooler 4

COC (Y/N)

Temperature: -0.3

IR: 1

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations:	LC		WLC		GH		RG			
Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:		60 mL HDPE		125 mL plastic		60 mL HDPE		60 mL HDPE		

Opened By: WW

Date: 9/22/22

Effective 7/29/20

COPY

Revision 004

BROOKS APPLIED LABS
13751 Lake City Way NE, Ste 108, Seattle, WA 98125 • USA • T:206-632-6206 • info@brooksapplied.com

October 6, 2022

Teck Resources Limited – Vancouver
Giovanna Diaz
421 Pine Avenue
Sparwood, B.C. CANADA V0B2G1
giovanna.diaz@teck.com

Re: Regional Effects Program

Dear Giovanna Diaz,

On September 29, 2022, Brooks Applied Labs (BAL) received two (2) aqueous samples. The samples were logged-in for total recoverable selenium [*Se*], dissolved Se [*Se*], and Se speciation analyses, according to the chain-of-custody (COC) form.

The sample fractions for total recoverable Se and dissolved Se were not preserved in the field. The samples were preserved (pH < 2) upon receipt at BAL. All sample fractions for total recoverable Se and dissolved Se were preserved within the (14 calendar day) preservation holding time.

The sample fractions logged in for Se speciation and dissolved Se had been field-filtered prior to receipt at BAL. All samples were stored according to BAL SOPs.

Total Recoverable and Dissolved Se

Each aqueous sample fraction for total recoverable or dissolved Se was digested in a closed vessel (bomb) with nitric and hydrochloric acids. The resulting digests were analyzed for Se content via inductively coupled plasma triple quadrupole mass spectrometry (ICP-QQQ-MS). The ICP-QQQ-MS instrumentation uses advanced interference removal techniques to ensure accuracy of the sample results. For more information, please visit the *Interference Reduction Technology* section on our website, brooksapplied.com.

Selenium Speciation

Each aqueous sample was analyzed for selenium speciation using ion chromatography inductively coupled plasma collision reaction cell mass spectrometry (IC-ICP-CRC-MS). Selenium species are chromatographically separated on an ion exchange column and then quantified using inductively coupled plasma collision reaction cell mass spectrometry (ICP-CRC-MS); for more information on this determinative technique, please visit the *Interference Reduction Technology* section on our website. The chromatographic method applied for the analyses provides greater retention of methylseleninic acid and selenomethionine, allowing for more definitive quantitation of these species.

In accordance with the quotation issued for this project, selenium speciation was defined as dissolved selenite [Se(IV)], selenate [*Se(VI)*], selenocyanate [*SeCN*], methylseleninic acid [*MeSe(IV)*], methaneselenonic acid [*MeSe(VI)*], selenomethionine [*SeMet*], selenosulfate [*SeSO3*], and dimethylselenoxide [*DMSeO*]. Unknown Se species was defined as the total concentration of all unknown Se species observed during the analysis. This item is identified on the report as [*Unk Se Sp*].

DMSeO elutes early in the chromatographic run due to the nature of the molecule and the applied chromatographic separation method. Since this species elutes near the dead volume, additional selenium species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting selenium species.

The results were not method blank corrected, as described in the calculations section of the relevant BAL SOPs and were evaluated using reporting limits adjusted to account for sample aliquot size. Please refer to the *Sample Results* page for sample-specific MDLs, MRLs, and other details.

In instances where a matrix spike/matrix spike duplicate (MS/MSD) set was spiked at a level less than the native sample concentration, the recoveries, and the relative percent difference (RPD) values are not considered valid indicators of data quality. In such instances, the recoveries of the laboratory fortified blanks (BS) and/or standard reference materials (SRM) demonstrate the accuracy of the applied methods. When the spiking level was less than 25% of the native sample concentration, the spike recovery was not reported (NR) and the relative percent difference (RPD) of the MS/MSD set was not calculated (N/C).

Except for concentration qualifiers, all data were reported without qualification. All associated quality control sample results met the acceptance criteria.

BAL, an accredited laboratory, certifies that the reported results of all analyses for which BAL is NELAP accredited meet all NELAP requirements. For more information, please see the *Report Information* page.

Please feel free to contact us if you have any questions regarding this report.

Sincerely,

Jeremy Maute
Senior Project Manager
Jeremy@brooksapplied.com

Report Information

Laboratory Accreditation

BAL is accredited by the *National Environmental Laboratory Accreditation Program* (NELAP) through the State of Florida Department of Health, Bureau of Laboratories (E87982) and is certified to perform many environmental analyses. BAL is also certified by many other states to perform environmental analyses. For a current list of our accreditations/certifications, please visit our website at <http://www.brooksapplied.com/resources/certificates-permits/> or review Tables 1 and 2 in our Accreditation Information. Results reported relate only to the samples listed in the report.

Field Quality Control Samples

Please be notified that certain EPA methods require the collection of field quality control samples of an appropriate type and frequency; failure to do so is considered a deviation from some methods and for compliance purposes should only be done with the approval of regulatory authorities. Please see the specific EPA methods for details regarding required field quality control samples.

Common Abbreviations

AR	as received	**MS**	matrix spike
BAL	Brooks Applied Labs	**MSD**	matrix spike duplicate
BLK	method blank	**ND**	non-detect
BS	blank spike	**NR**	non-reportable
CAL	calibration standard	**N/C**	not calculated
CCB	continuing calibration blank	**PS**	post preparation spike
CCV	continuing calibration verification	**REC**	percent recovery
COC	chain of custody record	**RPD**	relative percent difference
D	dissolved fraction	**SCV**	secondary calibration verification
DUP	duplicate	**SOP**	standard operating procedure
IBL	instrument blank	**SRM**	reference material
ICV	initial calibration verification	**T**	total fraction
MDL	method detection limit	**TR**	total recoverable fraction
MRL	method reporting limit		

Definition of Data Qualifiers

(Effective 3/23/2020)

E	An estimated value due to the presence of interferences. A full explanation is presented in the narrative.
H	Holding time and/or preservation requirements not met. Please see narrative for explanation.
J	Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.
J-1	Estimated value. A full explanation is presented in the narrative.
M	Duplicate precision (RPD) was not within acceptance criteria. Please see narrative for explanation.
N	Spike recovery was not within acceptance criteria. Please see narrative for explanation.
R	Rejected, unusable value. A full explanation is presented in the narrative.
U	Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.
X	Result is not BLK-corrected and is within 10x the absolute value of the highest detectable BLK in the batch. Result is estimated.
Z	Holding time and/or preservation requirements not established for this method; however, BAL recommendations for holding time were not followed. Please see narrative for explanation.

These qualifiers are based on those previously utilized by Brooks Applied Labs, those found in the EPA SOW ILM03.0, Exhibit B, Section III, pg. B-18, and the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review; USEPA; January 2010. These supersede all previous qualifiers ever employed by BAL.

Accreditation Information

Table 1. Accredited method/matrix/analytes for TNI

Issued by: State of Florida Dept. of Health (The NELAC Institute 2016 Standard)
Issued on: July 1, 2021; Valid to: June 30, 2022
Certificate Number: E87982-37

Method	Matrix	TNI Accredited Analyte(s)
EPA 1638	Non-Potable Waters	Ag, Cd, Cu, Ni, Pb, Sb, Se, Tl, Zn
EPA 200.8	Non-Potable Waters	Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
EPA 6020	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn
BAL-5000	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn, Hardness
	Solids/Chemicals	Ag, As, B, Be, Cd, Co, Cr, Cu, Pb, Mo, Ni, Sb, Se, Sn, Sr, Tl, V, Zn
	Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn
EPA 1640	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn
EPA 1631E	Non-Potable Waters, Solids/Chemicals & Biological	Total Mercury
EPA 1630	Non-Potable Waters	Methyl Mercury
BAL-3200	Solids/Chemicals & Biological	Methyl Mercury
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
BAL-4201	Non-Potable Waters	Se(IV), Se(VI)
BAL-4300	Non-Potable Waters Solid/Chemicals	Cr(VI)
SM2340B	Non-Potable Waters	Hardness

Accreditation Information

Table 2. Accredited method/matrix/analytes for ISO (1), Non-Governmental TNI (2)

Issued by: ANAB

Issued on: September 21, 2021; Valid to: March 30, 2024

Method	Matrix	ISO and Non-Gov. TNI Accredited Analyte(s)
EPA 1638 Mod EPA 200.8 Mod EPA 6020 Mod BAL-5000	Non-Potable Waters	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, V, Zn Hg (Biological Only)
EPA 1640 Mod	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn Ag, As, Cr, Co, Se, Tl, V (ISO Only)
EPA 1631E Mod BAL-3100	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic (ISO Only)
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)
AOAC 2015.01 Mod BAL-5000	Food	As, Cd, Hg, Pb
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
	Biological by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4101	Food by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)
SM2340B	Non-Potable Waters	Hardness
SM 2540G BAL-0501	Solids/Chemicals & Biological	% Dry Weight

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
RG_GHP_WS_LAEMP_GC_2022-09_N	2209379-01	WS	Sample	09/19/2022	09/29/2022
RG_GHP_WS_LAEMP_GC_2022-09_NP-NAL	2209379-02	WS	Sample	09/19/2022	09/29/2022
RG_GHP_WS_LAEMP_GC_2022-09_NP-NAL	2209379-03	WS	Sample	09/19/2022	09/29/2022

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201	09/29/2022	09/30/2022	B222221	S221013
MeSe(IV)	Water	SOP BAL-4201	09/29/2022	09/30/2022	B222221	S221013
MeSe(VI)	Water	SOP BAL-4201	09/29/2022	09/30/2022	B222221	S221013
Se	Water	EPA 1638 Mod	09/30/2022	10/04/2022	B222268	S221024
Se(IV)	Water	SOP BAL-4201	09/29/2022	09/30/2022	B222221	S221013
Se(VI)	Water	SOP BAL-4201	09/29/2022	09/30/2022	B222221	S221013
SeCN	Water	SOP BAL-4201	09/29/2022	09/30/2022	B222221	S221013
SeMet	Water	SOP BAL-4201	09/29/2022	09/30/2022	B222221	S221013
SeSO3	Water	SOP BAL-4201	09/29/2022	09/30/2022	B222221	S221013
Unk Se Sp	Water	SOP BAL-4201	09/29/2022	09/30/2022	B222221	S221013

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_GHP_WS_LAEMP_GC_2022-09_N										
2209379-01	DMSeO	WS	D	0.118		0.010	0.025	µg/L	B222221	S221013
2209379-01	MeSe(IV)	WS	D	0.079		0.010	0.025	µg/L	B222221	S221013
2209379-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222221	S221013
2209379-01	Se(IV)	WS	D	2.63		0.020	0.075	µg/L	B222221	S221013
2209379-01	Se(VI)	WS	D	129		0.010	0.055	µg/L	B222221	S221013
2209379-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222221	S221013
2209379-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222221	S221013
2209379-01	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222221	S221013
2209379-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222221	S221013
RG_GHP_WS_LAEMP_GC_2022-09_NP-NAL										
2209379-02	Se	WS	D	135		0.165	0.528	µg/L	B222268	S221024
RG_GHP_WS_LAEMP_GC_2022-09_NP-NAL										
2209379-03	Se	WS	TR	129		0.165	0.528	µg/L	B222268	S221024

Accuracy & Precision Summary

Batch: B222221
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B222221-BS1	**Blank Spike, (2236035)**								
	MeSe(IV)		5.095	5.499	µg/L	108%	75-125		
	Se(IV)		5.000	5.194	µg/L	104%	75-125		
	Se(VI)		5.000	4.839	µg/L	97%	75-125		
	SeCN		5.015	4.817	µg/L	96%	75-125		
	SeMet		4.982	4.857	µg/L	97%	75-125		
B222221-DUP4	**Duplicate, (2209376-10)**								
	DMSeO	ND		ND	µg/L			N/C	25
	MeSe(IV)	ND		ND	µg/L			N/C	25
	MeSe(VI)	ND		ND	µg/L			N/C	25
	Se(IV)	0.073		0.067	µg/L			7%	25
	Se(VI)	134.8		135.1	µg/L			0.2%	25
	SeCN	ND		ND	µg/L			N/C	25
	SeMet	ND		ND	µg/L			N/C	25
	SeSO3	ND		ND	µg/L			N/C	25
	Unk Se Sp	ND		ND	µg/L			N/C	25
B222221-MS4	**Matrix Spike, (2209376-10)**								
	Se(IV)	0.073	4.900	4.437	µg/L	89%	75-125		
	Se(VI)	134.8	5.100	140.5	µg/L	NR	75-125		
	SeCN	ND	1.962	1.766	µg/L	90%	75-125		
	SeMet	ND	1.977	1.920	µg/L	97%	75-125		
B222221-MSD4	**Matrix Spike Duplicate, (2209376-10)**								
	Se(IV)	0.073	4.900	4.348	µg/L	87%	75-125	2%	25
	Se(VI)	134.8	5.100	138.8	µg/L	NR	75-125	N/C	25
	SeCN	ND	1.962	1.769	µg/L	90%	75-125	0.2%	25
	SeMet	ND	1.977	1.864	µg/L	94%	75-125	3%	25

Accuracy & Precision Summary

Batch: B222268
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B222268-BS1	**Blank Spike, (2128023)**								
	Se		200.0	170.2	µg/L	85%	75-125		
B222268-BS2	**Blank Spike, (2128023)**								
	Se		200.0	157.6	µg/L	79%	75-125		
B222268-BS3	**Blank Spike, (2128023)**								
	Se		200.0	178.1	µg/L	89%	75-125		
B222268-SRM1	**Reference Material (2214016, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	11.10	µg/L	78%	75-125		
B222268-SRM2	**Reference Material (2214016, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	11.88	µg/L	83%	75-125		
B222268-SRM3	**Reference Material (2214016, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	11.92	µg/L	83%	75-125		
B222268-DUP4	**Duplicate, (2209378-03)**								
	Se	60.07		56.79	µg/L			6%	20
B222268-MS4	**Matrix Spike, (2209378-03)**								
	Se	60.07	220.0	273.4	µg/L	97%	75-125		
B222268-MSD4	**Matrix Spike Duplicate, (2209378-03)**								
	Se	60.07	220.0	248.3	µg/L	86%	75-125	10%	20

Method Blanks & Reporting Limits

Batch: B222221
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B222221-BLK1	0.00	µg/L
B222221-BLK2	0.00	µg/L
B222221-BLK3	0.00	µg/L
B222221-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B222221-BLK1	0.00	µg/L
B222221-BLK2	0.00	µg/L
B222221-BLK3	0.00	µg/L
B222221-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B222221-BLK1	0.00	µg/L
B222221-BLK2	0.00	µg/L
B222221-BLK3	0.00	µg/L
B222221-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: Se(IV)

Sample	Result	Units
B222221-BLK1	0.00	µg/L
B222221-BLK2	0.00	µg/L
B222221-BLK3	0.00	µg/L
B222221-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.004
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B222221-BLK1	0.00	µg/L
B222221-BLK2	0.00	µg/L
B222221-BLK3	0.00	µg/L
B222221-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B222221-BLK1	0.00	µg/L
B222221-BLK2	0.00	µg/L
B222221-BLK3	0.00	µg/L
B222221-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B222221-BLK1	0.00	µg/L
B222221-BLK2	0.00	µg/L
B222221-BLK3	0.00	µg/L
B222221-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: SeSO3

Sample	Result	Units
B222221-BLK1	0.00	µg/L
B222221-BLK2	0.00	µg/L
B222221-BLK3	0.00	µg/L
B222221-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: Unk Se Sp

Sample	Result	Units
B222221-BLK1	0.00	µg/L
B222221-BLK2	0.00	µg/L
B222221-BLK3	0.00	µg/L
B222221-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Method Blanks & Reporting Limits

Batch: B222268
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B222268-BLK1	0.027	µg/L
B222268-BLK2	0.095	µg/L
B222268-BLK3	-0.028	µg/L
B222268-BLK4	0.019	µg/L

Average: 0.028 **MDL:** 0.150
Limit: 0.480 **MRL:** 0.480

Sample Containers

Lab ID: 2209379-01
Sample: RG_GHP_WS_LAEMP_GC_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/19/2022
Received: 09/29/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 1 - 2209379
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 1 - 2209379
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 1 - 2209379

Lab ID: 2209379-02
Sample: RG_GHP_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/19/2022
Received: 09/29/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2037003	<2	Cooler 1 - 2209379

Lab ID: 2209379-03
Sample: RG_GHP_WS_LAEMP_GC_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/19/2022
Received: 09/29/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2037003	<2	Cooler 1 - 2209379

Shipping Containers

Cooler 1 - 2209379

Received: September 29, 2022 7:07
Tracking No: RWHV95589 via Courier
Coolant Type: Ice
Temperature: -1.4 °C

Description: Styrofoam Cooler
Damaged in transit? No
Returned to client? No
Comments: IR#:2

Custody seals present? No
Custody seals intact? No
COC present? Yes

COC ID:	REP_LAEMP_GC_2022-09_BROOKS	TURNAROUND TIME:	Rush	RUSH:	Priority

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Regional Effects Program			Lab Name	Brooks Applied Labs			Report Format / Distribution	Excel	PDF	EDD
Project Manager	Giovanna Diaz			Lab Contact	Ben Wozniak			Email 1: AquaSciLab@Teck.com	X	X	X
Email	Giovanna.Diaz@Teck.com			Email	Ben@brooksapplied.com			Email 2: teckcoal@equisonline.com			X
Address	421 Pine Avenune			Address	13751 Lake City Way			Email 3: Teck.Lab.Results@teck.com	X	X	X
					Suite 108			Email 4: lbowron@minnow.ca	X	X	X
City	Sparwood	Province	BC	City	Seattle	Province	WA	Email 5: Aweibe@minnow.ca	X	X	X
Postal Code	V0B 2G1	Country	Canada	Postal Code	98125	Country	United S	Email 6: Jessica.Ritz@Teck.com	X	X	X
Phone Number	1-250-865-3048			Phone Number	(206) 753-6158			PO number	VPO00817033		

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Brooks_Se_Speciation (F)	Brooks_Se_D (N)	Brooks_Se_T (N)
RG_GHP_WS_LAEMP_GC_2022-09_N	RG_GHP	WS		2022/09/19	9:15	G	1	1		
RG_GHP_WS_LAEMP_GC_2022-09_NP-NAL	RG_GHP	WS		2022/09/19	9:15	G	2		1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Jennifer Ings/Minnow	#############	Vw TBAL	9/29/22 707

SERVICE REQUEST (rush - subject to availability)					
Regular (default)		Sampler's Name	Jennifer Ings	Mobile #	519-500-3444
Priority (2-3 business days) - 50% surcharge	X	Sampler's Signature	J. Ings	Date/Time	September 26, 2022
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Confidential

BAL Final Report 2209379

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

RW HOT SHOT SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

No. 95589

Sparwood, BC | Vancouver, BC | Prince George, BC | Elkford, BC | Tumbler Ridge, BC
Terrace, BC | Calgary, AB | Edmonton, AB | Ft. McMurray, AB | Hinton, AB
Red Deer, AB | Montreal, QC | Spokane, WA | Shelby, MT | Gillette, WY

INVOICE TO: CAP

DATE: Sept 28/22

BILL OF LADING #: 2209A5600

PURCHASE ORDER NUMBER:

SHIPPER (FROM): Teck Coal: West Line Creek

CONSIGNEE (TO): Bureau Applied Labs

STREET: Water Treatment

STREET: 13751 Lake City Way NE Suite

CITY/PROVINCE: Sparwood BC

POSTAL CODE:

CITY/PROVINCE: Seattle, WA

POSTAL CODE:

SPECIAL INSTRUCTIONS:

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
5	Coolers Water Samples	175 lbs
	RWHV95589	

FREIGHT CHARGES
SHIPPER TO CHECK
☐PREPAID ☐COLLECT X
If not indicated, shipping will automatically move collect

FEE

WAITING

XPU

CHARGES

FSC

US

SUB TOTAL

GST

TOTAL $

IF AT OWNER'S RISK, WRITE ORD HERE

UNIT #

DECLARED VALUATION: Maximum liability of carrier is $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise $

DRIVER'S SIGNATURE - PICK UP BY

PICK UP TIME

DRIVER'S SIGNATURE - DELIVERY BY: Shane

FINISH TIME: 8pm

NOTICE OF CLAIM (a) No carrier is liable for loss, damage or delay of any goods under the Bill of Lading unless notice, thereof setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed in respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, or, in the case of failure to make delivery within nine (9) months from the date of shipment. (b) The final statement of the claim must be filed within nine (9) months from the date of shipment together with a copy of the paid freight bill. RECEIVED at the point of origin on the date specified from the consignor mentioned herein, the property herein described, in apparent good order, except as noted (contents and condition of contents of package unknown) marked, consigned and destined as indicated below, which the carrier agrees to carry and to deliver to the consignee at the said destination, subject to the rates and classification in effect on the date of shipment. It is mutually agreed as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time interested in all or any of the goods, that every service to be performed hereunder shall be subject to all the conditions of the uniform Bill of Lading, in power at the date of issuing, which are hereto agreed by the consignor and accepted for himself and his assigns. Printed or written including conditions set aside by the standard Bill of Lading, in power at the date of issuing, which are hereby agreed by the consignor and accepted for himself and his assigns. The Contract for the carriage of the goods listed in this Bill of Lading is governed by regulation in force in the jurisdiction at the time and place of shipment and is subject to the conditions set out in such conditions.

SHIPPER PRINT

CONSIGNEE PRINT: Slava

DATE: Sept 28/22

SHIPPER SIGN

CONSIGNEE SIGN

TIME: 8pm

NUMBER OF PIECES RECEIVED: 5

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROAD: Shipper

GST # 864540398RT0001

Cooler ID: Cooler 1

COC (Y/N)

Temperature: -1.4

IR: 2

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations:	RG volatile		LC		WLC		RG			
Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:	40 ml glass	40 ml glass		100 ml plastic	40 ml glass	125 ml plastic		100 ml plastic		

Opened By: WW

Date: 9/29/22

Effective 7/29/2(

2209379

COPY

Revision 004

CORDILLERA - BENTHIC INVERTEBRATE COMMUNITY

Methods and QC Report 2023

Project ID: 22-16 (GC LAEMP)

Client: Minnow Environmental

Prepared by:
Cordillera Consulting Inc.
Summerland, BC

Unit 1, 13216 Henry Ave B1202
Summerland, BC, V0H 1Z0
www.cordilleraconsulting.ca

P: 250.494.7553
F: 250.494.7562

Table of Contents

Sample Reception

On September 29, 2022, Cordillera Consulting received 6 benthic samples from Minnow Environmental. When samples arrived to Cordillera Consulting, exterior packaging was initially inspected for damage or wet spots that would have indicated damage to the interior containers.

Samples were logged into a proprietary software database (INSTAR1) where the clients assigned sample name was recorded along with a Cordillera Consulting (CC) number for cross-reference. Each sample was checked to ensure that all sites and replicates recorded on field sheets or packing lists were delivered intact and with adequate preservative. Any missing, mislabelled or extra samples were reported to the client immediately to confirm the total numbers and correct names on the sample jars. The client representative was notified of the arrival of the shipment and provided a sample inventory once intake was completed.
See table below for sample inventory:

Table 1: Summary of sample information including Cordillera Consulting (CC) number

Sample	CC#	Date	Size	# of Jars
RG_GHNF_BIC-1_2022-09-09_N	CC231330	9-Sep-22	400µM	2
RG_GHNF_BIC-3_2022-09-10_N	CC231331	10-Sep-22	400µM	1
RG_GHNF_BIC-5_2022-09-10_N	CC231332	10-Sep-22	400µM	4
RG_GHDT_BIC-1_2022-09-16_N	CC231333	16-Sep-22	400µM	1
RG_GHDT_BIC-3_2022-09-16_N	CC231334	16-Sep-22	400µM	1
RG_GHDT_BIC-5_2022-09-16_N	CC231335	16-Sep-22	400µM	1

Sample Sorting

- Using a gridded Petri dish, fine forceps and a low power stereo-microscope (Olympus, Nikon, Leica) the sorting technicians removed the invertebrates and sorted them into family/orders.
- The sorting technician kept a running tally of total numbers excluding organisms from Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera and terrestrial drop-ins such as aphids. These organisms were marked for their presence (given a value of 1) only and left in the sample. They were not included towards the 300-organism subsample count.
- Where specimens are broken or damaged, only heads were counted.
- Subsampling was conducted with the use of a Marchant Box.
- When using the Marchant box, cells were extracted at the same time in the order indicated by a random number table. If the 300th organism was found part way into sorting a cell then the balance of that cell was sorted. If the organism count had not reached 300 by the 50th cell then the entire sample was sorted.

- The total number of cells sorted and the number of organisms removed were recorded manually on a bench sheet and then recorded into INSTAR1
- Organisms were stored in vials containing 80% ethanol and an interior label indicating the site names, date of sampling, site code numbers and portion subsampled. This information was also recorded on the laboratory bench sheet and on INSTAR1.
- The sorted portion of the debris was preserved and labeled separately from the unsorted portion and was tested for sorting efficiency (Sorting Quality Control – Sorting Efficiency). The unsorted portion was also labeled and preserved in separate jars.

Percent sub-sampled and total countable invertebrates pulled from the samples were summarized in the table below.

Table 2: Percent sub-sample and invertebrate count for each sample

Sample	Date	CC#	400 micron fraction	
			% Sampled	# Invertebrates
RG_GHNF_BIC-1_2022-09-09_N	9-Sep-22	CC231330	19%	311
RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	100%	344
RG_GHNF_BIC-5_2022-09-10_N	10-Sep-22	CC231332	5%	542
RG_GHDT_BIC-1_2022-09-16_N	16-Sep-22	CC231333	100%	322
RG_GHDT_BIC-3_2022-09-16_N	16-Sep-22	CC231334	50%	357
RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	100%	327

Sorting Quality Control - Sorting Efficiency

As a part of Cordillera's laboratory policy, all projects undergo sorting efficiency checks.

- As sorting progresses, 10% of samples were randomly chosen by senior members of the sorting team for resorting.
- All sorters working on a project had at least 1 sample resorted by another sorter.
- An efficiency of 90 % was expected (95% for CABIN samples).
- If 90/95% efficiency was not met, samples from that sorter were resorted.
- To calculated sorting efficiency the following formula was used:

$$\frac{\#OrganismsMissed}{TotalOrganismsFound} * 100 = \%OM$$

Table 3 Summary of sorting efficiency

		Total from Sample	Percent Efficiency
Site - QC, Sample - QC 1, CC# - CC231333, Percent sampled = 100%, Sieve size = 400			
Chironomidae	4		
Plecoptera	2		
Empididae	1		
Ephemerellidae	1		
Diptera	1		
Total:	**9**	322	97.20%

Sorting Quality Control - Sub-Sampling QC

Certain Provincial and Mining projects require additional sorting checks in the form of sub-sampling QC, (Environmental Effects Monitoring (EEM) protocol). This ensured that any fraction of the total sample that was examined was actually an accurate representation of the number of total organisms. Organisms from the additional sub-samples were not identified; rather total organism count only was compared.

Sub-Sampling efficiency was measured on 10% of the number of sub-sampled samples in the project. Ex. In a project where 50 of 100 total samples were processed through subsampling using a Marchant box, then 10% of 50; or 5 samples were used for sub sampling efficiency.

Sub-Sampling efficiency was performed by fractioning the entire sample into sub-sample percentages. On each sub-sampled portion, a total organism count was recorded and compared to the rest of the sub-samples. In order to pass, all fractions were required to be within 20% of total organism count.

Example: If 300 organisms are found in 10% of the sample, the sorter will continue to sample in 10% fractions until the entire sample is separated. They will then count the total number of organisms in each of the 10 fractions of 10% and compare the organism count.

When divergence is >20% the sorting manager examines for the source of the problem and takes steps to correct it. With the Marchant box, the problem typically rested with how the box is flipped back to the upright position. For this reason, subsampling was performed by experienced employees only. Another common source of error would be the type of debris in the sample. Samples with algae or heavy with periphyton have a higher incident of failure due to clumping than clear samples.

Table 4 Summary of Sub Sample efficiency

Station ID		Organisms in Subsample																				Sorter		Actual Total	Precision		Accuracy	
CC#	Sample Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	By	Time		Percent Range		Min	Max
231334	RG_GHDT_BIC-3_2022-09-16_N	354	358																			MP	60	712	1.12	1.12	0.56	0.56

Taxonomic Effort

The next procedure was the identification to genus-species level where possible of all the organisms in the sample.

- Identifications were made at the genus/species level for all insect organisms found including Chironomidae (Based on CABIN protocol).
- Non-insect organisms (except those not included in CABIN count) were identified to genus/species where possible and to a minimum of family level with intact and mature specimens.
- The Standard Taxonomic Effort lists compiled by the CABIN manual[1], SAFIT[2] , and PNAMP[3] were used as a guide line for what level of identification to achieve where the condition and maturity of the organism enabled.
- Organisms from the same families/order were kept in separate vials with 80% ethanol and an interior label of printed laser paper.
- Chironomidae was identified to genus/species level where possible and was aided by slide mounts. CMC-10 was used to clear and mount the slide.
- Oligochaetes was identified to family/genus level with the aid of slide mounts. CMC-10 was used to clear and mount the slide.
- Other Annelida (leeches, polychaetes) were identified to the family/genus/species level with undamaged, mature specimens.
- Mollusca was identified to family and genus/species where possible
- Decapoda, Amphipoda and Isopoda were identified at family/genus/species level where possible.
- Bryozoans and Nemata remained at the phylum level
- Hydrachnidae and Cnidaria were identified at the family/genus level where possible.
- When requested, reference collections were made containing at least one individual from each taxa listed. Organisms represented will have been identified to the lowest practical level.
- Reference collection specimens were stored in 55 mm glass vials with screw-cap lids with polyseal inserts (museum quality). They were labeled with taxa name, site code, date identified and taxonomist name. The same information was applied to labels on the slide mounts.

Taxonomists

The taxonomists for this project were certified by the Society of Freshwater Science (SFS) Taxonomic Certification Program at level 2 which is the required certification for CABIN projects:

Scott Finlayson: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae (East/West); Group 4 Oligochaeta

Adam Bliss: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae
Rita Avery: Group 1 General Arthropods (East/West); Group 2 EPT (East/West)

Taxonomic QC

Taxonomic QC was performed in house by someone other than the original taxonomist.

- Quality control protocol involved complete, blind re-identification and re-enumeration of at least 10% of samples by a second SFS-certified taxonomist.
- Samples for taxonomic quality control were randomly selected and quality control procedures were conducted as the project progresses through the laboratories.

- The second (QC) taxonomist will calculate and record four types of errors:
    1. Misidentification error
    2. Enumeration error
    3. Questionable taxonomic resolution error
    4. Insufficient taxonomic resolution error

The QC coordinator then calculates the following estimates of taxonomic precision.

1. The percent total identification error rate is calculated as:

$$\frac{Sum\ of\ incorrect\ identifications}{total\ organisms\ counted\ in\ audit} * (100)$$

The average total identification error rate of audited samples did not exceed 5%. All samples that exceed a 5% error rate were re-evaluated to determine whether repeated errors or patterns in error contributed.

2. The percent difference in enumeration (PDE) to quantify the consistency of specimen counts.

$$PDE = \frac{|n_1 - n_2|}{n_1 + n_2} x100$$

3. The percent taxonomic disagreement (PTD) to quantify the shared precision between two sets of identifications.

$$PTD = \left(1 - \left[\frac{a}{N}\right]\right) x100$$

4. Bray Curtis dissimilarity Index to quantify the differences in identifications.

$$BC_{ij} = 1 - \frac{2C_{ij}}{S_j + S_i}$$

Error Summary

All samples report errors within the acceptable limits for CABIN Laboratory methods (less than 5% error).

Table 5 Summary of taxonomic error following QC

Site	Taxa Identified	% Error	PDE	PTD	Bray - Curtis Dissimilarity index
Site - 2022, Sample - RG_GHNF_BIC-3_2022-09-10_N, CC# - CC231331, Percent sampled = 100%, Sieve size = 400	346	0.00	0.28985507	0.57803468	0.00289855

There will always be disagreements between taxonomists regarding the degree of taxonomic resolution in immature specimens and when laboratories make use of different keys for certain groups (Mollusks is an especially disputed group). It is always possible that some taxa found by the original taxonomist were overlooked in QC.

All of the Taxonomic QC samples that were observed passed testing according to the CABIN misidentification protocols. See the tables below for results from taxonomic QC audit.

Error Rationale

Site - 2022, Sample - RG_GHNF_BIC-3_2022-09-10_N, CC# - CC231331, Percent sampled = 100%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Capniidae	27	27						
Chironomidae	9	9						
Collembola	2	2						
Corynoneura	1	1						
Dicranota	8	8						
Empididae	2	2						
Glutops	4	4						
Hydrobaenus	90	91	No			X		

Isoperla	4	4		
Lebertia	2	2		
Limnephilidae	44	44		
Limnophyes	2	2		
Megarcys	1	1		
Mesocapnia	2	2		
Micropsectra	1	1		
Monodiamesa	1	1		
Nemouridae	2	2		
Neoplasta	21	21		
Oribatida	1	1		
Pagastia	5	5		
Parametriocnemus	1	1		
Pericoma/Telmatoscopus	27	28	No	X
Perlodidae	34	34		
Pseudodiamesa	28	28		
Rhyacophila	1	1		
Trichoptera	4	4		
Tubificinae with hair chaetae	2	2		
Tubificinae without hair chaetae	7	7		
Tvetenia	4	4		
Zavrelimyia	7	7		
Total:	**344**	**346**		

					0	2	0
% Total Misidentification Rate =	misidentifications / total number	x100 =	0.00	**Pass**			

References

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[2] Southwest Association of Freshwater Invertebrate Taxonomists. (2015). www.safit.org

[3] Pacific Northwest Aquatic Monitoring Partnership (Accessed 2015). www.pnamp.org

Taxonomic Keys

Below is a reference list of taxonomic keys utilized by taxonomists at Cordillera Consulting. Cordillera taxonomists routinely seek out new literature to ensure the most accurate identification keys are being utilized. This is not reflective of the exhaustive list of resources that we use for identification. A more complete list of taxonomic resources can be found at Southwest Association of Freshwater Invertebrate Taxonomists. (2015).
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CORDILLERA CONSULTING
FRESHWATER INVERTEBRATE TAXONOMY

Project: 22-16 (GC LAEMP) (Formerly GGCAMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC#:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
Phylum: Arthropoda	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0
| Family: Ephemerellidae	11	0	0	0	0	1
| Order: Plecoptera	53	0	20	6	24	1
| Family: Capniidae	442	27	500	22	34	18
Mesocapnia	5	2	0	0	0	0
| Family: Chloroperlidae	47	0	0	1	2	6
Sweltsa	16	0	0	0	0	2
| Family: Nemouridae	37	2	40	1	10	4
Malenka	5	0	0	0	0	0
Zapada	0	0	0	12	16	17
Zapada cinctipes	5	0	0	15	0	6
| Family: Perlodidae	332	34	1060	21	68	5
Isoperla	0	4	20	0	2	1
Kogotus	0	0	0	0	0	1
Megarcys	0	1	60	5	8	10
| Family: Taeniopterygidae	0	0	0	2	46	15
| Order: Trichoptera	0	4	0	0	0	0
| Family: Hydropsychidae	0	0	0	0	2	0
| Family: Limnephilidae	42	44	0	3	0	2
Ecclisomyia	0	0	0	1	0	1
| Family: Rhyacophilidae	0	0	0	0	0	0
Rhyacophila	0	1	0	0	0	0
Rhyacophila betteni group	0	0	0	0	2	0
Rhyacophila brunnea/vemna group	0	0	0	0	0	5
Rhyacophila narvae	0	0	0	1	0	5
Rhyacophila vofixa group	0	0	0	2	0	0
| Order: Diptera	0	0	0	0	4	0
| Family: Chironomidae	32	9	580	20	62	20
| Subfamily: Chironominae	0	0	0	0	0	0
| Tribe: Tanytarsini	0	0	0	0	0	0
Micropsectra	0	1	20	2	4	0
| Subfamily: Diamesinae	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0
Pagastia	63	5	740	34	58	28
Pseudodiamesa	84	28	380	7	4	3
| Subfamily: Orthocladiinae	0	0	0	0	0	0
Brillia	0	0	40	0	0	0
Corynoneura	0	1	0	0	0	0
Eukiefferiella	5	0	20	101	168	78

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250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC#:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
Hydrobaenus	53	90	580	9	4	16
Limnophyes	0	2	0	0	0	0
Orthocladius complex	0	0	100	9	46	5
Parametriocnemus	0	1	40	0	0	0
Tvetenia	195	4	6180	22	90	17
| Subfamily: Prodiamesinae	0	0	0	0	0	0
Monodiamesa	0	1	0	0	0	0
| Subfamily: Tanypodinae	0	0	0	0	0	0
Ablabesmyia	0	0	0	1	0	0
Zavrelimyia	11	7	0	1	0	2
| Family: Dixidae	0	0	0	0	0	0
Dixa	0	0	0	0	0	1
| Family: Empididae	16	2	60	1	6	1
Neoplasta	105	21	40	11	32	29
Trichoclinocera	5	0	0	0	0	0
| Family: Limoniidae	0	0	0	0	0	0
Eloeophila	0	0	0	0	0	1
| Family: Muscidae	0	0	0	0	0	0
Limnophora	0	0	20	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0
Glutops	11	4	0	0	0	5
| Family: Psychodidae	0	0	0	0	0	0
Pericoma/Telmatoscopus	21	27	200	6	2	10
| Family: Tipulidae	0	0	0	0	0	0
Dicranota	11	8	20	2	4	2
| Order: Collembola	0	2	0	1	2	2
Subphylum: Chelicerata	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0
Lebertia	0	2	0	0	0	2
| Family: Sperchontidae	0	0	0	0	0	0
Sperchon	0	0	0	0	2	0
Phylum: Annelida	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	8	0
Enchytraeus	21	0	0	0	0	2
| Family: Naididae	0	0	0	0	0	0
| Subfamily: Tubificinae with hair chaetae	0	2	0	0	0	0
| Subfamily: Tubificinae without hair chaet	11	7	120	0	0	0

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250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC#:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
| Order: Oribatida	0	1	0	0	4	1
Phylum: Mollusca	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	1	0	0
| Class: Gastropoda	0	0	0	1	0	2
| Order: Hypsogastropoda	0	0	0	0	0	0
| Family: Hydrobiidae	0	0	0	1	0	0
Totals:	**1639**	**344**	**10840**	**322**	**714**	**327**

Taxa present but not included:

Phylum: Arthropoda	0	0	0	0	0	0
| Class: Copepoda	0	1	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0
| Class: Ostracoda	5	1	20	1	2	1
Phylum: Nemata	5	1	0	0	2	1
Phylum: Platyhelminthes	0	0	0	0	0	0
| Class: Turbellaria	5	1	20	1	2	1
Totals:	**15**	**4**	**40**	**2**	**6**	**3**

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250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC#:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
Phylum: Arthropoda	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0
| Family: Ephemerellidae	11	0	0	0	0	1
| Order: Plecoptera	53	0	20	6	24	1
| Family: Capniidae	447	29	500	22	34	18
| Family: Chloroperlidae	63	0	0	1	2	8
| Family: Nemouridae	47	2	40	28	26	27
| Family: Perlodidae	332	39	1140	26	78	17
| Family: Taeniopterygidae	0	0	0	2	46	15
| Order: Trichoptera	0	4	0	0	0	0
| Family: Hydropsychidae	0	0	0	0	2	0
| Family: Limnephilidae	42	44	0	4	0	3
| Family: Rhyacophilidae	0	1	0	3	2	10
| Order: Diptera	0	0	0	0	4	0
| Family: Chironomidae	443	149	8680	206	436	169
| Family: Dixidae	0	0	0	0	0	1
| Family: Empididae	126	23	100	12	38	30
| Family: Limoniidae	0	0	0	0	0	1
| Family: Muscidae	0	0	20	0	0	0
| Family: Pelecorhynchidae	11	4	0	0	0	5
| Family: Psychodidae	21	27	200	6	2	10
| Family: Tipulidae	11	8	20	2	4	2
| Order: Collembola	0	2	0	1	2	2
Subphylum: Chelicerata	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0
| Family: Lebertiidae	0	2	0	0	0	2
| Family: Sperchontidae	0	0	0	0	2	0
Phylum: Annelida	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0
| Family: Enchytraeidae	21	0	0	0	8	2
| Family: Naididae	11	9	120	0	0	0
| Order: Oribatida	0	1	0	0	4	1

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scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC#:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
Phylum: Mollusca	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	1	0	0
| Class: Gastropoda	0	0	0	1	0	2
| Order: Hypsogastropoda	0	0	0	0	0	0
| Family: Hydrobiidae	0	0	0	1	0	0
Totals:	**1639**	**344**	**10840**	**322**	**714**	**327**

Taxa present but not included:

Phylum: Arthropoda	0	0	0	0	0	0
| Class: Copepoda	0	1	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0
| Class: Ostracoda	5	1	20	1	2	1
Phylum: Nemata	5	1	0	0	2	1
Phylum: Platyhelminthes	0	0	0	0	0	0
| Class: Turbellaria	5	1	20	1	2	1
Totals:	**15**	**4**	**40**	**2**	**6**	**3**

CORDILLERA CONSULTING
FRESHWATER INVERTEBRATE TAXONOMY

Project: 22-16 (GC LAEMP) (Formerly GGCAMP)

Minnow Environmental (BC)

Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC#:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
Richness Measures						
Species Richness	22	28	18	28	25	33
EPT Richness	9	7	4	12	9	15
Ephemeroptera Richness	1	0	0	0	0	1
Plecoptera Richness	7	5	4	8	7	10
Trichoptera Richness	1	2	0	4	2	4
Chironomidae Richness	6	11	9	9	7	7
Oligochaeta Richness	2	2	1	0	1	1
Non-Chiro. Non-Olig. Richness	14	15	8	19	17	25
Abundance Measures						
Corrected Abundance	1639	344	10840	322	714	327
EPT Abundance	905	81	620	86	122	94
Dominance Measures						
1st Dominant Taxon	Capniidae	Hydrobaenus	Tvetenia	Eukiefferiella	Eukiefferiella	Eukiefferiella
1st Dominant Abundance	442	90	6180	101	168	78
2nd Dominant Taxon	Perlodidae	Limnephilidae	Perlodidae	Pagastia	Tvetenia	Neoplasta
2nd Dominant Abundance	332	44	1060	34	90	29
3rd Dominant Taxon	Tvetenia	Perlodidae	Pagastia	Tvetenia	Perlodidae	Pagastia
3rd Dominant Abundance	195	34	740	22	68	28
% 1 Dominant Taxon	26.97%	26.16%	57.01%	31.37%	23.53%	23.85%
% 2 Dominant Taxon	20.26%	12.79%	9.78%	10.56%	12.61%	8.87%
% 3 Dominant Taxon	11.90%	9.88%	6.83%	6.83%	9.52%	8.56%
Percent Dominance	59.13%	48.83%	73.62%	48.76%	45.66%	41.28%
Community Composition						
% Ephemeroptera	0.67%	0.00%	0.00%	0.00%	0.00%	0.31%
% Plecoptera	51.98%	10.47%	5.72%	24.53%	16.53%	24.46%
% Trichoptera	2.56%	13.08%	0.00%	2.17%	0.56%	3.98%
% EPT	55.22%	23.55%	5.72%	26.71%	17.09%	28.75%
% Diptera	34.41%	61.34%	77.31%	63.66%	59.66%	60.24%
% Oligochaeta	1.95%	2.62%	1.11%	0.00%	1.12%	0.61%
% Baetidae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Chironomidae	25.08%	45.93%	74.72%	57.76%	52.38%	45.57%
% Odonata	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

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scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC#:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
Functional Group Composition						
% Predators	6.41%	24.71%	0.59%	13.98%	9.10%	23.85%
% Shredder-Herbivores	5.74%	9.01%	0.27%	16.15%	7.42%	18.35%
% Collector-Gatherers	5.80%	62.50%	3.86%	29.19%	15.27%	26.61%
% Scrapers	0.00%	0.00%	0.00%	0.62%	0.00%	0.61%
% Macrophyte-Herbivore	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Collector-Filterer	0.00%	0.00%	0.00%	0.31%	0.14%	0.00%
% Omnivore	0.06%	0.00%	0.01%	31.68%	11.76%	24.16%
% Parasite	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Piercer-Herbivore	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Gatherer	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Unclassified	0.98%	3.78%	0.28%	8.07%	6.30%	6.42%
Functional Group Richness						
Predators Richness	9	11	8	9	10	16
Shredder-Herbivores Richness	5	3	3	5	4	5
Collector-Gatherers Richness	9	14	9	10	9	11
Scrapers Richness				2		1
MH Richness						
CF Richness				1	1	
OM Richness	1		1	2	1	2
PA Richness						
Piercer-Herbivore Richness						
Gatherer Richness						
Unclassified	2	2	2	2	3	2
Voltinism Composition						
% Univoltine	2.26%	4.65%	0.92%	5.59%	1.68%	3.06%
% Semivoltine	0.98%	0.00%	0.00%	0.00%	0.00%	0.61%
% Multivoltine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Voltinism Richness						
Univoltine	3	4	2	2	3	3
Semivoltine	1	0	0	0	0	1
Multivoltine	0	0	0	0	0	0

CORDILLERA CONSULTING
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Project: 22-16 (GC LAEMP) (Formerly GGCAMP)

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Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC#:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
Diversity/Evenness Measures						
Shannon-Weiner H' (log 10)	1.05	1.11	0.73	1.11	1.12	1.25
Shannon-Weiner H' (log 2)	3.49	3.69	2.43	3.7	3.71	4.15
Shannon-Weiner H' (log e)	2.42	2.56	1.68	2.56	2.57	2.88
Simpson's Index (D)	0.14	0.12	0.35	0.14	0.11	0.09
Simpson's Index of Diversity (1 - D)	0.86	0.88	0.65	0.86	0.89	0.91
Simpson's Reciprocal Index (1/D)	7.06	8.31	2.87	7.41	9.14	10.74
Biotic Indices						
Hilsenhoff Biotic Index	3.12	5.21	4.53	4.96	4.83	4.77

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scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC#:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
Richness Measures						
Species Richness	14	15	10	16	17	21
EPT Richness	1	0	0	0	0	1
Ephemeroptera Richness	1					1
Plecoptera Richness						
Trichoptera Richness						
Chironomidae Richness	1	1	1	1	1	1
Oligochaeta Richness	2	1	1		1	1
Non-Chiro. Non-Olig. Richness	11	13	8	15	15	19
Abundance Measures						
Corrected Abundance	1639	344	10840	322	714	327
EPT Abundance	995	119	1700	92	214	100
Dominance Measures						
1st Dominant Taxon	Capniidae	Chironomidae	Chironomidae	Chironomidae	Chironomidae	Chironomidae
1st Dominant Abundance	447	149	8680	206	436	169
2nd Dominant Taxon	Chironomidae	Limnephilidae	Perlodidae	Nemouridae	Perlodidae	Empididae
2nd Dominant Abundance	443	44	1140	28	78	30
3rd Dominant Taxon	Perlodidae	Perlodidae	Capniidae	Perlodidae	Taeniopterygidae	Nemouridae
3rd Dominant Abundance	332	39	500	26	46	27
% 1 Dominant Taxon	27.27%	43.31%	80.07%	63.98%	61.06%	51.68%
% 2 Dominant Taxon	27.03%	12.79%	10.52%	8.70%	10.92%	9.17%
% 3 Dominant Taxon	20.26%	11.34%	4.61%	8.07%	6.44%	8.26%
Percent Dominance	74.56%	67.44%	95.20%	80.75%	78.42%	69.11%
Community Composition						
% Ephemeroptera	0.67%	0.00%	0.00%	0.00%	0.00%	0.31%
% Plecoptera	57.47%	20.35%	15.68%	26.40%	29.41%	26.30%
% Trichoptera	2.56%	14.24%	0.00%	2.17%	0.56%	3.98%
% EPT	60.71%	34.59%	15.68%	28.57%	29.97%	30.58%
% Diptera	37.34%	61.34%	83.21%	70.19%	67.79%	66.67%
% Oligochaeta	1.95%	2.62%	1.11%	0.00%	1.12%	0.61%
% Baetidae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Chironomidae	27.03%	43.31%	80.07%	63.98%	61.06%	51.68%
% Odonata	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Functional Group Composition						
% Predators	32.46%	20.35%	11.62%	13.04%	17.37%	22.32%
% Shredder-Herbivores	30.81%	11.34%	5.17%	16.77%	15.41%	18.96%
% Collector-Gatherers	6.47%	23.84%	2.95%	3.42%	1.68%	5.50%
% Scrapers	0.00%	0.00%	0.00%	0.62%	0.00%	0.61%
% Macrophyte-Herbivore	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Collector-Filterer	0.00%	0.00%	0.00%	0.31%	0.28%	0.00%
% Omnivore	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Parasite	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

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FRESHWATER INVERTEBRATE TAXONOMY

Project: 22-16 (GC LAEMP) (Formerly GGCAMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC#:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
% Piercer-Herbivore	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Gatherer	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Unclassified	30.26%	44.48%	80.26%	65.84%	65.27%	52.60%
Functional Group Richness						
Predators Richness	4	6	3	4	5	7
Shredder-Herbivores Richness	3	3	3	4	4	4
Collector-Gatherers Richness	5	4	2	3	3	5
Scrapers Richness				2		1
MH Richness						
CF Richness				1	1	
OM Richness						
PA Richness						
Piercer-Herbivore Richness						
Gatherer Richness						
Unclassified	2	2	2	2	4	4
Voltinism Composition						
% Univoltine	7.69%	6.69%	0.92%	3.73%	5.32%	9.17%
% Semivoltine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Multivoltine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Voltinism Richness						
Univoltine	0	0	0	0	0	0
Semivoltine	0	0	0	0	0	0
Multivoltine	0	0	0	0	0	0
Diversity/Evenness Measures						
Shannon-Weiner H' (log 10)	1.05	1.11	0.73	1.11	1.12	1.25
Shannon-Weiner H' (log 2)	3.49	3.69	2.43	3.7	3.71	4.15
Shannon-Weiner H' (log e)	2.42	2.56	1.68	2.56	2.57	2.88
Simpson's Index (D)	0.14	0.12	0.35	0.14	0.11	0.09
Simpson's Index of Diversity (1 - D)	0.86	0.88	0.65	0.86	0.89	0.91
Simpson's Reciprocal Index (1/D)	7.06	8.31	2.87	7.41	9.14	10.74
Biotic Indices						
Hilsenhoff Biotic Index	3.12	5.21	4.53	4.96	4.83	4.77

CORDILLERA CONSULTING
FRESHWATER INVERTEBRATE TAXONOMY

Project: 22-16 (GC LAEMP) (Formerly GGCAMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022		2022		2022		2022	
Sample:	RG_GHNF_BIC-1_2022-09-09_N		RG_GHNF_BIC-3_2022-09-10_N		RG_GHNF_BIC-5_2022-09-10_N		RG_GHDT_BIC-1_2022-09-16_N		RG_GHDT_BIC-3_2022-09-16_N		RG_GHDT_BIC-5_2022-09-16_N	
Sample Collection Date:	9-Sep-22		10-Sep-22		10-Sep-22		16-Sep-22		16-Sep-22		16-Sep-22	
CC #:	CC231330		CC231331		CC231332		CC231333		CC231334		CC231335	
Sieve Size:	400		400		400		400		400		400	
SubSample %:	19		100		5		100		50		100	
Phylum: Arthropoda	0		0		0		0		0		0	
Subphylum: Hexapoda	0		0		0		0		0		0	
| Class: Insecta	0		0		0		0		0		0	
| Order: Ephemeroptera	0		0		0		0		0		0	
| Family: Ephemerellidae	2		0		0		0		0		1	
| Order: Plecoptera	10	ND	0		1	ND	6	ND	12	ND	1	ND
| Family: Capniidae	84		27		25		22		17		18	
Mesocapnia	1		2		0		0		0		0	
| Family: Chloroperlidae	9		0		0		1		1		6	
Sweltsa	3		0		0		0		0		2	
| Family: Nemouridae	7	ND	2		2		1		5		4	
Malenka	1		0		0		0		0		0	
Zapada	0		0		0		12		8		17	
Zapada cinctipes	1		0		0		15		0		6	
| Family: Perlodidae	63		34	ND	53	ND	21		34	ND	5	ND
Isoperla	0		4		1		0		1		1	
Kogotus	0		0		0		0		0		1	
Megarcys	0		1		3		5		4		10	
| Family: Taeniopterygidae	0		0		0		2		23		15	
| Order: Trichoptera	0		4	ND	0		0		0		0	
| Family: Hydropsychidae	0		0		0		0		1		0	
| Family: Limnephilidae	8		44		0		3		0		2	
Ecclisomyia	0		0		0		1		0		1	
| Family: Rhyacophilidae	0		0		0		0		0		0	
Rhyacophila	0		1		0		0		0		0	
Rhyacophila betteni group	0		0		0		0		1		0	
Rhyacophila brunnea/vemna group	0		0		0		0		0		5	
Rhyacophila narvae	0		0		0		1		0		5	
Rhyacophila vofixa group	0		0		0		2		0		0	
| Order: Diptera	0		0		0		0		2		0	
| Family: Chironomidae	6	ND	9		29	ND	20	ND	31	ND	20	ND
| Subfamily: Chironominae	0		0		0		0		0		0	
| Tribe: Tanytarsini	0		0		0		0		0		0	
Micropsectra	0		1		1		2		2		0	
| Subfamily: Diamesinae	0		0		0		0		0		0	
| Tribe: Diamesini	0		0		0		0		0		0	
Pagastia	12		5		37		34		29		28	
Pseudodiamesa	16		28		19		7		2		3	

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250-494-7553

Site:	2022		2022		2022		2022		2022		2022	
Sample:	RG_GHNF_BIC-1_2022-09-09_N		RG_GHNF_BIC-3_2022-09-10_N		RG_GHNF_BIC-5_2022-09-10_N		RG_GHDT_BIC-1_2022-09-16_N		RG_GHDT_BIC-3_2022-09-16_N		RG_GHDT_BIC-5_2022-09-16_N	
Sample Collection Date:	9-Sep-22		10-Sep-22		10-Sep-22		16-Sep-22		16-Sep-22		16-Sep-22	
CC #:	CC231330		CC231331		CC231332		CC231333		CC231334		CC231335	
Sieve Size:	400		400		400		400		400		400	
SubSample %:	19		100		5		100		50		100	
| Subfamily: Orthocladiinae	0		0		0		0		0		0	
Brillia	0		0		2		0		0		0	
Corynoneura	0		1		0		0		0		0	
Eukiefferiella	1		0		1		101		84		78	
Hydrobaenus	10		90		29		9		2		16	
Limnophyes	0		2		0		0		0		0	
Orthocladius complex	0		0		5		9		23		5	
Parametriocnemus	0		1		2		0		0		0	
Tvetenia	37		4		309		22		45		17	
| Subfamily: Prodiamesinae	0		0		0		0		0		0	
Monodiamesa	0		1		0		0		0		0	
| Subfamily: Tanypodinae	0		0		0		0		0		0	
Ablabesmyia	0		0		0		1		0		0	
Zavrelimyia	2		7		0		1		0		2	
| Family: Dixidae	0		0		0		0		0		0	
Dixa	0		0		0		0		0		1	
| Family: Empididae	3	ND	2		3	ND	1	ND	3		1	ND
Neoplasta	20		21		2		11		16		29	
Trichoclinocera	1		0		0		0		0		0	
| Family: Limoniidae	0		0		0		0		0		0	
Eloeophila	0		0		0		0		0		1	
| Family: Muscidae	0		0		0		0		0		0	
Limnophora	0		0		1		0		0		0	
| Family: Pelecorhynchidae	0		0		0		0		0		0	
Glutops	2		4		0		0		0		5	
| Family: Psychodidae	0		0		0		0		0		0	
Pericoma/Telmatoscopus	4		27		10		6		1		10	
| Family: Tipulidae	0		0		0		0		0		0	
Dicranota	2		8		1		2		2		2	
| Order: Collembola	0		2		0		1		1		2	
Subphylum: Chelicerata	0		0		0		0		0		0	
| Class: Arachnida	0		0		0		0		0		0	
| Order: Trombidiformes	0		0		0		0		0		0	
| Family: Lebertiidae	0		0		0		0		0		0	
Lebertia	0		2		0		0		0		2	
| Family: Sperchontidae	0		0		0		0		0		0	
Sperchon	0		0		0		0		1		0	
Phylum: Annelida	0		0		0		0		0		0	
Subphylum: Clitellata	0		0		0		0		0		0	
| Class: Oligochaeta	0		0		0		0		0		0	

CORDILLERA CONSULTING
FRESHWATER INVERTEBRATE TAXONOMY

Project: 22-16 (GC LAEMP) (Formerly GGCAMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC #:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
Sieve Size:	400	400	400	400	400	400
SubSample %:	19	100	5	100	50	100
| Order: Tubificida	0	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	4	0
Enchytraeus	4	0	0	0	0	2
| Family: Naididae	0	0	0	0	0	0
| Subfamily: Tubificinae with hair cha	0	2	0	0	0	0
| Subfamily: Tubificinae without hair	2	7	6	0	0	0
| Order: Oribatida	0	1	0	0	2	1
Phylum: Mollusca	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	1	0	0
| Class: Gastropoda	0	0	0	1	0	2
| Order: Hypsogastropoda	0	0	0	0	0	0
| Family: Hydrobiidae	0	0	0	1	0	0
Totals:	**311**	**344**	**542**	**322**	**357**	**327**

Taxa present but not included:

Phylum: Arthropoda	0	0	0	0	0	0
| Class: Copepoda	0	1	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0
| Class: Ostracoda	1	1	1	1	1	1
Phylum: Nemata	1	1	0	0	1	1
Phylum: Platyhelminthes	0	0	0	0	0	0
| Class: Turbellaria	1	1	1	1	1	1
Totals:	**3**	**4**	**2**	**2**	**3**	**3**

CORDILLERA CONSULTING
FRESHWATER INVERTEBRATE TAXONOMY

Project: 22-16 (GC LAEMP) (Formerly GGCAMP)

Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC #:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
Sieve Size:	400	400	400	400	400	400
SubSample %:	19	100	5	100	50	100
Phylum: Arthropoda	0	0	0	0	0	0
Subphylum: Hexapoda	0	0	0	0	0	0
| Class: Insecta	0	0	0	0	0	0
| Order: Ephemeroptera	0	0	0	0	0	0
| Family: Ephemerellidae	2	0	0	0	0	1
| Order: Plecoptera	10	0	1	6	12	1
| Family: Capniidae	84	27	25	22	17	18
Mesocapnia	1	2	0	0	0	0
| Family: Chloroperlidae	9	0	0	1	1	6
Sweltsa	3	0	0	0	0	2
| Family: Nemouridae	7	2	2	1	5	4
Malenka	1	0	0	0	0	0
Zapada	0	0	0	12	8	17
Zapada cinctipes	1	0	0	15	0	6
| Family: Perlodidae	63	34	53	21	34	5
Isoperla	0	4	1	0	1	1
Kogotus	0	0	0	0	0	1
Megarcys	0	1	3	5	4	10
| Family: Taeniopterygidae	0	0	0	2	23	15
| Order: Trichoptera	0	4	0	0	0	0
| Family: Hydropsychidae	0	0	0	0	1	0
| Family: Limnephilidae	8	44	0	3	0	2
Ecclisomyia	0	0	0	1	0	1
| Family: Rhyacophilidae	0	0	0	0	0	0
Rhyacophila	0	1	0	0	0	0
Rhyacophila betteni group	0	0	0	0	1	0
Rhyacophila brunnea/vemna group	0	0	0	0	0	5
Rhyacophila narvae	0	0	0	1	0	5
Rhyacophila vofixa group	0	0	0	2	0	0
| Order: Diptera	0	0	0	0	2	0
| Family: Chironomidae	6	9	29	20	31	20
| Subfamily: Chironominae	0	0	0	0	0	0
| Tribe: Tanytarsini	0	0	0	0	0	0
Micropsectra	0	1	1	2	2	0
| Subfamily: Diamesinae	0	0	0	0	0	0
| Tribe: Diamesini	0	0	0	0	0	0
Pagastia	12	5	37	34	29	28
Pseudodiamesa	16	28	19	7	2	3
| Subfamily: Orthocladiinae	0	0	0	0	0	0

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FRESHWATER INVERTEBRATE TAXONOMY

Project: 22-16 (GC LAEMP) (Formerly GGCAMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC #:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
Sieve Size:	400	400	400	400	400	400
SubSample %:	19	100	5	100	50	100
Brillia	0	0	2	0	0	0
Corynoneura	0	1	0	0	0	0
Eukiefferiella	1	0	1	101	84	78
Hydrobaenus	10	90	29	9	2	16
Limnophyes	0	2	0	0	0	0
Orthocladius complex	0	0	5	9	23	5
Parametriocnemus	0	1	2	0	0	0
Tvetenia	37	4	309	22	45	17
| Subfamily: Prodiamesinae	0	0	0	0	0	0
Monodiamesa	0	1	0	0	0	0
| Subfamily: Tanypodinae	0	0	0	0	0	0
Ablabesmyia	0	0	0	1	0	0
Zavrelimyia	2	7	0	1	0	2
| Family: Dixidae	0	0	0	0	0	0
Dixa	0	0	0	0	0	1
| Family: Empididae	3	2	3	1	3	1
Neoplasta	20	21	2	11	16	29
Trichoclinocera	1	0	0	0	0	0
| Family: Limoniidae	0	0	0	0	0	0
Eloeophila	0	0	0	0	0	1
| Family: Muscidae	0	0	0	0	0	0
Limnophora	0	0	1	0	0	0
| Family: Pelecorhynchidae	0	0	0	0	0	0
Glutops	2	4	0	0	0	5
| Family: Psychodidae	0	0	0	0	0	0
Pericoma/Telmatoscopus	4	27	10	6	1	10
| Family: Tipulidae	0	0	0	0	0	0
Dicranota	2	8	1	2	2	2
| Order: Collembola	0	2	0	1	1	2
Subphylum: Chelicerata	0	0	0	0	0	0
| Class: Arachnida	0	0	0	0	0	0
| Order: Trombidiformes	0	0	0	0	0	0
| Family: Lebertiidae	0	0	0	0	0	0
Lebertia	0	2	0	0	0	2
| Family: Sperchontidae	0	0	0	0	0	0
Sperchon	0	0	0	0	1	0
Phylum: Annelida	0	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0	0

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FRESHWATER INVERTEBRATE TAXONOMY

Project: 22-16 (GC LAEMP) (Formerly GGCAMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022	2022	2022	2022
Sample:	RG_GHNF_BIC-1_2022-09-09_N	RG_GHNF_BIC-3_2022-09-10_N	RG_GHNF_BIC-5_2022-09-10_N	RG_GHDT_BIC-1_2022-09-16_N	RG_GHDT_BIC-3_2022-09-16_N	RG_GHDT_BIC-5_2022-09-16_N
Sample Collection Date:	9-Sep-22	10-Sep-22	10-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
CC #:	CC231330	CC231331	CC231332	CC231333	CC231334	CC231335
Sieve Size:	400	400	400	400	400	400
SubSample %:	19	100	5	100	50	100
| Family: Enchytraeidae	0	0	0	0	4	0
Enchytraeus	4	0	0	0	0	2
| Family: Naididae	0	0	0	0	0	0
| Subfamily: Tubificinae with hair chaetae	0	2	0	0	0	0
| Subfamily: Tubificinae without hair chaetae	2	7	6	0	0	0
| Order: Oribatida	0	1	0	0	2	1
Phylum: Mollusca	0	0	0	0	0	0
| Class: Bivalvia	0	0	0	0	0	0
| Order: Veneroida	0	0	0	0	0	0
| Family: Pisidiidae	0	0	0	1	0	0
| Class: Gastropoda	0	0	0	1	0	2
| Order: Hypsogastropoda	0	0	0	0	0	0
| Family: Hydrobiidae	0	0	0	1	0	0
Totals:	**311**	**344**	**542**	**322**	**357**	**327**

Taxa present but not included:

Phylum: Arthropoda	0	0	0	0	0	0
| Class: Copepoda	0	1	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0	0
| Class: Ostracoda	1	1	1	1	1	1
Phylum: Nemata	1	1	0	0	1	1
Phylum: Platyhelminthes	0	0	0	0	0	0
| Class: Turbellaria	1	1	1	1	1	1
Totals:	**3**	**4**	**2**	**2**	**3**	**3**

CORDILLERA CONSULTING
FRESHWATER INVERTEBRATE TAXONOMY

Project: 22-16 (GC LAEMP) (Formerly GGCAMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site - 2022, Sample - RG_GHNF_BIC-1_2022-09-09_N, CC# - CC231330, Percent sa		
Perlodidae	Juvenile/Damaged	63
Capniidae	Juvenile/Damaged	84
Chloroperlidae	Juvenile/Damaged	9
Nemouridae	Juvenile/Damaged	7
Empididae	Juvenile/Damaged	3
Ephemerellidae	Juvenile/Damaged	2
Limnephilidae	Juvenile/Damaged	8
Chironomidae	Pupa	6
Zavrelimyia	Larvae	2
Sweltsa	Larvae	3
Mesocapnia	Larvae	1
Zapada cinctipes	Larvae	1
Malenka	Larvae	1
Neoplasta	Larvae	20
Trichoclinocera	Larvae	1
Pericoma/Telmatoscopus	Larvae	4
Dicranota	Larvae	2
Glutops	Larvae	2
Enchytraeus	None	4
Hydrobaenus	Larvae	10
Pseudodiamesa	Larvae	16
Tvetenia	Larvae	37
Pagastia	Larvae	12
Eukiefferiella	Larvae	1
Plecoptera	Juvenile/Damaged	10
Tubificinae without hair chaetae	None	2
Total:		**311**

Site - 2022, Sample - RG_GHNF_BIC-3_2022-09-10_N, CC# - CC231331, Percent sa		
Chironomidae	Pupa	9
Perlodidae	Juvenile/Damaged	34
Capniidae	Juvenile/Damaged	27
Nemouridae	Juvenile/Damaged	2
Limnephilidae	Juvenile/Damaged	44
Empididae	Pupa	2
Pseudodiamesa	Larvae	28
Hydrobaenus	Larvae	90
Pagastia	Larvae	5
Micropsectra	Larvae	1
Tvetenia	Larvae	4
Zavrelimyia	Larvae	7
Limnophyes	Larvae	2
Monodiamesa	Larvae	1
Parametriocnemus	Larvae	1
Corynoneura	Larvae	1
Isoperla	Larvae	4
Megarcys	Larvae	1
Mesocapnia	Larvae	2
Rhyacophila	Larvae	1

Neoplasta	Larvae	21
Pericoma/Telmatoscopus	Larvae	27
Glutops	Larvae	4
Dicranota	Larvae	8
Lebertia	Adult	2
Collembola	None	2
Trichoptera	Juvenile/Damaged	4
Oribatida	Adult	1
Tubificinae with hair chaetae	None	2
Tubificinae without hair chaetae	None	7
Total:		**344**

Site - 2022, Sample - RG_GHNF_BIC-5_2022-09-10_N, CC# - CC231332, Percent sa		
Chironomidae	Pupa	29
Perlodidae	Juvenile/Damaged	53
Capniidae	Juvenile/Damaged	25
Nemouridae	Juvenile/Damaged	2
Empididae	Juvenile/Damaged	2
Empididae	Pupa	1
Pseudodiamesa	Larvae	19
Pagastia	Larvae	37
Hydrobaenus	Larvae	29
Orthocladius complex	Larvae	5
Parametriocnemus	Larvae	2
Eukiefferiella	Larvae	1
Brillia	Larvae	2
Micropsectra	Larvae	1
Tvetenia	Larvae	309
Isoperla	Larvae	1
Megarcys	Larvae	3
Pericoma/Telmatoscopus	Larvae	10
Neoplasta	Larvae	2
Dicranota	Larvae	1
Limnophora	Larvae	1
Plecoptera	Juvenile/Damaged	1
Tubificinae without hair chaetae	None	6
Total:		**542**

Site - 2022, Sample - RG_GHDT_BIC-1_2022-09-16_N, CC# - CC231333, Percent sa		
Empididae	Pupa	1
Hydrobiidae	None	1
Limnephilidae	Juvenile/Damaged	3
Pisidiidae	Juvenile/Damaged	1
Chironomidae	Pupa	20
Perlodidae	Juvenile/Damaged	21
Capniidae	Juvenile/Damaged	22
Nemouridae	Juvenile/Damaged	1
Taeniopterygidae	Juvenile/Damaged	2
Chloroperlidae	Juvenile/Damaged	1
Orthocladius complex	Larvae	9
Ablabesmyia	Larvae	1
Dicranota	Larvae	2
Zavrelimyia	Larvae	1
Eukiefferiella	Larvae	101
Rhyacophila narvae	Larvae	1
Ecclisomyia	Larvae	1
Rhyacophila vofixa group	Larvae	2
Megarcys	Larvae	5
Zapada cinctipes	Larvae	15
Zapada	Larvae	12

Micropsectra	Larvae	2
Pseudodiamesa	Larvae	7
Pagastia	Larvae	34
Tvetenia	Larvae	22
Pericoma/Telmatoscopus	Larvae	6
Hydrobaenus	Larvae	9
Neoplasta	Larvae	11
Collembola	None	1
Plecoptera	Juvenile/Damaged	6
Gastropoda	Juvenile/Damaged	1
Total:		**322**

Site - 2022, Sample - RG_GHDT_BIC-3_2022-09-16_N, CC# - CC231334, Percent sa		
Chironomidae	Pupa	31
Enchytraeidae	None	4
Perlodidae	Juvenile/Damaged	34
Capniidae	Juvenile/Damaged	17
Chloroperlidae	Juvenile/Damaged	1
Taeniopterygidae	Juvenile/Damaged	23
Nemouridae	Juvenile/Damaged	5
Empididae	Pupa	3
Hydropsychidae	Juvenile/Damaged	1
Pagastia	Larvae	29
Tvetenia	Larvae	45
Orthocladius complex	Larvae	23
Hydrobaenus	Larvae	2
Pseudodiamesa	Larvae	2
Micropsectra	Larvae	2
Eukiefferiella	Larvae	84
Megarcys	Larvae	4
Isoperla	Larvae	1
Zapada	Larvae	8
Neoplasta	Larvae	16
Dicranota	Larvae	2
Pericoma/Telmatoscopus	Larvae	1
Rhyacophila betteni group	Larvae	1
Sperchon	Adult	1
Collembola	None	1
Plecoptera	Juvenile/Damaged	12
Diptera	Juvenile/Damaged	2
Oribatida	Adult	2
Total:		**357**

Site - 2022, Sample - RG_GHDT_BIC-5_2022-09-16_N, CC# - CC231335, Percent sa		
Chironomidae	Pupa	20
Perlodidae	Juvenile/Damaged	5
Capniidae	Juvenile/Damaged	18
Chloroperlidae	Juvenile/Damaged	6
Nemouridae	Juvenile/Damaged	4
Taeniopterygidae	Juvenile/Damaged	15
Empididae	Pupa	1
Ephemerellidae	Juvenile/Damaged	1
Limnephilidae	Juvenile/Damaged	2
Enchytraeus	None	2
Hydrobaenus	Larvae	16
Tvetenia	Larvae	17
Pagastia	Larvae	28
Orthocladius complex	Larvae	5
Pseudodiamesa	Larvae	3
Zavrelimyia	Larvae	2

Eukiefferiella	Larvae	78
Kogotus	Larvae	1
Isoperla	Larvae	1
Megarcys	Larvae	10
Sweltsa	Larvae	2
Zapada cinctipes	Larvae	6
Zapada	Larvae	17
Neoplasta	Larvae	29
Glutops	Larvae	5
Pericoma/Telmatoscopus	Larvae	10
Dixa	Larvae	1
Dicranota	Larvae	2
Eloeophila	Larvae	1
Rhyacophila narvae	Larvae	5
Rhyacophila brunnea/vemna group	Larvae	5
Ecclisomyia	Larvae	1
Lebertia	Adult	2
Collembola	None	2
Plecoptera	Juvenile/Damaged	1
Oribatida	Adult	1
Gastropoda	Juvenile/Damaged	2
Total:		**327**

CORDILLERA CONSULTING
FRESHWATER INVERTEBRATE TAXONOMY

Project: 22-16 (GC LAEMP) (Formerly GGCAMP)

Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Client	Project	Site	Sample	Date	CC#	400 micron fraction	
						% Sampled	# Invertebrates
Minnow Environmental (BC)	22-16 (GC I	2022	RG_GHNF_	9-Sep-22	CC231330	19%	311
Minnow Environmental (BC)	22-16 (GC I	2022	RG_GHNF_	10-Sep-22	CC231331	100%	344
Minnow Environmental (BC)	22-16 (GC I	2022	RG_GHNF_	10-Sep-22	CC231332	5%	542
Minnow Environmental (BC)	22-16 (GC I	2022	RG_GHDT_	16-Sep-22	CC231333	100%	322
Minnow Environmental (BC)	22-16 (GC I	2022	RG_GHDT_	16-Sep-22	CC231334	50%	357
Minnow Environmental (BC)	22-16 (GC I	2022	RG_GHDT_	16-Sep-22	CC231335	100%	327

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	Functional Feeding Groups	Abbreviation	ITIS Number	Tolerance	Voltinism	Habit
Phylum: Arthropoda	Unclassified		82696			
Subphylum: Hexapoda	Unclassified		563886			
| Class: Insecta	Unclassified		118831			
| Order: Ephemeroptera						
| Family: Ephemerellidae	Collector-Gatherer	CG	101232	1	Unclassified	
| Order: Plecoptera						
| Family: Capniidae	Shredder-Herbivore	SH	102643	1	Unclassified	
Mesocapnia	Shredder-Herbivore	SH	102771	1	UV	0
| Family: Chloroperlidae	Predator	P	103202	1	Unclassified	
Sweltsa	Predator	P	103273	1	SV	
| Family: Nemouridae	Shredder-Herbivore	SH	102517	2	Unclassified	
Malenka	Shredder-Herbivore	SH	102567	2	Unclassified	
Zapada	Shredder-Herbivore	SH	102591	2	Unclassified	
Zapada cinctipes	Shredder-Herbivore	SH	102594	2	UV	
| Family: Perlodidae	Predator	P	102994	2	Unclassified	
Isoperla	Predator	P	102995	2	UV	
Kogotus	Predator	P	103149	2	Unclassified	
Megarcys	Predator	P	103110	2	Unclassified	
| Family: Taeniopterygidae	Shredder-Herbivore	SH	102788	2	Unclassified	
| Order: Trichoptera						
| Family: Hydropsychidae	Collector-Filterer	CF	115398	4	Unclassified	
| Family: Limnephilidae	Collector-Gatherer	CG	115933	4	Unclassified	
Ecclisomyia	Omnivore	OM	116025	2	Unclassified	
| Family: Rhyacophilidae	Predator	P	115096	0	Unclassified	
Rhyacophila	Predator	P	115097	0	Unclassified	
Rhyacophila betteni group	Predator	P	115097C	1	Unclassified	
Rhyacophila brunnea/vemna group	Predator	P	115097D	1		
Rhyacophila narvae	Predator	P	115155	0		
Rhyacophila vofixa group	Predator	P	115097S	0	Unclassified	
| Order: Diptera						
| Family: Chironomidae	Unclassified		127917	6		
| Subfamily: Chironominae	Collector-Gatherer	CG	129228	6		
| Tribe: Tanytarsini	Collector-Gatherer	CG	129872	6		
Micropsectra	Collector-Gatherer	CG	129890	7		
| Subfamily: Diamesinae	Collector-Gatherer	CG	128341	2		
| Tribe: Diamesini	Collector-Gatherer	CG	128351	4		
Pagastia	Collector-Gatherer	CG	128401	1		
Pseudodiamesa	Collector-Gatherer	CG	128416	6		
| Subfamily: Orthocladiinae	Collector-Gatherer	CG	128457	5		
Brillia	Shredder-Herbivore	SH	128477	5		
Corynoneura	Collector-Gatherer	CG	128563	7		
Eukiefferiella	Omnivore	OM	128689	8		
Hydrobaenus	Collector-Gatherer	CG	128750	8		
Limnophyes	Collector-Gatherer	CG	128776	8		
Orthocladius complex	Collector-Gatherer	CG	128874A	6		

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250-494-7553

	Functional Feeding Groups	Abbreviation	ITIS Number	Tolerance	Voltinism	Habit
Parametriocnemus	Collector-Gatherer	CG	128978	5		
Tvetenia	Collector-Gatherer	CG	129197	5		
| Subfamily: Prodiamesinae	Collector-Gatherer	CG	128437	6		
Monodiamesa	Collector-Gatherer	CG	128440	7		
| Subfamily: Tanypodinae	Predator	P	127994	7		
Ablabesmyia	Collector-Gatherer	CG	128079	8		
Zavrelimyia	Predator	P	128259	8		
| Family: Dixidae	Unclassified		125809	2		
Dixa	Collector-Gatherer	CG	125810	2		
| Family: Empididae	Predator	P	135830	6	UV	
Neoplasta	Predator	P	136352	6		
Trichoclinocera	Predator	P	135903	6		
| Family: Limoniidae	Unclassified		118833A			0
Eloeophila	Predator	P	118833B	4		
| Family: Muscidae	Predator	P	150025	6		
Limnophora	Predator	P	150730	6		
| Family: Pelecorhynchidae	Predator	P	130914	3		
Glutops	Predator	P	130915	3		
| Family: Psychodidae	Collector-Gatherer	CG	125351	10		
Pericoma/Telmatoscopus	Collector-Gatherer	CG	125351A	4		
| Family: Tipulidae	Shredder-Herbivore	SH	118840	3		
Dicranota	Predator	P	121027	3	UV	
| Order: Collembola						
Subphylum: Chelicerata	Unclassified		82697			
| Class: Arachnida	Predator	P	733326	5		
| Order: Trombidiformes						
| Family: Lebertiidae	Predator	P	83033	5	Unclassified	
Lebertia	Predator	P	83034	8	Unclassified	
| Family: Sperchontidae	Unclassified		895710	5	Unclassified	
Sperchon	Predator	P	83006	8	Unclassified	
Phylum: Annelida	Unclassified		64357			
Subphylum: Clitellata	Unclassified		568832			
| Class: Oligochaeta	Unclassified		68498			
| Order: Tubificida						
| Family: Enchytraeidae	Collector-Gatherer	CG	68510	10		
Enchytraeus	Collector-Gatherer	CG	68531	10		
| Family: Naididae	Collector-Gatherer	CG	68854	10		
| Subfamily: Tubificinae with hair chaetae	Collector-Gatherer	CG	974289	10		
| Subfamily: Tubificinae without hair chaetae	Collector-Gatherer	CG	974289	10		
| Order: Oribatida						
Phylum: Mollusca	Unclassified		69458			
| Class: Bivalvia	Unclassified		80384			
| Order: Veneroida						

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	Functional Feeding Groups	Abbreviation	ITIS Number	Tolerance	Voltinism	Habit
| Family: Pisidiidae	Collector-Filterer	CF	81388	8		
| Class: Gastropoda	Unclassified		566851			
| Order: Hypsogastropoda						
| Family: Hydrobiidae	Scraper	SC	70493	7		
Taxa present but not included:						
Phylum: Arthropoda	Unclassified		82696			
| Class: Copepoda	Collector-Gatherer	CG	85257	8		0
Subphylum: Crustacea	Collector-Gatherer	CG	83677	8		
| Class: Ostracoda	Collector-Gatherer	CG	84195	8		0
Phylum: Nemata	Shredder-Herbivore	SH	563956			
Phylum: Platyhelminthes	Unclassified		53963	7		
| Class: Turbellaria	Predator	P	53964	4		

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Phylum	Sub Phylum	Class	Order	Family	Subfamily	Tribe
Arthropoda	Hexapoda	Insecta	Ephemeroptera	Ephemerellidae		
Arthropoda	Hexapoda	Insecta	Plecoptera			
Arthropoda	Hexapoda	Insecta	Plecoptera	Capniidae		
Arthropoda	Hexapoda	Insecta	Plecoptera	Capniidae		
Arthropoda	Hexapoda	Insecta	Plecoptera	Chloroperlidae		
Arthropoda	Hexapoda	Insecta	Plecoptera	Chloroperlidae		
Arthropoda	Hexapoda	Insecta	Plecoptera	Nemouridae		
Arthropoda	Hexapoda	Insecta	Plecoptera	Nemouridae		
Arthropoda	Hexapoda	Insecta	Plecoptera	Nemouridae		
Arthropoda	Hexapoda	Insecta	Plecoptera	Nemouridae		
Arthropoda	Hexapoda	Insecta	Plecoptera	Perlodidae		
Arthropoda	Hexapoda	Insecta	Plecoptera	Perlodidae		
Arthropoda	Hexapoda	Insecta	Plecoptera	Perlodidae		
Arthropoda	Hexapoda	Insecta	Plecoptera	Perlodidae		
Arthropoda	Hexapoda	Insecta	Plecoptera	Taeniopterygidae		
Arthropoda	Hexapoda	Insecta	Trichoptera			
Arthropoda	Hexapoda	Insecta	Trichoptera	Hydropsychidae		
Arthropoda	Hexapoda	Insecta	Trichoptera	Limnephilidae		
Arthropoda	Hexapoda	Insecta	Trichoptera	Limnephilidae		
Arthropoda	Hexapoda	Insecta	Trichoptera	Rhyacophilidae		
Arthropoda	Hexapoda	Insecta	Trichoptera	Rhyacophilidae		
Arthropoda	Hexapoda	Insecta	Trichoptera	Rhyacophilidae		
Arthropoda	Hexapoda	Insecta	Trichoptera	Rhyacophilidae		
Arthropoda	Hexapoda	Insecta	Trichoptera	Rhyacophilidae		
Arthropoda	Hexapoda	Insecta	Diptera			
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae		
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesini
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesini
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae	
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae	
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae	
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae	
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae	
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae	
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae	
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae	
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Prodiamesinae	
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Tanypodinae	
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Tanypodinae	
Arthropoda	Hexapoda	Insecta	Diptera	Dixidae		
Arthropoda	Hexapoda	Insecta	Diptera	Empididae		
Arthropoda	Hexapoda	Insecta	Diptera	Empididae		
Arthropoda	Hexapoda	Insecta	Diptera	Empididae		
Arthropoda	Hexapoda	Insecta	Diptera	Limoniidae		
Arthropoda	Hexapoda	Insecta	Diptera	Muscidae		
Arthropoda	Hexapoda	Insecta	Diptera	Pelecorhynchidae		
Arthropoda	Hexapoda	Insecta	Diptera	Psychodidae		
Arthropoda	Hexapoda	Insecta	Diptera	Tipulidae		
Arthropoda			Collembola			
Arthropoda		Copepoda				
Arthropoda	Chelicerata	Arachnida	Trombidiformes	Lebertiidae		
Arthropoda	Chelicerata	Arachnida	Trombidiformes	Sperchontidae		

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Arthropoda	Crustacea	Ostracoda			
Annelida	Clitellata	Oligochaeta	Tubificida	Enchytraeidae	
Annelida	Clitellata	Oligochaeta	Tubificida	Enchytraeidae	
Annelida	Clitellata	Oligochaeta	Tubificida	Naididae	Tubificinae with hair chaetae
Annelida	Clitellata	Oligochaeta	Tubificida	Naididae	Tubificinae without hair chaetae
	Chelicerata	Arachnida	Oribatida		
Mollusca		Bivalvia	Veneroida	Pisidiidae	
Mollusca		Gastropoda			
Mollusca		Gastropoda	Hypsogastropoda	Hydrobiidae	
Nemata					
Platyhelminthes		Turbellaria			

ND designation of a taxa represents a non-distinct taxa. This adjusts where the associated taxa fall in the metrics for this sample because the individuals are likely

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Phylum	Voltinism	Functional Feeding Group	Maturity	Name
Arthropoda	Unclassified	Collector-Gatherer	Juvenile/Damaged	Ephemerellidae
Arthropoda	Unclassified		Juvenile/Damaged	Plecoptera
Arthropoda	Unclassified	Shredder-Herbivore	Juvenile/Damaged	Capniidae
Arthropoda	UV	Shredder-Herbivore	Larvae	Mesocapnia
Arthropoda	Unclassified	Predator	Juvenile/Damaged	Chloroperlidae
Arthropoda	SV	Predator	Larvae	Sweltsa
Arthropoda	Unclassified	Shredder-Herbivore	Juvenile/Damaged	Nemouridae
Arthropoda	Unclassified	Shredder-Herbivore	Larvae	Malenka
Arthropoda	Unclassified	Shredder-Herbivore	Larvae	Zapada
Arthropoda	UV	Shredder-Herbivore	Larvae	Zapada cinctipes
Arthropoda	Unclassified	Predator	Juvenile/Damaged	Perlodidae
Arthropoda	UV	Predator	Larvae	Isoperla
Arthropoda	Unclassified	Predator	Larvae	Kogotus
Arthropoda	Unclassified	Predator	Larvae	Megarcys
Arthropoda	Unclassified	Shredder-Herbivore	Juvenile/Damaged	Taeniopterygidae
Arthropoda			Juvenile/Damaged	Trichoptera
Arthropoda	Unclassified	Collector-Filterer	Juvenile/Damaged	Hydropsychidae
Arthropoda	Unclassified	Collector-Gatherer	Juvenile/Damaged	Limnephilidae
Arthropoda	Unclassified	Omnivore	Larvae	Ecclisomyia
Arthropoda	Unclassified	Predator	Larvae	Rhyacophila
Arthropoda	Unclassified	Predator	Larvae	Rhyacophila betteni group
Arthropoda		Predator	Larvae	Rhyacophila brunnea/vemna group
Arthropoda		Predator	Larvae	Rhyacophila narvae
Arthropoda	Unclassified	Predator	Larvae	Rhyacophila vofixa group
Arthropoda			Juvenile/Damaged	Diptera
Arthropoda			Pupa	Chironomidae
Arthropoda		Collector-Gatherer	Larvae	Micropsectra
Arthropoda		Collector-Gatherer	Larvae	Pagastia
Arthropoda		Collector-Gatherer	Larvae	Pseudodiamesa
Arthropoda		Shredder-Herbivore	Larvae	Brillia
Arthropoda		Collector-Gatherer	Larvae	Corynoneura
Arthropoda		Omnivore	Larvae	Eukiefferiella
Arthropoda		Collector-Gatherer	Larvae	Hydrobaenus
Arthropoda		Collector-Gatherer	Larvae	Limnophyes
Arthropoda		Collector-Gatherer	Larvae	Orthocladius complex
Arthropoda		Collector-Gatherer	Larvae	Parametriocnemus
Arthropoda		Collector-Gatherer	Larvae	Tvetenia
Arthropoda		Collector-Gatherer	Larvae	Monodiamesa
Arthropoda		Collector-Gatherer	Larvae	Ablabesmyia
Arthropoda		Predator	Larvae	Zavrelimyia
Arthropoda		Collector-Gatherer	Larvae	Dixa
Arthropoda	UV	Predator	Pupa	Empididae
Arthropoda		Predator	Larvae	Neoplasta
Arthropoda		Predator	Larvae	Trichoclinocera
Arthropoda		Predator	Larvae	Eloeophila
Arthropoda		Predator	Larvae	Limnophora
Arthropoda		Predator	Larvae	Glutops
Arthropoda		Collector-Gatherer	Larvae	Pericoma/Telmatoscopus
Arthropoda	UV	Predator	Larvae	Dicranota
Arthropoda		Collector-Gatherer	None	Collembola
Arthropoda		Collector-Gatherer	None	Copepoda
Arthropoda	Unclassified	Predator	Adult	Lebertia
Arthropoda	Unclassified	Predator	Adult	Sperchon

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Arthropoda	Collector-Gatherer	None	Ostracoda
Annelida	Collector-Gatherer	None	Enchytraeidae
Annelida	Collector-Gatherer	None	Enchytraeus
Annelida	Collector-Gatherer	None	Tubificinae with hair chaetae
Annelida	Collector-Gatherer	None	Tubificinae without hair chaetae
	Predator	Adult	Oribatida
Mollusca	Collector-Filterer	Juvenile/Damaged	Pisidiidae
Mollusca	Scraper	Juvenile/Damaged	Gastropoda
Mollusca	Scraper	None	Hydrobiidae
Nemata	Shredder-Herbivore	None	Nemata
Platyhelminthes	Predator	None	Turbellaria

ND designation of a taxa repres represented by Genus or Species level identifications.

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Phylum	ND	Site	Sample	Date	CC#	Count	Percent Sa
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	1	100
Arthropoda	ND	2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	1	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	27	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	2	100
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	6	100
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	2	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	2	100
Arthropoda		2022	RG_GHNF_BIC-1_2022-09-09_N	9-Sep-22	CC231330	1	19
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	17	100
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	6	100
Arthropoda	ND	2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	34	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	4	100
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	1	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	1	100
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	15	100
Arthropoda	ND	2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	4	100
Arthropoda		2022	RG_GHDT_BIC-3_2022-09-16_N	16-Sep-22	CC231334	1	50
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	44	100
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	1	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	1	100
Arthropoda		2022	RG_GHDT_BIC-3_2022-09-16_N	16-Sep-22	CC231334	1	50
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	5	100
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	5	100
Arthropoda		2022	RG_GHDT_BIC-1_2022-09-16_N	16-Sep-22	CC231333	2	100
Arthropoda		2022	RG_GHDT_BIC-3_2022-09-16_N	16-Sep-22	CC231334	2	50
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	9	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	1	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	5	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	28	100
Arthropoda		2022	RG_GHNF_BIC-5_2022-09-10_N	10-Sep-22	CC231332	2	5
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	1	100
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	78	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	90	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	2	100
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	5	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	1	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	4	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	1	100
Arthropoda		2022	RG_GHDT_BIC-1_2022-09-16_N	16-Sep-22	CC231333	1	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	7	100
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	1	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	2	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	21	100
Arthropoda		2022	RG_GHNF_BIC-1_2022-09-09_N	9-Sep-22	CC231330	1	19
Arthropoda		2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	1	100
Arthropoda		2022	RG_GHNF_BIC-5_2022-09-10_N	10-Sep-22	CC231332	1	5
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	4	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	27	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	8	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	2	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	1	100
Arthropoda		2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	2	100
Arthropoda		2022	RG_GHDT_BIC-3_2022-09-16_N	16-Sep-22	CC231334	1	50

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Arthropoda	2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	1	100
Annelida	2022	RG_GHDT_BIC-3_2022-09-16_N	16-Sep-22	CC231334	4	50
Annelida	2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	2	100
Annelida	2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	2	100
Annelida	2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	7	100
	2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	1	100
Mollusca	2022	RG_GHDT_BIC-1_2022-09-16_N	16-Sep-22	CC231333	1	100
Mollusca	2022	RG_GHDT_BIC-5_2022-09-16_N	16-Sep-22	CC231335	2	100
Mollusca	2022	RG_GHDT_BIC-1_2022-09-16_N	16-Sep-22	CC231333	1	100
Nemata	2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	1	100
Platyhelminthes	2022	RG_GHNF_BIC-3_2022-09-10_N	10-Sep-22	CC231331	1	100

ND designation of a taxa repres

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Phylum	Seive Size
Arthropoda	400
Arthropoda	400
Arthropoda	400
Arthropoda	400
Arthropoda	400
Arthropoda	400
Arthropoda	400
Arthropoda	400
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Arthropoda	400

CORDILLERA CONSULTIN
FRESHWATER INVERTEBRATE TAXONOM
Project: 22-16 (GC LAEMP) (For
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsu
250-494-7553

Arthropoda	400
Annelida	400
Annelida	400
Annelida	400
Annelida	400
	400
Mollusca	400
Mollusca	400
Mollusca	400
Nemata	400
Platyhelminthes	400

ND designation of a taxa repres

CORDILLERA CONSULTING
FRESHWATER INVERTEBRATE TAXONOMY

Project: 22-16 (GC LAEMP) (Formerly GGCAMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

		Total from	Percent Efficiency
Site - QC, Sample - QC 1, CC# - CC231333, Percent sampled = 100%, Sieve size = 400			
Chironomidae	4		
Plecoptera	2		
Empididae	1		
Ephemerellidae	1		
Diptera	1		
Total:	**9**	322	97.20%

ZEAS - BENTHIC INVERTEBRATE COMMUNITY

TABLE 1: CALCULATION OF SUBSAMPLING ERROR FOR BENTHIC MACROINVERTEBRATE SAMPLES FROM LOWER GREENHILLS (2022).

Station	Whole Organisms	Number of Organisms in Fraction 1	Number of Organisms in Fraction 2	Number of Organisms in Fraction 3	Number of Organisms in Fraction 4	Actual Density*	Precision % range		Accuracy	
									min	max
GHBP-6	-	196	200	-	-	396	2.0	-	1.0	-
GHFF-1	-	144	164	-	-	308	12.2	-	6.5	-
GHUT-6		141	179	-	-	-	21.2	-	-	-

* whole large organisms excluded in calculations.
min = minimum absolute % error
max = maximum absolute % error

TABLE 2: PERCENT RECOVERY OF BENTHIC MACROINVERTEBRATES FROM SAMPLES COLLECTED FROM LOWER GRENNHILLS (2022).

Station	Number of Organisms Recovered (initial sort)	Number of Organisms in Re-sort	Percent Recovery
GANF-6	183	190	96.3%
GHBP-6	378	396	95.5%
GHDT-1	81	84	96.4%
GHDT-5	135	145	93.1%
GHNF-5	215	230	93.5%
		Average % Recovery	95.0%

TABLE 3: SAMPLE FRACTIONS SORTED FROM LOWER GREENHILLS (2022).

Station	Fraction Sorted	Station	Fraction Sorted	Station	Fraction Sorted
GANF-1	1/2	GHBP-3	1/4	GHDT-5	1/2
GANF-2	1/2	GHBP-4	1/4	GHDT-6	Whole
GANF-3	1/2	GHBP-5	1/2	GHFF-1	Whole[a]
GANF-4	1/2	GHBP-6	Whole[a]	GHFF-2	Whole
GANF-5	1/2	GHNF-1	1/8	GHFF-3	Whole
GANF-6	Whole	GHNF-2	1/4	GHFF-4	Whole
GAUT-1	1/2	GHNF-3	Whole	GHFF-5	Whole
GAUT-2	1/2	GHNF-4	1/16	GHFF-6	1/4
GAUT-3	1/2	GHNF-5	1/16	GHUT-1	1/4, 1/16[c]
GAUT-4	1/2	GHNF-6	1/16	GHUT-2	1/4
GAUT-5	Whole	GHDT-1	1/4	GHUT-3	Whole
GAUT-6	1/2	GHDT-2	1/2	GHUT-4	1/2
GHBP-1	1/2	GHDT-3	Whole	GHUT-5	1/4
GHBP-2	1/2	GHDT-4	Whole	GHUT-6	1/8[b]

[a] two halves sorted for subsampling error calculations.
[b] two sixteenths sorted for subsampling error calculations.
[c] algae portion of sample sorted to 1/16, remaining sample sorted to 1/4

QA/QC Notes

Pupae should not be counted toward total number of taxa unless they were the sole representative of their taxa group. Immatures should not be counted toward total number of taxa unless they were the sole representative of their taxa group. The exceptions to this rule are immature tubificidae with and without hairs. Immature oligocheates are counted as taxa as the probability of the immature being a unique taxa is high.

Indeterminates are unique taxa that could not be identified further for whatever reason, e.g., (small, damaged).

Reported fractions averaged 4 hours to sort due to high quantities of organic matter.
ZEAS has shown that subsampling precision and accuracy are density dependent (Zaranko and Keene 2005). Specifically, small absolute differences between subsampled fractions become increasingly large, when expressed as a percentage of total organisms, as organism densities decline. Therefore, the probability of meeting precision and accuracy criteria is reduced in samples with low organism densities (i.e., <150 organisms/subsample).

Zaranko, D.T. and J. Keene. 2005. Are the costs to meet environmental effects monitoring (EEM) benthic sample precision and accuracy criteria justified? In Dixon, D.G., S. Munro and A.J. Niimi (eds). Proceedings of the 32nd Annual Aquatic Toxicity Workshop: October 3 to 5, 2005, Waterloo, Ontario. Can. Tech. Rep. Fish. Aquat. Sci: 2617. 120p.

TABLE 1: CALCULATION OF SUBSAMPLING ERROR FOR BENTHIC MACROINVERTEBRATE SAMPLES FROM GREEN HILLS POND (2022).

Station	Whole Organisms	Number of Organisms in Fraction 1	Number of Organisms in Fraction 2	Number of Organisms in Fraction 3	Number of Organisms in Fraction 4	Actual Density*	Precision % range		Accuracy min	Accuracy max
GHP-06	-	262	276	289	337	1164	4.5	22.3	0.7	15.8
GHP-06	-	538	626			1164	14.1	-	7.6	-

* whole large organisms excluded in calculations.
min = minimum absolute % error
max = maximum absolute % error

TABLE 2: PERCENT RECOVERY OF BENTHIC MACROINVERTEBRATES FROM SAMPLES COLLECTED FROM GREEN HILLS POND (2022).

Station	Number of Organisms Recovered (initial sort)	Number of Organisms in Re-sort	Percent Recovery
GHP-06	1158	1164	99.5%

TABLE 3: SAMPLE FRACTIONS SORTED FROM GREEN HILLS POND (2022).

Station	Fraction Sorted	Station	Fraction Sorted
GHP-01	1/4	GHP-04	1/4
GHP-02	1/8	GHP-05	Whole
GHP-03	1/2	GHP-06	Whole[ab]

[a] four quarters sorted for subsampling error calculations.
[b] two halves sorted for subsampling error calculations.

QA/QC Notes

Indeterminates are unique taxa that could not be identified further for whatever reason, e.g., (small, damaged).

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Planariidae	50	400	1	0.0012	
9/13/2022	1	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Polycelis	50	400	1		
9/13/2022	1	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Enchytraeidae	50	400	1	0.0005	
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Sperchonidae	50	400	1	0.0013	
9/13/2022	1	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Sperchon	50	400	1		
9/13/2022	25	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0066	
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Elmidae	50	400	1	0.0001	
9/13/2022	1	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Elmidae	50	400	1		immature
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Baetidae	50	400	1	0.0037	
9/13/2022	2	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Baetis	50	400	1		
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0394	
9/13/2022	53	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Peltoperlidae	50	400	1	0.0011	
9/13/2022	1	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Yoraperla	50	400	1		
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.0266	
9/13/2022	14	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Isoperla	50	400	1		
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0495	
9/13/2022	2	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Taeniopterygidae	50	400	1	0.0008	
9/13/2022	2	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Taeniopterygidae	50	400	1		immature
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Brachycentridae	50	400	1	0.0013	
9/13/2022	5	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Micrasema	50	400	1		
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Hydropsychidae	50	400	1	0.0014	
9/13/2022	1	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Hydropsychidae	50	400	1		immature
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0080	
9/13/2022	1	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.0326	
9/13/2022	15	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Ceratopogonidae	50	400	1	0.0011	
9/13/2022	1	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Atrichopogon	50	400	1		
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0606	
9/13/2022	14	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1		pupae
9/13/2022	4	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Micropsectra	50	400	1		
9/13/2022	37	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Pagastia	50	400	1		
9/13/2022	1	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Chaetocladius	50	400	1		
9/13/2022	9	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	50	400	1		
9/13/2022	59	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Eukiefferiella	50	400	1		
9/13/2022	5	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Tvetenia	50	400	1		
9/13/2022	1	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Zavrelimyia	50	400	1		
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Empididae	50	400	1	0.0057	
9/13/2022	8	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Chelifera/Metachela	50	400	1		
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Pelecorhyncidae	50	400	1	0.0132	
9/13/2022	7	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Glutops	50	400	1		
9/13/2022		RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Psychodidae	50	400	1	0.0010	
9/13/2022	1	RG_GANF_BICA-1-2022-09-13_N	RG_GANF_BICA-1-2022-09-13_N	1/3 m^2 kick & sweep	Pericoma	50	400	1		
9/13/2022		RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Planariidae	50	400	1	0.0006	
9/13/2022	2	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Polycelis	50	400	1		
9/13/2022	3	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Enchytraeidae	50	400	1	0.0004	

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/13/2022	14	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0032	
9/13/2022	1	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Collembola	50	400	1	0.0001	
9/13/2022		RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1	0.0004	
9/13/2022	2	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1		immature
9/13/2022		RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0036	
9/13/2022	12	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/13/2022		RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.0851	
9/13/2022	16	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Isoperla	50	400	1		
9/13/2022	3	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Megarcys	50	400	1		
9/13/2022		RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.0209	
9/13/2022	7	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		
9/13/2022		RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0093	
9/13/2022	14	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1		pupae
9/13/2022	15	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Pagastia	50	400	1		
9/13/2022	7	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	50	400	1		
9/13/2022	2	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Eukiefferiella	50	400	1		
9/13/2022	1	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Orthocladiinae	50	400	1		indeterminate
9/13/2022	1	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Zavrelimyia	50	400	1		
9/13/2022		RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Empididae	50	400	1	0.0223	
9/13/2022	29	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Chelifera/Metachela	50	400	1		
9/13/2022		RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Pelecorhyncidae	50	400	1	0.0002	
9/13/2022	1	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Glutops	50	400	1		
9/13/2022		RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Psychodidae	50	400	1	0.0005	
9/13/2022	2	RG_GANF_BICA-2-2022-09-13_N	RG_GANF_BICA-2-2022-09-13_N	1/3 m^2 kick & sweep	Pericoma	50	400	1		
9/13/2022	1	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Enchytraeidae	50	400	1	0.0001	
9/13/2022		RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Lumbricidae	100	400	1	0.1199	
9/13/2022	1	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Eiseniella tetraedra	100	400	1		
9/13/2022		RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Naididae	50	400	1	0.0004	
9/13/2022	1	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Tubificinae	50	400	1		immature with hai
9/13/2022	36	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0074	
9/13/2022		RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Capniidae	50	400	1	0.0004	
9/13/2022	3	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Capniidae	50	400	1		immature
9/13/2022		RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0052	
9/13/2022	5	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/13/2022	25	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1		immature
9/13/2022		RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.0215	
9/13/2022	24	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Isoperla	50	400	1		
9/13/2022		RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0332	
9/13/2022	1	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/13/2022		RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0252	
9/13/2022	1	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		
9/13/2022	1	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1		pupae
9/13/2022		RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.0280	
9/13/2022	2	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		
9/13/2022		RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0067	
9/13/2022	3	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1		pupae
9/13/2022	3	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Micropsectra	50	400	1		
9/13/2022	13	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Pagastia	50	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/13/2022	3	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	50	400	1		
9/13/2022	1	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Eukiefferiella	50	400	1		
9/13/2022	1	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Hydrobaenus	50	400	1		
9/13/2022	1	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Tvetenia	50	400	1		
9/13/2022		RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Empididae	50	400	1	0.0187	
9/13/2022	24	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Chelifera/Metachela	50	400	1		
9/13/2022		RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Pelecorhyncidae	50	400	1	0.0037	
9/13/2022	1	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Glutops	50	400	1		
9/13/2022		RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Psychodidae	50	400	1	0.0007	
9/13/2022	5	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Pericoma	50	400	1		
9/13/2022		RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Pediciidae	50	400	1	0.0002	
9/13/2022	1	RG_GANF_BICA-3-2022-09-13_N	RG_GANF_BICA-3-2022-09-13_N	1/3 m^2 kick & sweep	Dicranota	50	400	1		
9/13/2022	1	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Nematoda	50	400	1	0.0001	
9/13/2022	4	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Enchytraeidae	50	400	1	0.0006	
9/13/2022	1	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Lumbricidae	50	400	1	0.0075	
9/13/2022	8	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0017	
9/13/2022		RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Capniidae	50	400	1	0.0003	
9/13/2022	2	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Paracapnia	50	400	1		
9/13/2022		RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0046	
9/13/2022	13	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/13/2022		RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.0133	
9/13/2022	14	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Isoperla	50	400	1		
9/13/2022		RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Taeniopterygidae	50	400	1	0.0004	
9/13/2022	5	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Taeniopterygidae	50	400	1		immature
9/13/2022		RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.0062	
9/13/2022	2	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		
9/13/2022		RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0053	
9/13/2022	5	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1		pupae
9/13/2022	13	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Pagastia	50	400	1		
9/13/2022	2	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	50	400	1		
9/13/2022	1	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Eukiefferiella	50	400	1		
9/13/2022	1	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Zavrelimyia	50	400	1		
9/13/2022		RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Empididae	50	400	1	0.0036	
9/13/2022	6	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Chelifera/Metachela	50	400	1		
9/13/2022		RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Psychodidae	50	400	1	0.0006	
9/13/2022	4	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Pericoma	50	400	1		
9/13/2022		RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Pediciidae	50	400	1	0.0002	
9/13/2022	2	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Dicranota	50	400	1		
9/13/2022		RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Tipulidae	50	400	1	0.0009	
9/13/2022	1	RG_GANF_BICA-4-2022-09-13_N	RG_GANF_BICA-4-2022-09-13_N	1/3 m^2 kick & sweep	Tipula	50	400	1		
9/13/2022		RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Planariidae	50	400	1	0.0007	
9/13/2022	1	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Polycelis	50	400	1		
9/13/2022	2	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Enchytraeidae	50	400	1	0.0008	
9/13/2022		RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Sperchonidae	50	400	1	0.0003	
9/13/2022	1	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Sperchon	50	400	1		
9/13/2022	19	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0038	
9/13/2022		RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Capniidae	50	400	1	0.0007	
9/13/2022	2	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Paracapnia	50	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/13/2022	2	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Capniidae	50	400	1		immature
9/13/2022		RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1	0.0021	
9/13/2022	1	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Sweltsa	50	400	1		
9/13/2022	2	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1		immature
9/13/2022		RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0033	
9/13/2022	17	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/13/2022		RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.0205	
9/13/2022	21	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Isoperla	50	400	1		
9/13/2022		RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Taeniopterygidae	50	400	1	0.0005	
9/13/2022	3	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Taeniopterygidae	50	400	1		immature
9/13/2022		RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.0157	
9/13/2022	3	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		
9/13/2022		RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0058	
9/13/2022	5	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1		pupae
9/13/2022	7	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Pagastia	50	400	1		
9/13/2022	2	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	50	400	1		
9/13/2022	2	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Eukiefferiella	50	400	1		
9/13/2022	1	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Hydrobaenus	50	400	1		
9/13/2022	1	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Tvetenia	50	400	1		
9/13/2022	1	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Zavrelimyia	50	400	1		
9/13/2022		RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Dixidae	50	400	1	0.0009	
9/13/2022	1	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Dixa	50	400	1		
9/13/2022		RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Empididae	50	400	1	0.0026	
9/13/2022	6	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Chelifera/Metachela	50	400	1		
9/13/2022		RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Pelecorhyncidae	50	400	1	0.0061	
9/13/2022	4	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Glutops	50	400	1		
9/13/2022		RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Psychodidae	50	400	1	0.0004	
9/13/2022	2	RG_GANF_BICA-5-2022-09-13_N	RG_GANF_BICA-5-2022-09-13_N	1/3 m^2 kick & sweep	Pericoma	50	400	1		
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Lebertiidae	100	400	1	0.0012	
9/13/2022	2	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Lebertia	100	400	1		
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Sperchonidae	100	400	1	0.0004	
9/13/2022	1	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Sperchon	100	400	1		
9/13/2022	94	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Ostracoda	100	400	1	0.0206	
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Elmidae	100	400	1	0.0005	
9/13/2022	1	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Heterlimnius	100	400	1		
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Capniidae	100	400	1	0.0005	
9/13/2022	2	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Paracapnia	100	400	1		
9/13/2022	1	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Capniidae	100	400	1		immature
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Chloroperlidae	100	400	1	0.0003	
9/13/2022	1	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Chloroperlidae	100	400	1		immature
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1	0.0030	
9/13/2022	16	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Zapada	100	400	1		
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0071	
9/13/2022	7	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Isoperla	100	400	1		
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1	0.0001	
9/13/2022	1	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1		immature
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0044	
9/13/2022	1	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0096	
9/13/2022	6	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1		pupae
9/13/2022	1	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Micropsectra	100	400	1		
9/13/2022	12	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Pagastia	100	400	1		
9/13/2022	6	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	100	400	1		
9/13/2022	1	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Heleniella	100	400	1		
9/13/2022	1	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Macropelopia	100	400	1		
9/13/2022	2	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Zavrelimyia	100	400	1		
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Empididae	100	400	1	0.0122	
9/13/2022	13	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Chelifera/Metachela	100	400	1		
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Pelecorhyncidae	100	400	1	0.0080	
9/13/2022	6	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Glutops	100	400	1		
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Psychodidae	100	400	1	0.0025	
9/13/2022	13	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Pericoma	100	400	1		
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Pediciidae	100	400	1	0.0022	
9/13/2022	1	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Dicranota	100	400	1		
9/13/2022		RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Limoniidae	100	400	1	0.0010	
9/13/2022	1	RG_GANF_BICA-6-2022-09-13_N	RG_GANF_BICA-6-2022-09-13_N	1/3 m^2 kick & sweep	Rhabdomastix	100	400	1		
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Lumbricidae	100	400	1	0.0955	
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Eiseniella tetraedra	100	400	1		
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Lumbricidae	50	400	1	0.0070	
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Lumbricidae	50	400	1		
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Hygrobatidae	50	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Hygrobates	50	400	1		
9/14/2022	24	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0030	
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Elmidae	50	400	1	0.0073	
9/14/2022	5	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Heterlimnius	50	400	1		
9/14/2022	2	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Elmidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Heptageniidae	50	400	1	0.0074	
9/14/2022	6	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Heptageniidae	50	400	1		indeterminate
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Crambidae	50	400	1	0.0016	
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Capniidae	50	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Paracapnia	50	400	1		
9/14/2022	3	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Capniidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0026	
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Malenka	50	400	1		
9/14/2022	2	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.0007	
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Isoperla	50	400	1		
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Glossosomatidae	50	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Anagapetus	50	400	1		
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Limnephilidae	50	400	1	0.0003	
9/14/2022	2	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Ecclisomyia	50	400	1		
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Limnephilidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.0026	
9/14/2022	3	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0021	
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Pagastia	50	400	1		
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Eukiefferiella	50	400	1		
9/14/2022	2	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Orthocladius lignicola	50	400	1		
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Paraphaenocladius	50	400	1		
9/14/2022	4	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Tvetenia	50	400	1		
9/14/2022	3	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Macropelopia	50	400	1		
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Limoniidae	50	400	1	0.0016	
9/14/2022	2	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Limnophila	50	400	1		
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Tipulidae	50	400	1	0.0016	
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Tipula	50	400	1		
9/14/2022		RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Tipulidae	100	400	1	0.0772	
9/14/2022	1	RG_GAUT_BICA-1-2022-09-14_N	RG_GAUT_BICA-1-2022-09-14_N	1/3 m^2 kick & sweep	Tipula	100	400	1		
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Planariidae	50	400	1	0.0010	
9/14/2022	2	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Polycelis	50	400	1		
9/14/2022	2	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Enchytraeidae	50	400	1	0.0001	
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Naididae	50	400	1	0.0001	
9/14/2022	2	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Naididae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Lebertiidae	50	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Lebertia	50	400	1		
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Sperchonidae	50	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Sperchon	50	400	1		
9/14/2022	66	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0115	
9/14/2022	2	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Collembola	50	400	1	0.0001	
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Elmidae	50	400	1	0.0080	
9/14/2022	6	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Heterlimnius	50	400	1		
9/14/2022	7	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Elmidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Capniidae	50	400	1	0.0112	
9/14/2022	4	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Eucapnopsis	50	400	1		
9/14/2022	35	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Paracapnia	50	400	1		
9/14/2022	30	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Capniidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0032	
9/14/2022	7	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/14/2022	23	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.0112	
9/14/2022	3	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Isoperla	50	400	1		
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Megarcys	50	400	1		
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0485	
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Glossosomatidae	50	400	1	0.0110	
9/14/2022	17	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Anagapetus	50	400	1		
9/14/2022	23	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Glossosomatidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Limnephilidae	50	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Ecclisomyia	50	400	1		
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.0095	
9/14/2022	4	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Ceratopogonidae	50	400	1	0.0001	
9/14/2022	2	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Ceratopogonidae	50	400	1		pupae

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9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0018	
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1		pupae
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Micropsectra	50	400	1		
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Limnophyes	50	400	1		
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Metriocnemus	50	400	1		
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Paraphaenocladius	50	400	1		
9/14/2022	3	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Tvetenia	50	400	1		
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Macropelopia	50	400	1		
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Empididae	50	400	1	0.0015	
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Chelifera/Metachela	50	400	1		
9/14/2022	2	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Wiedemannia	50	400	1		
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Limoniidae	50	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Limnophila	50	400	1		
9/14/2022		RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Tipulidae	100	400	1	0.0661	
9/14/2022	1	RG_GAUT_BICA-2-2022-09-14_N	RG_GAUT_BICA-2-2022-09-14_N	1/3 m^2 kick & sweep	Tipula	100	400	1		
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Planariidae	50	400	1	0.0071	
9/14/2022	2	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Polycelis	50	400	1		
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Naididae	50	400	1	0.0003	
9/14/2022	1	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Tubificinae	50	400	1		immature with hai
9/14/2022	31	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0085	
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Dytiscidae	50	400	1	0.0003	
9/14/2022	1	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Dytiscidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Elmidae	50	400	1	0.0142	
9/14/2022	7	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Heterlimnius	50	400	1		
9/14/2022	3	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Elmidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Capniidae	50	400	1	0.0175	
9/14/2022	14	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Eucapnopsis	50	400	1		
9/14/2022	41	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Paracapnia	50	400	1		
9/14/2022	77	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Capniidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1	0.0040	
9/14/2022	1	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Sweltsa	50	400	1		
9/14/2022	3	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0032	
9/14/2022	13	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/14/2022	16	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.0245	
9/14/2022	2	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Isoperla	50	400	1		
9/14/2022	3	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Megarcys	50	400	1		
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Apataniidae	50	400	1	0.0086	
9/14/2022	1	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Allomyia	50	400	1		
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Glossosomatidae	50	400	1	0.0022	
9/14/2022	9	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Anagapetus	50	400	1		
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Limnephilidae	50	400	1	0.0005	
9/14/2022	1	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Limnephilidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Uenoidae	50	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Neothremma	50	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Ceratopogonidae	50	400	1	0.0001	
9/14/2022	2	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Bezzia	50	400	1		
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0021	
9/14/2022	1	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Brillia	50	400	1		
9/14/2022	1	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Chaetocladius	50	400	1		
9/14/2022	1	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Orthocladius lignicola	50	400	1		
9/14/2022	3	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Zavrelimyia	50	400	1		
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Empididae	50	400	1	0.0085	
9/14/2022	1	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Chelifera/Metachela	50	400	1		
9/14/2022	6	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Wiedemannia	50	400	1		
9/14/2022		RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Tipulidae	50	400	1	0.0024	
9/14/2022	1	RG_GAUT_BICA-3-2022-09-14_N	RG_GAUT_BICA-3-2022-09-14_N	1/3 m^2 kick & sweep	Tipula	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Planariidae	50	400	1	0.0312	
9/14/2022	6	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Polycelis	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Lumbricidae	100	400	1	0.0974	
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Eiseniella tetraedra	100	400	1		
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Lumbricidae	100	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Hygrobatidae	50	400	1	0.0008	
9/14/2022	3	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Hygrobates	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Lebertiidae	50	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Lebertia	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Sperchonidae	50	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Sperchon	50	400	1		
9/14/2022	56	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0101	
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Dytiscidae	50	400	1	0.0036	
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Dytiscidae	50	400	1		adult
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Elmidae	50	400	1	0.0092	
9/14/2022	4	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Heterlimnius	50	400	1		
9/14/2022	4	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Elmidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Ameletidae	50	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Ameletus	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Heptageniidae	100	400	1	0.0093	
9/14/2022	2	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Cinygma	100	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Heptageniidae	50	400	1	0.0127	
9/14/2022	4	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Cinygma	50	400	1		immature
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Capniidae	50	400	1	0.0063	
9/14/2022	55	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Paracapnia	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1	0.0023	
9/14/2022	2	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Sweltsa	50	400	1		
9/14/2022	2	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0016	
9/14/2022	4	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/14/2022	2	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0555	
9/14/2022	3	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.0021	
9/14/2022	3	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Isoperla	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Apataniidae	50	400	1	0.0002	

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Allomyia	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Glossosomatidae	50	400	1	0.0001	
9/14/2022	4	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Anagapetus	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Limnephilidae	50	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Limnephilidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.0137	
9/14/2022	4	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0006	
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Micropsectra	50	400	1		
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Chaetocladius	50	400	1		
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Heleniella	50	400	1		
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Hydrobaenus	50	400	1		
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Orthocladius lignicola	50	400	1		
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Paraphaenocladius	50	400	1		
9/14/2022	2	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Zavrelimyia	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Empididae	50	400	1	0.0081	
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Chelifera/Metachela	50	400	1		
9/14/2022	3	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Wiedemannia	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Pelecorhyncidae	50	400	1	0.0001	
9/14/2022	2	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Glutops	50	400	1		
9/14/2022		RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Tipulidae	50	400	1	0.0020	
9/14/2022	1	RG_GAUT_BICA-4-2022-09-14_N	RG_GAUT_BICA-4-2022-09-14_N	1/3 m^2 kick & sweep	Tipula	50	400	1		
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Lumbricidae	100	400	1	0.1390	
9/14/2022	1	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Eiseniella tetraedra	100	400	1		
9/14/2022	3	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Lumbricidae	100	400	1		
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Lebertiidae	100	400	1	0.0001	
9/14/2022	2	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Lebertia	100	400	1		
9/14/2022	23	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Ostracoda	100	400	1	0.0038	
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Elmidae	100	400	1	0.0110	
9/14/2022	5	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Heterlimnius	100	400	1		
9/14/2022	17	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Elmidae	100	400	1		immature
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Heptageniidae	100	400	1	0.0063	
9/14/2022	3	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Cinygma	100	400	1		
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Capniidae	100	400	1	0.0148	
9/14/2022	1	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Eucapnopsis	100	400	1		
9/14/2022	15	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Paracapnia	100	400	1		
9/14/2022	121	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Capniidae	100	400	1		immature
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Chloroperlidae	100	400	1	0.0013	
9/14/2022	1	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Sweltsa	100	400	1		
9/14/2022	1	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Chloroperlidae	100	400	1		immature
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1	0.0078	
9/14/2022	11	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Zapada	100	400	1		
9/14/2022	20	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1		immature
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.1003	
9/14/2022	4	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Isoperla	100	400	1		
9/14/2022	4	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Glossosomatidae	100	400	1	0.0021	
9/14/2022	12	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Anagapetus	100	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/14/2022	2	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Glossosomatidae	100	400	1		
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1	0.0003	
9/14/2022	1	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1		immature
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0539	
9/14/2022	23	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0002	
9/14/2022	2	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Heleniella	100	400	1		
9/14/2022	1	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Zavrelimyia	100	400	1		
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Empididae	100	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Chelifera/Metachela	100	400	1		
9/14/2022		RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Pelecorhyncidae	100	400	1	0.0001	
9/14/2022	1	RG_GAUT_BICA-5-2022-09-14_N	RG_GAUT_BICA-5-2022-09-14_N	1/3 m^2 kick & sweep	Glutops	100	400	1		
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Planariidae	50	400	1	0.0101	
9/14/2022	2	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Polycelis	50	400	1		
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Lumbricidae	50	400	1	0.2632	
9/14/2022	1	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Eiseniella tetraedra	50	400	1		
9/14/2022	2	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Lumbricidae	50	400	1		
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Lebertiidae	50	400	1	0.0005	
9/14/2022	1	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Lebertia	50	400	1		
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Sperchonidae	50	400	1	0.0005	
9/14/2022	1	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Sperchon	50	400	1		
9/14/2022	21	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0041	
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Elmidae	50	400	1	0.0104	
9/14/2022	6	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Heterlimnius	50	400	1		
9/14/2022	2	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Elmidae	50	400	1		immature
9/14/2022	1	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Staphylinidae	50	400	1	0.0010	
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Capniidae	50	400	1	0.0282	
9/14/2022	5	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Eucapnopsis	50	400	1		
9/14/2022	46	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Paracapnia	50	400	1		
9/14/2022	153	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Capniidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1	0.0007	
9/14/2022	1	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Leuctridae	50	400	1	0.0001	
9/14/2022	3	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Leuctridae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0129	
9/14/2022	18	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/14/2022	36	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.1495	
9/14/2022	3	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Isoperla	50	400	1		
9/14/2022	13	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Megarcys	50	400	1		
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.1064	
9/14/2022	5	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Glossosomatidae	50	400	1	0.0039	
9/14/2022	2	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Anagapetus	50	400	1		
9/14/2022	8	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Glossosomatidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1	0.0758	
9/14/2022	1	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Psychoglypha	100	400	1		
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Limnephilidae	50	400	1	0.1449	

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/14/2022	2	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Psychoglypha	50	400	1		
9/14/2022	1	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Limnephilidae	50	400	1		immature
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0104	
9/14/2022	1	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.0655	
9/14/2022	8	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Ceratopogonidae	50	400	1	0.0007	
9/14/2022	2	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Probezzia	50	400	1		
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0009	
9/14/2022	1	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Limnophyes	50	400	1		
9/14/2022	1	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Tvetenia	50	400	1		
9/14/2022	1	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Zavrelimyia	50	400	1		
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Dixidae	50	400	1	0.0010	
9/14/2022	2	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Dixa	50	400	1		
9/14/2022		RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Empididae	50	400	1	0.0110	
9/14/2022	17	RG_GAUT_BICA-6-2022-09-14_N	RG_GAUT_BICA-6-2022-09-14_N	1/3 m^2 kick & sweep	Wiedemannia	50	400	1		
9/10/2022	3	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Nematoda	50	400	1	0.0004	
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Planariidae	50	400	1	0.0036	
9/10/2022	7	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Polycelis	50	400	1		
9/10/2022	1	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Enchytraeidae	50	400	1	0.0002	
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Lumbricidae	100	400	1	0.3089	
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Lumbricidae	50	400	1	0.0155	
9/10/2022	4	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Eiseniella tetraedra	100	400	1		
9/10/2022	1	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Lumbricidae	100	400	1		immature
9/10/2022	6	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Lumbricidae	50	400	1		immature
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Lebertiidae	50	400	1	0.0003	
9/10/2022	2	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Lebertia	50	400	1		
9/10/2022	1	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0001	
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Gammaridae	50	400	1	0.0024	
9/10/2022	1	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Gammarus	50	400	1		
9/10/2022	1	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Collembola	50	400	1	0.0001	
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Elmidae	50	400	1	0.0022	
9/10/2022	1	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Heterlimnius	50	400	1		
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Baetidae	50	400	1	0.0445	
9/10/2022	67	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Baetis	50	400	1		
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Heptageniidae	50	400	1	0.0053	
9/10/2022	1	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Rhithrogena	50	400	1		
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1	0.0043	
9/10/2022	3	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Sweltsa	50	400	1		
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0610	
9/10/2022	15	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Malenka	50	400	1		
9/10/2022	78	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/10/2022	15	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1		immature
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.0021	
9/10/2022	2	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Isoperla	50	400	1		
9/10/2022	4	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1		immature
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Brachycentridae	50	400	1	0.0003	
9/10/2022	2	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Micrasema	50	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.2367	
9/10/2022	40	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0203	
9/10/2022	4	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1		pupae
9/10/2022	2	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Micropsectra	50	400	1		
9/10/2022	4	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Pseudodiamesa	50	400	1		
9/10/2022	1	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Corynoneura	50	400	1		
9/10/2022	1	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Eukiefferiella	50	400	1		
9/10/2022	1	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Hydrobaenus	50	400	1		
9/10/2022	1	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Tvetenia	50	400	1		
9/10/2022	2	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Pentaneura	50	400	1		
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Empididae	50	400	1	0.0019	
9/10/2022	1	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Empididae	50	400	1		pupae
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Psychodidae	50	400	1	0.0069	
9/10/2022	41	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Pericoma	50	400	1		
9/10/2022	41	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Simuliidae	50	400	1	0.0502	
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Pediciidae	50	400	1	0.0001	
9/10/2022	1	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Dicranota	50	400	1		
9/10/2022		RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Pisidiidae	50	400	1	0.1538	
9/10/2022	124	RG_GHBP_BICA-1_2022-09-10_N	RG_GHBP_BICA-1_2022-09-10_N	1/3 m^2 kick & sweep	Pisidium (Cyclocalyx)	50	400	1		
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Planariidae	50	400	1	0.0053	
9/12/2022	5	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Polycelis	50	400	1		
9/12/2022	3	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Enchytraeidae	50	400	1	0.0008	
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Lumbricidae	100	400	1	0.1868	
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Lumbricidae	50	400	1	0.0151	
9/12/2022	2	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Eiseniella tetraedra	100	400	1		
9/12/2022	1	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Lumbricidae	100	400	1		immature
9/12/2022	1	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Lumbricidae	50	400	1		immature
9/12/2022	1	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0001	
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Gammaridae	100	400	1	0.1227	
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Gammaridae	50	400	1	0.0266	
9/12/2022	2	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Gammarus	100	400	1		
9/12/2022	1	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Gammarus	50	400	1		
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Elmidae	50	400	1	0.0001	
9/12/2022	1	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Heterlimnius	50	400	1		
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Baetidae	50	400	1	0.0234	
9/12/2022	32	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Baetis	50	400	1		
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1	0.0094	
9/12/2022	2	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Sweltsa	50	400	1		
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0211	
9/12/2022	4	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Malenka	50	400	1		
9/12/2022	30	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/12/2022	8	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1		immature
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.0002	
9/12/2022	1	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1		immature
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Brachycentridae	50	400	1	0.0007	
9/12/2022	2	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Micrasema	50	400	1		
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0218	

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.1808	
9/12/2022	1	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		
9/12/2022	37	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0055	
9/12/2022	7	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1		pupae
9/12/2022	11	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Micropsectra	50	400	1		
9/12/2022	1	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Eukiefferiella	50	400	1		
9/12/2022	1	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Macropelopia	50	400	1		
9/12/2022	1	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Pentaneura	50	400	1		
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Psychodidae	50	400	1	0.0278	
9/12/2022	118	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Pericoma	50	400	1		
9/12/2022	31	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Simuliidae	50	400	1	0.0204	
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Pediciidae	50	400	1	0.0010	
9/12/2022	3	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Dicranota	50	400	1		
9/12/2022		RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Pisidiidae	50	400	1	0.0802	
9/12/2022	72	RG_GHBP_BICA-2_2022-09-12_N	RG_GHBP_BICA-2_2022-09-12_N	1/3 m^2 kick & sweep	Pisidium (Cyclocalyx)	50	400	1		
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Planariidae	25	400	1	0.0208	
9/12/2022	16	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Polycelis	25	400	1		
9/12/2022	7	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Enchytraeidae	25	400	1	0.0014	
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Lumbricidae	25	400	1	0.0590	
9/12/2022	1	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Eiseniella tetraedra	100	400	1		
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Lebertiidae	25	400	1	0.0005	
9/12/2022	2	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Lebertia	25	400	1		
9/12/2022	1	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Ostracoda	25	400	1	0.0001	
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Elmidae	25	400	1	0.0036	
9/12/2022	2	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Heterlimnius	25	400	1		
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Baetidae	25	400	1	0.0311	
9/12/2022	46	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Baetis	25	400	1		
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Callibaetis	25	400	1		
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Chloroperlidae	25	400	1	0.0076	
9/12/2022	3	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Sweltsa	25	400	1		
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Nemouridae	25	400	1	0.0205	
9/12/2022	5	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Malenka	25	400	1		
9/12/2022	20	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Zapada	25	400	1		
9/12/2022	5	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Nemouridae	25	400	1		immature
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Perlodidae	25	400	1	0.0010	
9/12/2022	3	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Perlodidae	25	400	1		immature
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Brachycentridae	25	400	1	0.0015	
9/12/2022	2	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Micrasema	25	400	1		
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0624	
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophilidae	25	400	1	0.2015	
9/12/2022	1	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		
9/12/2022	39	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophila	25	400	1		
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1	0.0060	
9/12/2022	4	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1		pupae
9/12/2022	9	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Micropsectra	25	400	1		
9/12/2022	1	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Corynoneura	25	400	1		
9/12/2022	2	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Eukiefferiella	25	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/12/2022	1	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Heleniella	25	400	1		
9/12/2022	1	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Pentaneura	25	400	1		
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Pelecorhyncidae	25	400	1	0.0046	
9/12/2022	4	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Glutops	25	400	1		
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Psychodidae	25	400	1	0.0277	
9/12/2022	91	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Pericoma	25	400	1		
9/12/2022	19	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Simuliidae	25	400	1	0.0188	
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Pediciidae	25	400	1	0.0035	
9/12/2022	5	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Dicranota	25	400	1		
9/12/2022		RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Pisidiidae	25	400	1	0.0996	
9/12/2022	52	RG_GHBP_BICA-3_2022-09-12_N	RG_GHBP_BICA-3_2022-09-12_N	1/3 m^2 kick & sweep	Pisidium (Cyclocalyx)	25	400	1		
9/12/2022	5	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Nematoda	25	400	1	0.0005	
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Planariidae	25	400	1	0.0534	
9/12/2022	57	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Polycelis	25	400	1		
9/12/2022	1	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Planariidae	25	400	1		indeterminate
9/12/2022	8	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Enchytraeidae	25	400	1	0.0015	
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Lumbricidae	25	400	1	0.0030	
9/12/2022	1	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Lumbricidae	25	400	1		immature
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Lebertiidae	25	400	1	0.0001	
9/12/2022	1	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Lebertia	25	400	1		
9/12/2022	1	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Ostracoda	25	400	1	0.0001	
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Gammaridae	100	400	1	0.0121	
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Gammaridae	25	400	1	0.0080	
9/12/2022	1	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Gammarus	100	400	1		
9/12/2022	1	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Gammarus	25	400	1		
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Elmidae	25	400	1	0.0013	
9/12/2022	3	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Heterlimnius	25	400	1		
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Baetidae	25	400	1	0.0153	
9/12/2022	30	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Baetis	25	400	1		
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Chloroperlidae	25	400	1	0.0120	
9/12/2022	8	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Sweltsa	25	400	1		
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Leuctridae	25	400	1	0.0002	
9/12/2022	2	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Leuctridae	25	400	1		immature
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Nemouridae	25	400	1	0.0247	
9/12/2022	7	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Malenka	25	400	1		
9/12/2022	14	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Zapada	25	400	1		
9/12/2022	6	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Nemouridae	25	400	1		immature
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Perlodidae	25	400	1	0.0004	
9/12/2022	4	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Perlodidae	25	400	1		immature
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophilidae	25	400	1	0.3692	
9/12/2022	49	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophila	25	400	1		
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1	0.0029	
9/12/2022	2	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1		pupae
9/12/2022	7	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Micropsectra	25	400	1		
9/12/2022	1	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Eukiefferiella	25	400	1		
9/12/2022	1	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Heleniella	25	400	1		
9/12/2022	1	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Tvetenia	25	400	1		
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Pelecorhyncidae	100	400	1	0.0290	

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Pelecorhyncidae	25	400	1	0.0127	
9/12/2022	2	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Glutops	100	400	1		
9/12/2022	3	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Glutops	25	400	1		
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Psychodidae	25	400	1	0.0555	
9/12/2022	238	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Pericoma	25	400	1		
9/12/2022	43	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Simuliidae	25	400	1	0.0472	
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Pediciidae	25	400	1	0.0010	
9/12/2022	6	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Dicranota	25	400	1		
9/12/2022		RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Pisidiidae	25	400	1	0.0804	
9/12/2022	66	RG_GHBP_BICA-4_2022-09-12_N	RG_GHBP_BICA-4_2022-09-12_N	1/3 m^2 kick & sweep	Pisidium (Cyclocalyx)	25	400	1		
9/12/2022	2	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Nematoda	50	400	1	0.0009	
9/12/2022	1	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Platyhelminthes	50	400	1	0.0010	
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Planariidae	50	400	1	0.0193	
9/12/2022	19	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Polycelis	50	400	1		
9/12/2022	1	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Planaridae	50	400	1		indeterminate
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Lumbricidae	50	400	1	0.0223	
9/12/2022	1	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Lumbricidae	50	400	1		immature
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Lebertiidae	50	400	1	0.0009	
9/12/2022	3	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Lebertia	50	400	1		
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Sperchontidae	50	400	1	0.0009	
9/12/2022	1	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Sperchon	50	400	1		
9/12/2022	2	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0010	
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Gammaridae	50	400	1	0.0183	
9/12/2022	3	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Gammarus	50	400	1		
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Baetidae	50	400	1	0.0499	
9/12/2022	69	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Baetis	50	400	1		
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1	0.0019	
9/12/2022	2	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Sweltsa	50	400	1		
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Leuctridae	50	400	1	0.0007	
9/12/2022	1	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Leuctridae	50	400	1		immature
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0229	
9/12/2022	6	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Malenka	50	400	1		
9/12/2022	7	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Brachycentridae	50	400	1	0.0020	
9/12/2022	10	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Micrasema	50	400	1		
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.0702	
9/12/2022	10	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0040	
9/12/2022	2	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1		pupae
9/12/2022	8	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Micropsectra	50	400	1		
9/12/2022	1	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Eukiefferiella	50	400	1		
9/12/2022	1	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Pentaneura	50	400	1		
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Empididae	50	400	1	0.0016	
9/12/2022	1	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Chelifera/Metachela	50	400	1		
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Pelecorhyncidae	50	400	1	0.0010	
9/12/2022	2	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Glutops	50	400	1		
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Psychodidae	50	400	1	0.0223	
9/12/2022	98	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Pericoma	50	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/12/2022	12	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Simuliidae	50	400	1	0.0151	
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Pediciidae	50	400	1	0.0009	
9/12/2022	1	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Dicranota	50	400	1		
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Planorbidae	50	400	1	0.0006	
9/12/2022	1	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Gyraulus	50	400	1		
9/12/2022		RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Pisidiidae	50	400	1	0.0466	
9/12/2022	67	RG_GHBP_BICA-5_2022-09-12_N	RG_GHBP_BICA-5_2022-09-12_N	1/3 m^2 kick & sweep	Pisidium (Cyclocalyx)	50	400	1		
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Planariidae	100	400	1	0.0280	
9/12/2022	24	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Polycelis	100	400	1		
9/12/2022	4	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Enchytraeidae	100	400	1	0.0007	
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Lebertiidae	100	400	1	0.0016	
9/12/2022	6	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Lebertia	100	400	1		
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Sperchonidae	100	400	1	0.0004	
9/12/2022	3	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Sperchon	100	400	1		
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Torrenticolidae	100	400	1	0.0001	
9/12/2022	1	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Torrenticolidae	100	400	1		indeterminate
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Baetidae	100	400	1	0.0626	
9/12/2022	76	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Baetis	100	400	1		
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Chloroperlidae	100	400	1	0.0006	
9/12/2022	1	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Sweltsa	100	400	1		
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1	0.0338	
9/12/2022	11	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Malenka	100	400	1		
9/12/2022	4	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Zapada	100	400	1		
9/12/2022	3	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1		immature
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0002	
9/12/2022	1	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1		immature
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Brachycentridae	100	400	1	0.0139	
9/12/2022	92	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Micrasema	100	400	1		
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Hydropsychidae	100	400	1	0.0005	
9/12/2022	1	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Cheumatopsyche	100	400	1		
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Lepidostomatidae	100	400	1	0.0001	
9/12/2022	1	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Lepidostoma	100	400	1		
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0372	
9/12/2022	13	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0019	
9/12/2022	3	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Micropsectra	100	400	1		
9/12/2022	2	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Nanocladius	100	400	1		
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Empididae	100	400	1	0.0010	
9/12/2022	1	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Chelifera/Metachela	100	400	1		
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Psychodidae	100	400	1	0.0095	
9/12/2022	62	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Pericoma	100	400	1		
9/12/2022	29	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Simuliidae	100	400	1	0.0376	
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Limoniidae	100	400	1	0.0032	
9/12/2022	15	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Antocha	100	400	1		
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Pediciidae	100	400	1	0.0007	
9/12/2022	1	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Dicranota	100	400	1		
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Planorbidae	100	400	1	0.0010	
9/12/2022	1	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Gyraulus	100	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/12/2022		RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Pisidiidae	100	400	1	0.0771	
9/12/2022	41	RG_GHBP_BICA-6_2022-09-12_N	RG_GHBP_BICA-6_2022-09-12_N	1/3 m^2 kick & sweep	Pisidium (Cyclocalyx)	100	400	1		
9/9/2022	1	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Nematoda	12.5	400	1	0.0001	
9/9/2022	3	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Polycelis	12.5	400	1	0.0039	
9/9/2022	14	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Enchytraeidae	12.5	400	1	0.0008	
9/9/2022		RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Trombidiformes	12.5	400	1	0.0002	
9/9/2022	1	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Trombidiformes	12.5	400	1		indeterminate
9/9/2022	34	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Ostracoda	12.5	400	1	0.0057	
9/9/2022	1	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Collembola	12.5	400	1	0.0001	
9/9/2022		RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Capniidae	12.5	400	1	0.0111	
9/9/2022	1	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Mesocapnia	12.5	400	1		
9/9/2022	24	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Paracapnia	12.5	400	1		
9/9/2022	29	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Capniidae	12.5	400	1		immature
9/9/2022		RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Chloroperlidae	12.5	400	1	0.0002	
9/9/2022	1	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Chloroperlidae	12.5	400	1		immature
9/9/2022		RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Nemouridae	12.5	400	1	0.0020	
9/9/2022	2	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Malenka	12.5	400	1		
9/9/2022		RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Perlodidae	12.5	400	1	0.0326	
9/9/2022	29	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Isoperla	12.5	400	1		
9/9/2022		RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Brachycentridae	12.5	400	1	0.0002	
9/9/2022	1	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Brachycentrus	12.5	400	1		
9/9/2022		RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Chironomidae	12.5	400	1	0.0488	
9/9/2022	6	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Chironomidae	12.5	400	1		pupae
9/9/2022	2	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Micropsectra	12.5	400	1		
9/9/2022	9	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Pseudodiamesa	12.5	400	1		
9/9/2022	1	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Corynoneura	12.5	400	1		
9/9/2022	2	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	12.5	400	1		
9/9/2022	2	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Eukiefferiella	12.5	400	1		
9/9/2022	19	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Heleniella	12.5	400	1		
9/9/2022	17	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Hydrobaenus	12.5	400	1		
9/9/2022	40	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Tvetenia	12.5	400	1		
9/9/2022	4	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Zavrelimyia	12.5	400	1		
9/9/2022		RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Empididae	12.5	400	1	0.0063	
9/9/2022	8	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Chelifera/Metachela	12.5	400	1		
9/9/2022		RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Pelecorhyncidae	12.5	400	1	0.0250	
9/9/2022	8	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Glutops	12.5	400	1		
9/9/2022		RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Psychodidae	12.5	400	1	0.0010	
9/9/2022	4	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Pericoma	12.5	400	1		
9/9/2022		RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Pediciidae	12.5	400	1	0.0051	
9/9/2022	6	RG_GHNF_BICA-1_2022-09-09_N	RG_GHNF_BICA-1_2022-09-09_N	1/3 m^2 kick & sweep	Dicranota	12.5	400	1		
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Planariidae	25	400	1	0.0246	
9/9/2022	21	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Polycelis	25	400	1		
9/9/2022	12	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Enchytraeidae	25	400	1	0.0013	
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Sperchonidae	25	400	1	0.0002	
9/9/2022	1	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Sperchon	25	400	1		
9/9/2022	103	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Ostracoda	25	400	1	0.0256	
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Capniidae	25	400	1	0.0006	
9/9/2022	4	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Paracapnia	25	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/9/2022	2	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Capniidae	25	400	1		immature
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Chloroperlidae	25	400	1	0.0021	
9/9/2022	4	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Sweltsa	25	400	1		
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Leuctridae	25	400	1	0.0001	
9/9/2022	1	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Leuctridae	25	400	1		
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Nemouridae	25	400	1	0.0001	
9/9/2022	1	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Nemouridae	25	400	1		immature
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Perlodidae	25	400	1	0.0105	
9/9/2022	12	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Isoperla	25	400	1		
9/9/2022	1	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Perlodidae	25	400	1		immature
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Taeniopterygidae	25	400	1	0.0001	
9/9/2022	1	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Taeniopterygidae	25	400	1		immature
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Limnephilidae	25	400	1	0.0013	
9/9/2022	10	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Limnephilidae	25	400	1		immature
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1	0.0098	
9/9/2022	17	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1		pupae
9/9/2022	1	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Micropsectra	25	400	1		
9/9/2022	1	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Pseudodiamesa	25	400	1		
9/9/2022	3	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Heleniella	25	400	1		
9/9/2022	8	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Hydrobaenus	25	400	1		
9/9/2022	2	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Tvetenia	25	400	1		
9/9/2022	3	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Zavrelimyia	25	400	1		
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Empididae	25	400	1	0.0144	
9/9/2022	21	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Chelifera/Metachela	25	400	1		
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Pelecorhyncidae	100	400	1	0.1655	
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Pelecorhyncidae	25	400	1	0.0086	
9/9/2022	7	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Glutops	100	400	1		
9/9/2022	12	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Glutops	25	400	1		
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Psychodidae	25	400	1	0.0019	
9/9/2022	7	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Pericoma	25	400	1		
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Pediciidae	25	400	1	0.0001	
9/9/2022	1	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Dicranota	25	400	1		
9/9/2022		RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Limoniidae	25	400	1	0.0025	
9/9/2022	1	RG_GHNF_BICA-2_2022-09-09_N	RG_GHNF_BICA-2_2022-09-09_N	1/3 m^2 kick & sweep	Limnophila	25	400	1		
9/10/2022		RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Planariidae	100	400	1	0.0024	
9/10/2022	1	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Polycelis	100	400	1		
9/10/2022	1	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Enchytraeidae	100	400	1	0.0004	
9/10/2022	6	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Ostracoda	100	400	1	0.0015	
9/10/2022	1	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Collembola	100	400	1	0.0002	
9/10/2022	1	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Staphylinidae	100	400	1	0.0014	
9/10/2022		RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Capniidae	100	400	1	0.0049	
9/10/2022	2	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Mesocapnia	100	400	1		
9/10/2022	3	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Capniidae	100	400	1		immature
9/10/2022		RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1	0.0005	
9/10/2022	4	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1		immature
9/10/2022		RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.1249	
9/10/2022	35	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Isoperla	100	400	1		
9/10/2022	9	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/10/2022	2	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1		immature
9/10/2022		RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1	0.0002	
9/10/2022	1	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1		immature
9/10/2022		RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0108	
9/10/2022	19	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1		pupae
9/10/2022	5	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Pagastia	100	400	1		
9/10/2022	2	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Brillia	100	400	1		
9/10/2022	1	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	100	400	1		
9/10/2022	1	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Eukiefferiella	100	400	1		
9/10/2022	17	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Tvetenia	100	400	1		
9/10/2022		RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Empididae	100	400	1	0.0148	
9/10/2022	9	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Chelifera/Metachela	100	400	1		
9/10/2022	1	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Wiedemannia	100	400	1		
9/10/2022	3	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Empididae	100	400	1		pupae
9/10/2022		RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Pelecorhyncidae	100	400	1	0.0008	
9/10/2022	1	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Glutops	100	400	1		
9/10/2022		RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Psychodidae	100	400	1	0.0011	
9/10/2022	3	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Pericoma	100	400	1		
9/10/2022		RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Pediciidae	100	400	1	0.0006	
9/10/2022	2	RG_GHNF_BICA-3_2022-09-10_N	RG_GHNF_BICA-3_2022-09-10_N	1/3 m^2 kick & sweep	Dicranota	100	400	1		
9/10/2022	2	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Nematoda	6.25	400	1	0.0001	
9/10/2022		RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Planariidae	6.25	400	1	0.0030	
9/10/2022	1	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Polycelis	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Enchytraeidae	6.25	400	1	0.0002	
9/10/2022	14	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Ostracoda	6.25	400	1	0.0021	
9/10/2022		RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Capniidae	6.25	400	1	0.0065	
9/10/2022	3	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Mesocapnia	6.25	400	1		
9/10/2022	4	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Paracapnia	6.25	400	1		
9/10/2022	20	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Capniidae	6.25	400	1		immature
9/10/2022		RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Nemouridae	6.25	400	1	0.0015	
9/10/2022	1	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Zapada	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Nemouridae	6.25	400	1		immature
9/10/2022		RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0236	
9/10/2022	1	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/10/2022		RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Perlodidae	6.25	400	1	0.0225	
9/10/2022	31	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Isoperla	6.25	400	1		
9/10/2022		RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Chironomidae	6.25	400	1	0.0376	
9/10/2022	3	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Chironomidae	6.25	400	1		pupae
9/10/2022	8	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Pagastia	6.25	400	1		
9/10/2022	4	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Pseudodiamesa	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Brillia	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	6.25	400	1		
9/10/2022	6	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Hydrobaenus	6.25	400	1		
9/10/2022	82	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Tvetenia	6.25	400	1		
9/10/2022		RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Empididae	6.25	400	1	0.0039	
9/10/2022	2	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Chelifera/Metachela	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Empididae	6.25	400	1		
9/10/2022		RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Psychodidae	6.25	400	1	0.0006	

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/10/2022	2	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Pericoma	6.25	400	1		
9/10/2022		RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Pediciidae	6.25	400	1	0.0021	
9/10/2022	2	RG_GHNF_BICA-4_2022-09-10_N	RG_GHNF_BICA-4_2022-09-10_N	1/3 m^2 kick & sweep	Dicranota	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Enchytraeidae	6.25	400	1	0.0002	
9/10/2022	3	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Staphylinidae	6.25	400	1	0.0028	
9/10/2022		RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Capniidae	6.25	400	1	0.0012	
9/10/2022	6	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Capniidae	6.25	400	1		immature
9/10/2022		RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Perlodidae	6.25	400	1	0.0113	
9/10/2022	17	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Isoperla	6.25	400	1		
9/10/2022		RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Taeniopterygidae	6.25	400	1	0.0001	
9/10/2022	1	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Taeniopterygidae	6.25	400	1		immature
9/10/2022		RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Chironomidae	6.25	400	1	0.0314	
9/10/2022	12	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Chironomidae	6.25	400	1		pupae
9/10/2022	19	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Pagastia	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Brillia	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Eukiefferiella	6.25	400	1		
9/10/2022	157	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Tvetenia	6.25	400	1		
9/10/2022		RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Empididae	6.25	400	1	0.0077	
9/10/2022	3	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Chelifera/Metachela	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Empididae	6.25	400	1		pupae
9/10/2022		RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Psychodidae	6.25	400	1	0.0021	
9/10/2022	6	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Pericoma	6.25	400	1		
9/10/2022		RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Pediciidae	6.25	400	1	0.0005	
9/10/2022	1	RG_GHNF_BICA-5_2022-09-10_N	RG_GHNF_BICA-5_2022-09-10_N	1/3 m^2 kick & sweep	Dicranota	6.25	400	1		
9/10/2022		RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-11	1/3 m^2 kick & sweep	Planariidae	6.25	400	1	0.0031	
9/10/2022	2	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-12	1/3 m^2 kick & sweep	Polycelis	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-13	1/3 m^2 kick & sweep	Enchytraeidae	6.25	400	1	0.0001	
9/10/2022	30	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-14	1/3 m^2 kick & sweep	Ostracoda	6.25	400	1	0.0051	
9/10/2022		RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-15	1/3 m^2 kick & sweep	Capniidae	6.25	400	1	0.0088	
9/10/2022	5	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-17	1/3 m^2 kick & sweep	Paracapnia	6.25	400	1		
9/10/2022	38	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-18	1/3 m^2 kick & sweep	Capniidae	6.25	400	1		immature
9/10/2022		RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-19	1/3 m^2 kick & sweep	Nemouridae	6.25	400	1	0.0016	
9/10/2022	1	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-20	1/3 m^2 kick & sweep	Malenka	6.25	400	1		
9/10/2022	2	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-22	1/3 m^2 kick & sweep	Nemouridae	6.25	400	1		immature
9/10/2022		RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-23	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0125	
9/10/2022	1	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-24	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/10/2022		RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-25	1/3 m^2 kick & sweep	Perlodidae	6.25	400	1	0.0238	
9/10/2022	29	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-26	1/3 m^2 kick & sweep	Isoperla	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-27	1/3 m^2 kick & sweep	Perlodidae	6.25	400	1		indeterminate
9/10/2022		RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-28	1/3 m^2 kick & sweep	Chironomidae	6.25	400	1	0.0770	
9/10/2022	3	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-29	1/3 m^2 kick & sweep	Chironomidae	6.25	400	1		pupae
9/10/2022	5	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-30	1/3 m^2 kick & sweep	Pagastia	6.25	400	1		
9/10/2022	15	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-31	1/3 m^2 kick & sweep	Pseudodiamesa	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-32	1/3 m^2 kick & sweep	Heleniella	6.25	400	1		
9/10/2022	18	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-33	1/3 m^2 kick & sweep	Hydrobaenus	6.25	400	1		
9/10/2022	110	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-34	1/3 m^2 kick & sweep	Tvetenia	6.25	400	1		
9/10/2022		RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-35	1/3 m^2 kick & sweep	Empididae	6.25	400	1	0.0106	

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/10/2022	5	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-36	1/3 m^2 kick & sweep	Chelifera/Metachela	6.25	400	1		
9/10/2022	1	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-37	1/3 m^2 kick & sweep	Clinocera	6.25	400	1		
9/10/2022	2	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-38	1/3 m^2 kick & sweep	Empididae	6.25	400	1		pupae
9/10/2022		RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-39	1/3 m^2 kick & sweep	Pelecorhyncidae	100	400	1	0.0672	
9/10/2022		RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-40	1/3 m^2 kick & sweep	Pelecorhyncidae	6.25	400	1	0.0187	
9/10/2022	3	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-41	1/3 m^2 kick & sweep	Glutops	100	400	1		
9/10/2022	1	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-42	1/3 m^2 kick & sweep	Glutops	6.25	400	1		
9/10/2022		RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-43	1/3 m^2 kick & sweep	Psychodidae	6.25	400	1	0.0002	
9/10/2022	1	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-44	1/3 m^2 kick & sweep	Pericoma	6.25	400	1		
9/10/2022		RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-45	1/3 m^2 kick & sweep	Pediciidae	6.25	400	1	0.0018	
9/10/2022		RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-46	1/3 m^2 kick & sweep	Antocha	6.25	400	1		
9/10/2022	3	RG_GHNF_BICA-6_2022-09-10_N	RG_GHNF_BICA-6_2022-09-47	1/3 m^2 kick & sweep	Dicranota	6.25	400	1		
9/16/2022		RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Planariidae	25	400	1	0.0071	
9/16/2022	2	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Polycelis	25	400	1		
9/16/2022	12	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Ostracoda	25	400	1	0.0031	
9/16/2022	1	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Collembola	25	400	1	0.0001	
9/16/2022		RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Elmidae	25	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Heterlimnius	25	400	1		
9/16/2022		RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Capniidae	25	400	1	0.0042	
9/16/2022	1	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Mesocapnia	25	400	1		
9/16/2022	2	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Paracapnia	25	400	1		
9/16/2022	1	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Capniidae	25	400	1		immature
9/16/2022		RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Nemouridae	25	400	1	0.0022	
9/16/2022	1	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Zapada	25	400	1		
9/16/2022	3	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Nemouridae	25	400	1		immature
9/16/2022		RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Perlodidae	25	400	1	0.0120	
9/16/2022	6	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Isoperla	25	400	1		
9/16/2022		RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Taeniopterygidae	25	400	1	0.0012	
9/16/2022	4	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Taeniopterygidae	25	400	1		immature
9/16/2022		RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Limnephilidae	25	400	1	0.0058	
9/16/2022	1	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Ecclisomyia	25	400	1		
9/16/2022	2	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Limnephilidae	25	400	1		immature
9/16/2022		RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Rhyacophilidae	25	400	1	0.0045	
9/16/2022	2	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Rhyacophila	25	400	1		
9/16/2022		RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1	0.0164	
9/16/2022	4	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1		pupae
9/16/2022	1	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Micropsectra	25	400	1		
9/16/2022	3	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Pagastia	25	400	1		
9/16/2022	1	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	25	400	1		
9/16/2022	16	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Eukiefferiella	25	400	1		
9/16/2022	6	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Hydrobaenus	25	400	1		
9/16/2022	3	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Tvetenia	25	400	1		
9/16/2022		RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Empididae	25	400	1	0.0160	
9/16/2022	4	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Chelifera/Metachela	25	400	1		
9/16/2022	2	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Empididae	25	400	1		pupae
9/16/2022		RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Pelecorhyncidae	25	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Glutops	25	400	1		
9/16/2022		RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Psychodidae	25	400	1	0.0015	

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/16/2022	4	RG_GHDT_BICA-1_2022-09-16_N	RG_GHDT_BICA-1_2022-09-16_N	1/3 m^2 kick & sweep	Pericoma	25	400	1		
9/16/2022		RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Planariidae	50	400	1	0.0003	
9/16/2022	1	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Polycelis	50	400	1		
9/16/2022		RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Lebertiidae	50	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Lebertia	50	400	1		
9/16/2022	2	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Ostracoda	50	400	1	0.0007	
9/16/2022	1	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Collembola	50	400	1	0.0003	
9/16/2022		RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Capniidae	50	400	1	0.0012	
9/16/2022	1	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Mesocapnia	50	400	1		
9/16/2022	2	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Capniidae	50	400	1		immature
9/16/2022		RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Nemouridae	50	400	1	0.0043	
9/16/2022	3	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Zapada	50	400	1		
9/16/2022	7	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Nemouridae	50	400	1		immature
9/16/2022		RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Perlodidae	100	400	1	0.0376	
9/16/2022		RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Perlodidae	50	400	1	0.0200	
9/16/2022	12	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Isoperla	50	400	1		
9/16/2022	3	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Megarcys	100	400	1		
9/16/2022	1	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Perlodidae	50	400	1		immature
9/16/2022		RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Taeniopterygidae	50	400	1	0.0015	
9/16/2022	9	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Taeniopterygidae	50	400	1		immature
9/16/2022		RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Limnephilidae	50	400	1	0.0064	
9/16/2022	1	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Ecclisomyia	50	400	1		
9/16/2022	1	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Limnephilidae	50	400	1		immature
9/16/2022		RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Chironomidae	50	400	1	0.0309	
9/16/2022	19	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Chironomidae	50	400	1		pupae
9/16/2022	20	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Pagastia	50	400	1		
9/16/2022	1	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Brillia	50	400	1		
9/16/2022	3	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Cricotopus/Orthocladius	50	400	1		
9/16/2022	97	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Eukiefferiella	50	400	1		
9/16/2022	15	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Tvetenia	50	400	1		
9/16/2022		RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Empididae	50	400	1	0.0035	
9/16/2022	6	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Chelifera/Metachela	50	400	1		
9/16/2022		RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Pediciidae	50	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-2_2022-09-16_N	RG_GHDT_BICA-2_2022-09-16_N	Petite Ponar	Dicranota	50	400	1		
9/16/2022	2	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Ostracoda	100	400	1	0.0001	
9/16/2022		RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Capniidae	100	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Capniidae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1	0.0047	
9/16/2022	1	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Zapada	100	400	1		
9/16/2022	3	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.2516	
9/16/2022	1	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Isoperla	100	400	1		
9/16/2022	6	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/16/2022		RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1	0.0004	
9/16/2022	6	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1	0.0003	
9/16/2022	1	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0417	
9/16/2022	14	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1		pupae
9/16/2022	5	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Pagastia	100	400	1		
9/16/2022	24	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	100	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/16/2022	114	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Eukiefferiella	100	400	1		
9/16/2022	2	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Tvetenia	100	400	1		
9/16/2022		RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Dixidae	100	400	1	0.0013	
9/16/2022	1	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Dixa	100	400	1		
9/16/2022		RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Empididae	100	400	1	0.0013	
9/16/2022	1	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Empididae	100	400	1		pupae
9/16/2022		RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Psychodidae	100	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-3_2022-09-16_N	RG_GHDT_BICA-3_2022-09-16_N	1/3 m^2 kick & sweep	Pericoma	100	400	1		
9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Planariidae	100	400	1	0.0023	
9/16/2022	3	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Polycelis	100	400	1		
9/16/2022	2	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Enchytraeidae	100	400	1	0.0004	
9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Lebertiidae	100	400	1	0.0006	
9/16/2022	2	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Lebertia	100	400	1		
9/16/2022	7	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Ostracoda	100	400	1	0.0022	
9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Ephemerellidae	100	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Ephemerellidae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Capniidae	100	400	1	0.0044	
9/16/2022	4	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Paracapnia	100	400	1		
9/16/2022	4	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Capniidae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1	0.0029	
9/16/2022	3	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Zapada	100	400	1		
9/16/2022	5	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0140	
9/16/2022	8	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Isoperla	100	400	1		
9/16/2022	1	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1	0.0003	
9/16/2022	1	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1	0.0316	
9/16/2022	3	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Ecclisomyia	100	400	1		
9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		
9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0149	
9/16/2022	9	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1		pupae
9/16/2022	2	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Micropsectra	100	400	1		
9/16/2022	13	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Pagastia	100	400	1		
9/16/2022	1	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Pseudodiamesa	100	400	1		
9/16/2022	1	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Chaetocladius	100	400	1		
9/16/2022	3	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	100	400	1		
9/16/2022	15	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Eukiefferiella	100	400	1		
9/16/2022	3	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Hydrobaenus	100	400	1		
9/16/2022	5	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Tvetenia	100	400	1		
9/16/2022	2	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Zavrelimyia	100	400	1		
9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Empididae	100	400	1	0.0091	
9/16/2022	11	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Chelifera/Metachela	100	400	1		
9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Pelecorhyncidae	100	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Glutops	100	400	1		
9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Psychodidae	100	400	1	0.0007	
9/16/2022	5	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Pericoma	100	400	1		

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9/16/2022		RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Pediciidae	100	400	1	0.0002	
9/16/2022	1	RG_GHDT_BICA-4_2022-09-16_N	RG_GHDT_BICA-4_2022-09-16_N	1/3 m^2 kick & sweep	Dicranota	100	400	1		
9/16/2022		RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Planariidae	50	400	1	0.0050	
9/16/2022	6	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Polycelis	50	400	1		
9/16/2022	1	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Enchytraeidae	50	400	1	0.0001	
9/16/2022	11	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0048	
9/16/2022		RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Capniidae	50	400	1	0.0045	
9/16/2022	7	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Paracapnia	50	400	1		
9/16/2022	4	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Capniidae	50	400	1		immature
9/16/2022		RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Chloroperlidae	50	400	1		immature
9/16/2022		RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0002	
9/16/2022	1	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Zapada	50	400	1		
9/16/2022		RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.1532	
9/16/2022	1	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Isoperla	50	400	1		
9/16/2022	4	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Megarcys	50	400	1		
9/16/2022		RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Taeniopterygidae	50	400	1	0.0005	
9/16/2022	5	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Taeniopterygidae	50	400	1		immature
9/16/2022		RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Limnephilidae	50	400	1	0.0687	
9/16/2022	8	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Ecclisomyia	50	400	1		
9/16/2022	5	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Limnephilidae	50	400	1		immature
9/16/2022		RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Rhyacophilidae	50	400	1	0.0011	
9/16/2022	1	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Rhyacophila	50	400	1		
9/16/2022		RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0157	
9/16/2022	8	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1		pupae
9/16/2022	24	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Pagastia	50	400	1		
9/16/2022	8	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	50	400	1		
9/16/2022	21	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Eukiefferiella	50	400	1		
9/16/2022	1	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Hydrobaenus	50	400	1		
9/16/2022	11	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Tvetenia	50	400	1		
9/16/2022		RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Empididae	50	400	1	0.0029	
9/16/2022	7	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Chelifera/Metachela	50	400	1		
9/16/2022	1	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Empididae	50	400	1		immature
9/16/2022		RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Pelecorhyncidae	50	400	1	0.0008	
9/16/2022	3	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Glutops	50	400	1		
9/16/2022		RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Psychodidae	50	400	1	0.0002	
9/16/2022	4	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Pericoma	50	400	1		
9/16/2022		RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Pediciidae	50	400	1	0.0001	
9/16/2022	2	RG_GHDT_BICA-5_2022-09-16_N	RG_GHDT_BICA-5_2022-09-16_N	1/3 m^2 kick & sweep	Dicranota	50	400	1		
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Planariidae	100	400	1	0.0119	
9/16/2022	3	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Polycelis	100	400	1		
9/16/2022	2	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Enchytraeidae	100	400	1	0.0001	
9/16/2022	2	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Ostracoda	100	400	1	0.0001	
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Capniidae	100	400	1	0.0002	
9/16/2022	2	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Paracapnia	100	400	1		
9/16/2022	2	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Capniidae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1	0.0020	
9/16/2022	5	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Zapada	100	400	1		

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9/16/2022	7	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0578	
9/16/2022	2	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Isoperla	100	400	1		
9/16/2022	3	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1	0.0001	
9/16/2022	3	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Hydropsychidae	100	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Hydropsychidae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1	0.0001	
9/16/2022	2	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1		immature
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0238	
9/16/2022	12	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1		pupae
9/16/2022	13	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Pagastia	100	400	1		
9/16/2022	9	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	100	400	1		
9/16/2022	38	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Eukiefferiella	100	400	1		
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Heleniella	100	400	1		
9/16/2022	1	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Hydrobaenus	100	400	1		
9/16/2022	8	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Tvetenia	100	400	1		
9/16/2022	1	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Zavrelimyia	100	400	1		
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Empididae	100	400	1	0.0030	
9/16/2022	4	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Chelifera/Metachela	100	400	1		
9/16/2022	1	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Empididae	100	400	1		pupae
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Pelecorhyncidae	100	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Glutops	100	400	1		
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Psychodidae	100	400	1	0.0001	
9/16/2022	2	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Pericoma	100	400	1		
9/16/2022		RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Pediciidae	100	400	1	0.0001	
9/16/2022	1	RG_GHDT_BICA-6_2022-09-16_N	RG_GHDT_BICA-6_2022-09-16_N	1/3 m^2 kick & sweep	Dicranota	100	400	1		
9/8/2022	1	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Nematoda	100	400	1	0.0001	
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Planariidae	100	400	1	0.0049	
9/8/2022	5	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Polycelis	100	400	1		
9/8/2022	7	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Enchytraeidae	100	400	1	0.0011	
9/8/2022	7	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Ostracoda	100	400	1	0.002	
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Ephemerellidae	100	400	1	0.0001	
9/8/2022	1	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Ephemerellidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Heptageniidae	100	400	1	0.0003	
9/8/2022	1	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Heptageniidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Capniidae	100	400	1	0.0009	
9/8/2022	4	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Capniidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1	0.0131	
9/8/2022	6	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Zapada	100	400	1		
9/8/2022	30	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0426	
9/8/2022	2	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Isoperla	100	400	1		
9/8/2022	3	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/8/2022	1	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1		immature

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1	0.0001	
9/8/2022	2	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Hydropsychidae	100	400	1	0.0002	
9/8/2022	1	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Hydropsychidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1	0.0004	
9/8/2022	5	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0199	
9/8/2022	5	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0431	
9/8/2022	20	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1		pupae
9/8/2022	5	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Micropsectra	100	400	1		
9/8/2022	43	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Pagastia	100	400	1		
9/8/2022	8	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	100	400	1		
9/8/2022	120	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Eukiefferiella	100	400	1		
9/8/2022	1	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Hydrobaenus	100	400	1		
9/8/2022	3	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Tvetenia	100	400	1		
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Empididae	100	400	1	0.0266	
9/8/2022	15	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Chelifera/Metachela	100	400	1		
9/8/2022	3	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Clinocera	100	400	1		
9/8/2022	3	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Empididae	100	400	1		pupae
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Pelecorhyncidae	100	400	1	0.0008	
9/8/2022	1	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Glutops	100	400	1		
9/8/2022		RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Psychodidae	100	400	1	0.0008	
9/8/2022	5	RG_GHFF_BICA-1-2022-09-08_N	RG_GHFF_BICA-1-2022-09-08_N	1/3 m^2 kick & sweep	Pericoma	100	400	1		
9/8/2022	2	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Nematoda	100	400	1	0.0003	
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Planariidae	100	400	1	0.0304	
9/8/2022	27	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Polycelis	100	400	1		
9/8/2022	9	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Enchytraeidae	100	400	1	0.0017	
9/8/2022	8	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Ostracoda	100	400	1	0.0023	
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Elmidae	100	400	1	0.0002	
9/8/2022	1	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Elmidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Ephemerellidae	100	400	1	0.0005	
9/8/2022	4	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Ephemerellidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Heptageniidae	100	400	1	0.0006	
9/8/2022	3	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Cinygmula	100	400	1		
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Capniidae	100	400	1	0.0008	
9/8/2022	2	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Paracapnia	100	400	1		
9/8/2022	3	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Capniidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Chloroperlidae	100	400	1	0.0013	
9/8/2022	3	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Chloroperlidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1	0.0189	
9/8/2022	4	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Zapada	100	400	1		
9/8/2022	25	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.3464	
9/8/2022	2	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Isoperla	100	400	1		
9/8/2022	20	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/8/2022	1	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1	0.0041	

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/8/2022	1	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Ecclisomyia	100	400	1		
9/8/2022	2	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.2688	
9/8/2022	22	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0331	
9/8/2022	33	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1		pupae
9/8/2022	41	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Pagastia	100	400	1		
9/8/2022	3	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	100	400	1		
9/8/2022	45	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Eukiefferiella	100	400	1		
9/8/2022	5	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Tvetenia	100	400	1		
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Empididae	100	400	1	0.0392	
9/8/2022	43	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Chelifera/Metachela	100	400	1		
9/8/2022	4	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Empididae	100	400	1		pupae
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Pelecorhyncidae	100	400	1	0.0009	
9/8/2022	3	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Glutops	100	400	1		
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Psychodidae	100	400	1	0.0013	
9/8/2022	9	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Pericoma	100	400	1		
9/8/2022		RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Pediciidae	100	400	1	0.0007	
9/8/2022	4	RG_GHFF_BICA-02-2022-09-08_N	RG_GHFF_BICA-02-2022-09-08_N	1/3 m^2 kick & sweep	Dicranota	100	400	1		
9/8/2022	3	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Nematoda	100	400	1	0.0002	
9/8/2022		RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Planariidae	100	400	1	0.0033	
9/8/2022	2	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Polycelis	100	400	1		
9/8/2022	2	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Enchytraeidae	100	400	1	0.0002	
9/8/2022		RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Lebertiidae	100	400	1	0.0004	
9/8/2022	2	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Lebertia	100	400	1		
9/8/2022	8	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Ostracoda	100	400	1	0.0020	
9/8/2022		RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Capniidae	100	400	1	0.0001	
9/8/2022	1	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Capniidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1	0.0031	
9/8/2022	2	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Zapada	100	400	1		
9/8/2022	14	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0025	
9/8/2022	2	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Isoperla	100	400	1		
9/8/2022	2	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1	0.0002	
9/8/2022	1	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1	0.0003	
9/8/2022	3	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1		immature
9/8/2022		RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0602	
9/8/2022	39	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1		pupae
9/8/2022	36	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Pagastia	100	400	1		
9/8/2022	14	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	100	400	1		
9/8/2022	148	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Eukiefferiella	100	400	1		
9/8/2022	4	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Tvetenia	100	400	1		
9/8/2022		RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Empididae	100	400	1	0.0122	
9/8/2022	14	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Chelifera/Metachela	100	400	1		
9/8/2022	1	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Empididae	100	400	1		pupae
9/8/2022		RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Pelecorhyncidae	100	400	1	0.0001	

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/8/2022	1	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Glutops	100	400	1		
9/8/2022		RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Psychodidae	100	400	1	0.0002	
9/8/2022	3	RG_GHFF_BICA-3-2022-09-08_N	RG_GHFF_BICA-3-2022-09-08_N	1/3 m^2 kick & sweep	Pericoma	100	400	1		
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Planariidae	100	400	1	0.0285	
9/9/2022	13	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Polycelis	100	400	1		
9/9/2022	5	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Enchytraeidae	100	400	1	0.0005	
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Lebertiidae	100	400	1	0.0003	
9/9/2022	2	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Lebertia	100	400	1		
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Sperchonidae	100	400	1	0.0001	
9/9/2022	1	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Sperchon	100	400	1		
9/9/2022	35	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Ostracoda	100	400	1	0.0089	
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Elmidae	100	400	1	0.0003	
9/9/2022	2	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Elmidae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Ephemerellidae	100	400	1	0.0002	
9/9/2022	2	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Ephemerellidae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Capniidae	100	400	1	0.0006	
9/9/2022	4	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Paracapnia	100	400	1		
9/9/2022	1	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Capniidae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Chloroperlidae	100	400	1	0.0026	
9/9/2022	3	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Sweltsa	100	400	1		
9/9/2022	2	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Chloroperlidae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Leuctridae	100	400	1	0.0001	
9/9/2022	1	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Leuctridae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1	0.0020	
9/9/2022	3	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Zapada	100	400	1		
9/9/2022	14	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.3072	
9/9/2022	2	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Isoperla	100	400	1		
9/9/2022	10	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1	0.0001	
9/9/2022	1	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Hydropsychidae	100	400	1	0.1955	
9/9/2022	1	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Parapsyche	100	400	1		
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1	0.0003	
9/9/2022	3	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0103	
9/9/2022	8	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0204	
9/9/2022	14	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1		pupae
9/9/2022	1	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Boreoheptagyia	100	400	1		
9/9/2022	10	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Micropsectra	100	400	1		
9/9/2022	13	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Pagastia	100	400	1		
9/9/2022	1	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Pseudodiamesa	100	400	1		
9/9/2022	21	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	100	400	1		
9/9/2022	31	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Eukiefferiella	100	400	1		
9/9/2022	3	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Hydrobaenus	100	400	1		
9/9/2022	1	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Limnophyes	100	400	1		
9/9/2022	2	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Tvetenia	100	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Empididae	100	400	1	0.0298	
9/9/2022	16	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Chelifera/Metachela	100	400	1		
9/9/2022	1	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Clinocera	100	400	1		
9/9/2022	9	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Empididae	100	400	1		pupae
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Pelecorhyncidae	100	400	1	0.0037	
9/9/2022	3	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Glutops	100	400	1		
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Psychodidae	100	400	1	0.0048	
9/9/2022	50	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Pericoma	100	400	1		
9/9/2022		RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Pediciidae	100	400	1	0.0001	
9/9/2022	1	RG_GHFF_BICA-4-2022-09-09_N	RG_GHFF_BICA-4-2022-09-09_N	1/3 m^2 kick & sweep	Pedicia	100	400	1		
9/9/2022	22	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Planariidae	100	400	1	0.0253	
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Polycelis	100	400	1		
9/9/2022	17	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Enchytraeidae	100	400	1	0.0041	
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Lebertiidae	100	400	1	0.0002	
9/9/2022	1	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Lebertia	100	400	1		
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Sperchonidae	100	400	1	0.0002	
9/9/2022	1	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Sperchon	100	400	1		
9/9/2022	28	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Ostracoda	100	400	1	0.0043	
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Ephemerellidae	100	400	1	0.0005	
9/9/2022	6	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Ephemerellidae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Heptageniidae	100	400	1	0.0005	
9/9/2022	2	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Cinygmula	100	400	1		
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Capniidae	100	400	1	0.0001	
9/9/2022	1	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Capniidae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Chloroperlidae	100	400	1	0.0005	
9/9/2022	2	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Chloroperlidae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1	0.0113	
9/9/2022	9	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Zapada	100	400	1		
9/9/2022	33	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Nemouridae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0456	
9/9/2022	15	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Isoperla	100	400	1		
9/9/2022	1	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1	0.0024	
9/9/2022	9	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Taeniopterygidae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1	0.0004	
9/9/2022	4	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1		immature
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0094	
9/9/2022	6	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0811	
9/9/2022	65	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1		pupae
9/9/2022	2	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Micropsectra	100	400	1		
9/9/2022	104	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Pagastia	100	400	1		
9/9/2022	22	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	100	400	1		
9/9/2022	126	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Eukiefferiella	100	400	1		
9/9/2022	19	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Tvetenia	100	400	1		
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Empididae	100	400	1	0.0349	
9/9/2022	26	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Chelifera/Metachela	100	400	1		
9/9/2022	4	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Empididae	100	400	1		pupae

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Psychodidae	100	400	1	0.0024	
9/9/2022	22	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Pericoma	100	400	1		
9/9/2022		RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Pediciidae	100	400	1	0.0001	
9/9/2022	1	RG_GHFF_BICA-5-2022-09-09_N	RG_GHFF_BICA-5-2022-09-09_N	1/3 m^2 kick & sweep	Dicranota	100	400	1		
9/9/2022	2	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Nematoda	25	400	1	0.0001	
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Planariidae	25	400	1	0.0017	
9/9/2022	2	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Polycelis	25	400	1		
9/9/2022	9	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Enchytraeidae	25	400	1	0.0017	
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Lebertiidae	25	400	1	0.0002	
9/9/2022	1	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Lebertia	25	400	1		
9/9/2022	4	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Ostracoda	25	400	1	0.0006	
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Elmidae	25	400	1	0.0002	
9/9/2022	1	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Elmidae	25	400	1		immature
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Capniidae	25	400	1	0.0004	
9/9/2022	1	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Paracapnia	25	400	1		
9/9/2022	3	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Capniidae	25	400	1		immature
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Chloroperlidae	25	400	1	0.0002	
9/9/2022	1	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Chloroperlidae	25	400	1		immature
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Nemouridae	25	400	1	0.0054	
9/9/2022	5	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Zapada	25	400	1		
9/9/2022	14	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Nemouridae	25	400	1		immature
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Perlodidae	25	400	1	0.0668	
9/9/2022	12	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Isoperla	25	400	1		
9/9/2022	3	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Megarcys	25	400	1		
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0895	
9/9/2022	4	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Megarcys	100	400	1		
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Taeniopterygidae	25	400	1	0.0004	
9/9/2022	6	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Taeniopterygidae	25	400	1		immature
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Rhyacophilidae	25	400	1	0.0287	
9/9/2022	4	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Rhyacophila	25	400	1		
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1	0.0760	
9/9/2022	40	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1		pupae
9/9/2022	18	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Micropsectra	25	400	1		
9/9/2022	2	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Tanytarsus	25	400	1		
9/9/2022	108	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Pagastia	25	400	1		
9/9/2022	1	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Pseudodiamesa	25	400	1		
9/9/2022	32	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	25	400	1		
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Diplocladius	25	400	1		
9/9/2022	73	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Eukiefferiella	25	400	1		
9/9/2022	2	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Hydrobaenus	25	400	1		
9/9/2022	32	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Tvetenia	25	400	1		
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Empididae	25	400	1	0.0418	
9/9/2022	34	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Chelifera/Metachela	25	400	1		
9/9/2022	4	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Empididae	25	400	1		pupae
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Pelecorhyncidae	25	400	1	0.0006	
9/9/2022	1	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Glutops	25	400	1		
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Psychodidae	25	400	1	0.0022	
9/9/2022	24	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Pericoma	25	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Pediciidae	25	400	1	0.0020	
9/9/2022		RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Antocha	25	400	1		
9/9/2022	5	RG_GHFF_BICA-6-2022-09-09_N	RG_GHFF_BICA-6-2022-09-09_N	1/3 m^2 kick & sweep	Dicranota	25	400	1		
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Planariidae	25	400	1	0.0044	
9/15/2022	1	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Polycelis	25	400	1		
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Planariidae	6.25	400	1	0.0070	
9/15/2022	1	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Polycelis	6.25	400	1		
9/15/2022	12	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Enchytraeidae	25	400	1	0.0010	
9/15/2022	12	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Enchytraeidae	6.25	400	1	0.0010	
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Lebertiidae	25	400	1	0.0001	
9/15/2022	1	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Lebertia	25	400	1		
9/15/2022	8	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Ostracoda	25	400	1	0.0017	
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	6.25	400	1	0.0010	
9/15/2022	3	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	6.25	400	1		immature
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	25	400	1	0.0018	
9/15/2022	3	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Paracapnia	25	400	1		
9/15/2022	23	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	25	400	1		immature
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Nemouridae	25	400	1	0.0001	
9/15/2022	3	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Nemouridae	25	400	1		immature
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Peltoperlidae	25	400	1	0.0001	
9/15/2022	2	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Yoraperla	25	400	1		
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Perlodidae	25	400	1	0.0001	
9/15/2022	1	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Isoperla	25	400	1		
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Taeniopterygidae	25	400	1	0.0001	
9/15/2022	1	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Taeniopterygidae	25	400	1		immature
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Ceratopogonidae	25	400	1	0.0001	
9/15/2022	1	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Probezzia	25	400	1		
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	6.25	400	1	0.0079	
9/15/2022	1	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	6.25	400	1		pupae
9/15/2022	1	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Pagastia	6.25	400	1		
9/15/2022	2	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Pseudodiamesa	6.25	400	1		
9/15/2022	2	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	6.25	400	1		
9/15/2022	6	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Eukiefferiella	6.25	400	1		
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1	0.0519	
9/15/2022	11	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1		pupae
9/15/2022	26	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Pagastia	25	400	1		
9/15/2022	2	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Pseudodiamesa	25	400	1		
9/15/2022	1	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Corynoneura	25	400	1		
9/15/2022	51	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	25	400	1		
9/15/2022	66	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Eukiefferiella	25	400	1		
9/15/2022	12	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Hydrobaenus	25	400	1		
9/15/2022	4	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Tvetenia	25	400	1		
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Empididae	25	400	1	0.0007	
9/15/2022	1	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Empididae	25	400	1		pupae
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Psychodidae	6.25	400	1	0.0001	
9/15/2022	1	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Pericoma	6.25	400	1		
9/15/2022		RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Psychodidae	25	400	1	0.0003	
9/15/2022	4	RG_GHUT_BICA-1-2022-09-15_N	RG_GHUT_BICA-1-2022-09-15_N	1/3 m^2 kick & sweep	Pericoma	25	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/15/2022		RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Planariidae	25	400	1	0.0016	
9/15/2022	1	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Polycelis	25	400	1		
9/15/2022	3	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Enchytraeidae	25	400	1	0.0003	
9/15/2022		RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Naididae	100	400	1	0.0029	
9/15/2022	2	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Tubificinae	100	400	1		immature with hai
9/15/2022		RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Naididae	25	400	1	0.0020	
9/15/2022	2	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Tubificinae	25	400	1		immature with hai
9/15/2022	14	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Ostracoda	25	400	1	0.0034	
9/15/2022		RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	25	400	1	0.0031	
9/15/2022	1	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Mesocapnia	25	400	1		
9/15/2022	1	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Paracapnia	25	400	1		
9/15/2022	4	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	25	400	1		immature
9/15/2022		RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Chloroperlidae	25	400	1	0.0004	
9/15/2022	1	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Sweltsa	25	400	1		
9/15/2022	1	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Chloroperlidae	25	400	1		immature
9/15/2022		RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Peltoperlidae	25	400	1	0.0002	
9/15/2022	1	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Yoraperla	25	400	1		
9/15/2022		RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Perlodidae	25	400	1	0.0111	
9/15/2022	3	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Isoperla	25	400	1		
9/15/2022	1	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Megarcys	25	400	1		
9/15/2022		RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Taeniopterygidae	25	400	1	0.0001	
9/15/2022	2	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Taeniopterygidae	25	400	1		immature
9/15/2022		RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0152	
9/15/2022	1	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Pseudodiamesa	100	400	1		
9/15/2022		RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1	0.0308	
9/15/2022	4	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1		pupae
9/15/2022	13	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Pagastia	25	400	1		
9/15/2022	6	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Pseudodiamesa	25	400	1		
9/15/2022	1	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Brillia	25	400	1		
9/15/2022	9	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	25	400	1		
9/15/2022	24	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Eukiefferiella	25	400	1		
9/15/2022	5	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Hydrobaenus	25	400	1		
9/15/2022	4	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Tvetenia	25	400	1		
9/15/2022		RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Empididae	25	400	1	0.0039	
9/15/2022	1	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Clinocera	25	400	1		
9/15/2022	1	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Empididae	25	400	1		pupae
9/15/2022		RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Psychodidae	25	400	1	0.0016	
9/15/2022	6	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Pericoma	25	400	1		
9/15/2022		RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Pediciidae	25	400	1	0.0016	
9/15/2022	5	RG_GHUT_BICA-2_2022-09-15_N	RG_GHUT_BICA-2_2022-09-15_N	1/3 m^2 kick & sweep	Dicranota	25	400	1		
9/15/2022		RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Planariidae	100	400	1	0.0162	
9/15/2022	3	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Polycelis	100	400	1		
9/15/2022	1	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Enchytraeidae	100	400	1	0.0011	
9/15/2022	51	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Ostracoda	100	400	1	0.0130	
9/15/2022	1	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Collembola	100	400	1	0.0008	
9/15/2022		RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	100	400	1	0.0175	
9/15/2022	8	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Mesocapnia	100	400	1		
9/15/2022	4	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	100	400	1		immature

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/15/2022		RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Peltoperlidae	100	400	1	0.0004	
9/15/2022	2	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Yoraperla	100	400	1		
9/15/2022		RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Perlodidae	100	400	1	0.0077	
9/15/2022	10	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Isoperla	100	400	1		
9/15/2022		RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1	0.0013	
9/15/2022	9	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Limnephilidae	100	400	1		immature
9/15/2022		RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Rhyacophilidae	100	400	1	0.0209	
9/15/2022	1	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Rhyacophila	100	400	1		pupae
9/15/2022		RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1	0.0493	
9/15/2022	2	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	100	400	1		pupae
9/15/2022	9	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Pseudodiamesa	100	400	1		
9/15/2022	2	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Brillia	100	400	1		
9/15/2022	1	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Eukiefferiella	100	400	1		
9/15/2022	17	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Hydrobaenus	100	400	1		
9/15/2022		RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Empididae	100	400	1	0.0046	
9/15/2022	2	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Clinocera	100	400	1		
9/15/2022	1	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Empididae	100	400	1		pupae
9/15/2022		RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Pelecorhyncidae	100	400	1	0.0076	
9/15/2022	1	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Glutops	100	400	1		
9/15/2022		RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Psychodidae	100	400	1	0.0050	
9/15/2022	23	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Pericoma	100	400	1		
9/15/2022		RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Pediciidae	100	400	1	0.0149	
9/15/2022	8	RG_GHUT_BICA-3_2022-09-15_N	RG_GHUT_BICA-3_2022-09-15_N	1/3 m^2 kick & sweep	Dicranota	100	400	1		
9/15/2022		RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Planariidae	50	400	1	0.0017	
9/15/2022	2	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Polycelis	50	400	1		
9/15/2022	4	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Enchytraeidae	50	400	1	0.0008	
9/15/2022	7	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Ostracoda	50	400	1	0.0022	
9/15/2022		RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Elmidae	50	400	1	0.0017	
9/15/2022	1	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Heterlimnius	50	400	1		
9/15/2022		RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	50	400	1	0.0035	
9/15/2022	1	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Mesocapnia	50	400	1		
9/15/2022	4	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	50	400	1		immature
9/15/2022		RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1	0.0003	
9/15/2022	1	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Nemouridae	50	400	1		immature
9/15/2022		RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Perlodidae	50	400	1	0.0036	
9/15/2022	5	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Isoperla	50	400	1		
9/15/2022		RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Limnephilidae	50	400	1	0.0001	
9/15/2022	1	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Limnephilidae	50	400	1		immature
9/15/2022		RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1	0.0320	
9/15/2022	8	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	50	400	1		pupae
9/15/2022	6	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Pagastia	50	400	1		
9/15/2022	13	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Pseudodiamesa	50	400	1		
9/15/2022	1	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	50	400	1		
9/15/2022	7	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Eukiefferiella	50	400	1		
9/15/2022	3	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Hydrobaenus	50	400	1		
9/15/2022	8	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Tvetenia	50	400	1		
9/15/2022		RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Empididae	50	400	1	0.0033	
9/15/2022	1	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Chelifera/Metachela	50	400	1		

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9/15/2022	1	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Clinocera	50	400	1		
9/15/2022	2	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Empididae	50	400	1		pupae
9/15/2022		RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Psychodidae	50	400	1	0.0046	
9/15/2022	22	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Pericoma	50	400	1		
9/15/2022		RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Pediciidae	50	400	1	0.0011	
9/15/2022	3	RG_GHUT_BICA-4_2022-09-15_N	RG_GHUT_BICA-4_2022-09-15_N	1/3 m^2 kick & sweep	Dicranota	50	400	1		
9/15/2022	4	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Enchytraeidae	25	400	1	0.0006	
9/15/2022	4	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Ostracoda	25	400	1	0.0010	
9/15/2022		RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Elmidae	25	400	1	0.0024	
9/15/2022	1	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Heterlimnius	25	400	1		
9/15/2022		RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	25	400	1	0.0081	
9/15/2022	2	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Mesocapnia	25	400	1		
9/15/2022	1	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Paracapnia	25	400	1		
9/15/2022	18	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	25	400	1		immature
9/15/2022		RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Peltoperlidae	25	400	1	0.0018	
9/15/2022	2	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Yoraperla	25	400	1		
9/15/2022		RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Perlodidae	25	400	1	0.0154	
9/15/2022	8	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Isoperla	25	400	1		
9/15/2022	2	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Megarcys	25	400	1		
9/15/2022		RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Limnephilidae	25	400	1	0.0025	
9/15/2022	11	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Limnephilidae	25	400	1		
9/15/2022		RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1	0.0394	
9/15/2022	14	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	25	400	1		pupae
9/15/2022	1	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Diamesa	25	400	1		
9/15/2022	10	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Pagastia	25	400	1		
9/15/2022	15	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Pseudodiamesa	25	400	1		
9/15/2022	1	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Brillia	25	400	1		
9/15/2022	30	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Eukiefferiella	25	400	1		
9/15/2022	17	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Hydrobaenus	25	400	1		
9/15/2022	21	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Tvetenia	25	400	1		
9/15/2022		RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Empididae	25	400	1	0.0085	
9/15/2022	3	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Clinocera	25	400	1		
9/15/2022	1	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Wiedemannia	25	400	1		
9/15/2022	1	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Empididae	25	400	1		pupae
9/15/2022		RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Psychodidae	25	400	1	0.0105	
9/15/2022	38	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Pericoma	25	400	1		
9/15/2022		RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Pediciidae	25	400	1	0.0002	
9/15/2022	1	RG_GHUT_BICA-5_2022-09-15_N	RG_GHUT_BICA-5_2022-09-15_N	1/3 m^2 kick & sweep	Dicranota	25	400	1		
9/15/2022	1	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Nematoda	12.5	400	1	0.0001	
9/15/2022		RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Planariidae	12.5	400	1	0.0091	
9/15/2022	3	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Polycelis	12.5	400	1		
9/15/2022	3	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Enchytraeidae	12.5	400	1	0.0005	
9/15/2022	13	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Ostracoda	12.5	400	1	0.0039	
9/15/2022		RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Elmidae	12.5	400	1	0.0003	
9/15/2022	2	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Elmidae	12.5	400	1		immature
9/15/2022		RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	12.5	400	1	0.0281	
9/15/2022	10	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Mesocapnia	12.5	400	1		
9/15/2022	3	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Paracapnia	12.5	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	%_SAMPLED	MESH	POOLED_REPS	MEASURED_BIOMASS	QC_COMMENTS
9/15/2022	18	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Capniidae	12.5	400	1		
9/15/2022		RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Leuctridae	12.5	400	1	0.0001	
9/15/2022	1	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Leuctridae	12.5	400	1		
9/15/2022		RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Nemouridae	12.5	400	1	0.0086	
9/15/2022	3	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Zapada	12.5	400	1		
9/15/2022	5	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Nemouridae	12.5	400	1		immature
9/15/2022		RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Peltoperlidae	12.5	400	1	0.0018	
9/15/2022	1	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Yoraperla	12.5	400	1		
9/15/2022		RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Perlodidae	12.5	400	1	0.0184	
9/15/2022	12	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Isoperla	12.5	400	1		
9/15/2022	1	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Megarcys	12.5	400	1		
9/15/2022		RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Limnephilidae	12.5	400	1	0.0019	
9/15/2022	7	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Limnephilidae	12.5	400	1		immature
9/15/2022		RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	12.5	400	1	0.0718	
9/15/2022	41	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Chironomidae	12.5	400	1		pupae
9/15/2022	1	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Micropsectra	12.5	400	1		
9/15/2022	1	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Diamesa	12.5	400	1		
9/15/2022	25	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Pagastia	12.5	400	1		
9/15/2022	14	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Pseudodiamesa	12.5	400	1		
9/15/2022	17	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Cricotopus/Orthocladius	12.5	400	1		
9/15/2022	98	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Eukiefferiella	12.5	400	1		
9/15/2022	9	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Hydrobaenus	12.5	400	1		
9/15/2022	2	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Tvetenia	12.5	400	1		
9/15/2022		RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Empididae	12.5	400	1	0.0064	
9/15/2022	3	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Empididae	12.5	400	1		pupae
9/15/2022		RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Psychodidae	12.5	400	1	0.0070	
9/15/2022	21	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Pericoma	12.5	400	1		
9/15/2022		RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Pediciidae	12.5	400	1	0.0145	
9/15/2022	4	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Dicranota	12.5	400	1		
9/15/2022		RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Tipulidae	12.5	400	1	0.0022	
9/15/2022	1	RG_GHUT_BICA-6_2022-09-15_N	RG_GHUT_BICA-6_2022-09-15_N	1/3 m^2 kick & sweep	Tipula	12.5	400	1		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	PERCENT_SAMPLED	MESH	POOLED_REPS	AREA_PER_REP	MEASURED_BIOMASS	QC_COMMENTS
9/20/2022	1	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Nematoda	25	500	5	0.0232	0.0001	
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Naididae	25	500	5	0.0232	0.0027	
9/20/2022	2	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Tubificinae	25	500	5	0.0232		immature with hair chaetae
9/20/2022	3	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Limnodrilus udekemianus	25	500	5	0.0232		
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Pionidae	25	500	5	0.0232	0.0002	
9/20/2022	2	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Pionidae	25	500	5	0.0232		indeterminate
9/20/2022	47	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Ostracoda	25	500	5	0.0232	0.0123	
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Gammaridae	25	500	5	0.0232	0.3423	
9/20/2022	16	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Gammarus lacustris	25	500	5	0.0232		
9/20/2022	8	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Gammarus	25	500	5	0.0232		
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Hyalellidae	25	500	5	0.0232	0.0110	
9/20/2022	8	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Hyalella	25	500	5	0.0232		
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Haliplidae	25	500	5	0.0232	0.0003	
9/20/2022	1	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Haliplus	25	500	5	0.0232		
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Baetidae	25	500	5	0.0232	0.0050	
9/20/2022	10	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Callibaetis	25	500	5	0.0232		
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Coenagrionidae	25	500	5	0.0232	0.0002	
9/20/2022	1	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Coenagrionidae	25	500	5	0.0232		immature
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Chironomidae	25	500	5	0.0232	0.3133	
9/20/2022	2	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Chironomidae	25	500	5	0.0232		pupae
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Chironomidae	25	500	5	0.0232		
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Apedilum	25	500	5	0.0232		
9/20/2022	55	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Chironomus	25	500	5	0.0232		
9/20/2022	3	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Cryptochironomus	25	500	5	0.0232		
9/20/2022	1	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Sergentia	25	500	5	0.0232		
9/20/2022	6	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Stictochironomus	25	500	5	0.0232		
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Micropsectra	25	500	5	0.0232		
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Paratanytarsus	25	500	5	0.0232		
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Polypedilum	25	500	5	0.0232		
9/20/2022	18	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Tanytarsus	25	500	5	0.0232		
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Diamesa	25	500	5	0.0232		
9/20/2022	1	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Pagastia	25	500	5	0.0232		
9/20/2022	7	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Psectrocladius	25	500	5	0.0232		
9/20/2022	21	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Ablabesmyia	25	500	5	0.0232		
9/20/2022	13	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Procladius	25	500	5	0.0232		
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Planorbidae	25	500	5	0.0232	0.0075	
9/20/2022	12	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Gyraulus	25	500	5	0.0232		
9/20/2022		RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Pisidiidae	25	500	5	0.0232	0.1677	
9/20/2022	26	RG_GHP_BICA-01-2022-09-19	RG_GHP_BICA-01-2022-09-19	Petite Ponar	Pisidium (Cyclocalyx)	25	500	5	0.0232		
9/19/2022	43	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Ostracoda	12.5	500	5	0.0232	0.0094	
9/19/2022		RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Gammaridae	12.5	500	5	0.0232	0.0544	
9/19/2022	1	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Gammarus lacustris	12.5	500	5	0.0232		
9/19/2022	5	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Gammarus	12.5	500	5	0.0232		
9/19/2022		RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Hyalellidae	12.5	500	5	0.0232	0.0169	
9/19/2022	21	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Hyalella	12.5	500	5	0.0232		
9/19/2022		RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Baetidae	12.5	500	5	0.0232	0.0002	
9/19/2022	1	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Callibaetis	12.5	500	5	0.0232		
9/19/2022		RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Coenagrionidae	12.5	500	5	0.0232	0.0018	
9/19/2022	1	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Coenagrionidae	12.5	500	5	0.0232		immature
9/19/2022		RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Chironomidae	12.5	500	5	0.0232	0.0271	
9/19/2022	5	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Chironomus	12.5	500	5	0.0232		
9/19/2022	4	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Cryptochironomus	12.5	500	5	0.0232		
9/19/2022	3	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Stictochironomus	12.5	500	5	0.0232		
9/19/2022	1	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Paratanytarsus	12.5	500	5	0.0232		
9/19/2022	2	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Psectrocladius	12.5	500	5	0.0232		
9/19/2022	20	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Ablabesmyia	12.5	500	5	0.0232		
9/19/2022	3	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Procladius	12.5	500	5	0.0232		

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	PERCENT_SAMPLED	MESH	POOLED_REPS	AREA_PER_REP	MEASURED_BIOMASS	QC_COMMENTS
9/19/2022		RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Planorbidae	12.5	500	5	0.0232	0.0417	
9/19/2022	51	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Gyraulus	12.5	500	5	0.0232		
9/19/2022		RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Pisidiidae	12.5	500	5	0.0232	0.3271	
9/19/2022	138	RG_GHP_BICA-02-2022-09-19	RG_GHP_BICA-02-2022-09-19	Petite Ponar	Pisidium (Cyclocalyx)	12.5	500	5	0.0232		
9/19/2022	236	RG_GHP_BICA-03-2022-09-19	RG_GHP_BICA-03-2022-09-19	Petite Ponar	Ostracoda	50	500	5	0.0232	0.0466	
9/19/2022		RG_GHP_BICA-03-2022-09-19	RG_GHP_BICA-03-2022-09-19	Petite Ponar	Gammaridae	50	500	5	0.0232	0.0311	
9/19/2022	1	RG_GHP_BICA-03-2022-09-19	RG_GHP_BICA-03-2022-09-19	Petite Ponar	Gammarus lacustris	50	500	5	0.0232		
9/19/2022		RG_GHP_BICA-03-2022-09-19	RG_GHP_BICA-03-2022-09-19	Petite Ponar	Chaoboridae	50	500	5	0.0232	0.0040	
9/19/2022	1	RG_GHP_BICA-03-2022-09-19	RG_GHP_BICA-03-2022-09-19	Petite Ponar	Chaoborus flavicans	50	500	5	0.0232		
9/19/2022		RG_GHP_BICA-03-2022-09-19	RG_GHP_BICA-03-2022-09-19	Petite Ponar	Chironomidae	50	500	5	0.0232	0.5568	
9/19/2022	193	RG_GHP_BICA-03-2022-09-19	RG_GHP_BICA-03-2022-09-19	Petite Ponar	Chironomus	50	500	5	0.0232		
9/19/2022	20	RG_GHP_BICA-03-2022-09-19	RG_GHP_BICA-03-2022-09-19	Petite Ponar	Cryptochironomus	50	500	5	0.0232		
9/19/2022	6	RG_GHP_BICA-03-2022-09-19	RG_GHP_BICA-03-2022-09-19	Petite Ponar	Tanytarsus	50	500	5	0.0232		
9/19/2022	40	RG_GHP_BICA-03-2022-09-19	RG_GHP_BICA-03-2022-09-19	Petite Ponar	Procladius	50	500	5	0.0232		
9/19/2022		RG_GHP_BICA-03-2022-09-19	RG_GHP_BICA-03-2022-09-19	Petite Ponar	Pisidiidae	50	500	5	0.0232	1.2504	
9/19/2022	340	RG_GHP_BICA-03-2022-09-19	RG_GHP_BICA-03-2022-09-19	Petite Ponar	Pisidium (Cyclocalyx)	50	500	5	0.0232		
9/19/2022	62	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Ostracoda	25	500	5	0.0232	0.0133	
9/19/2022		RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Gammaridae	100	500	5	0.0232	1.2799	
9/19/2022		RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Gammaridae	25	500	5	0.0232	0.2238	
9/19/2022	22	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Gammarus lacustris	100	500	5	0.0232		
9/19/2022	7	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Gammarus lacustris	25	500	5	0.0232		
9/19/2022	4	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Gammarus	25	500	5	0.0232		
9/19/2022		RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Hyalellidae	25	500	5	0.0232	0.0001	
9/19/2022	1	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Hyalella	25	500	5	0.0232		
9/19/2022		RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Baetidae	25	500	5	0.0232	0.0026	
9/19/2022	6	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Callibaetis	25	500	5	0.0232		
9/19/2022		RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Chironomidae	25	500	5	0.0232	0.0687	
9/19/2022	1	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Chironomidae	25	500	5	0.0232		pupae
9/19/2022	13	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Chironomus	25	500	5	0.0232		
9/19/2022	2	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Cryptochironomus	25	500	5	0.0232		
9/19/2022	1	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Stictochironomus	25	500	5	0.0232		
9/19/2022	16	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Tanytarsus	25	500	5	0.0232		
9/19/2022	2	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Psectrocladius	25	500	5	0.0232		
9/19/2022	9	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Ablabesmyia	25	500	5	0.0232		
9/19/2022	2	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Procladius	25	500	5	0.0232		
9/19/2022		RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Planorbidae	25	500	5	0.0232	0.0004	
9/19/2022	3	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Gyraulus	25	500	5	0.0232		
9/19/2022		RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Pisidiidae	25	500	5	0.0232	0.5044	
9/19/2022	185	RG_GHP_BICA-04-2022-09-19	RG_GHP_BICA-04-2022-09-19	Petite Ponar	Pisidium (Cyclocalyx)	25	500	5	0.0232		
9/19/2022	2	RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Nematoda	100	500	5	0.0232	0.0002	
9/19/2022	322	RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Ostracoda	100	500	5	0.0232	0.0634	
9/19/2022		RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Gammaridae	100	500	5	0.0232	0.0618	
9/19/2022	2	RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Gammarus lacustris	100	500	5	0.0232		
9/19/2022		RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Chaoboridae	100	500	5	0.0232	0.0049	
9/19/2022	1	RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Chaoborus flavicans	100	500	5	0.0232		
9/19/2022		RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Chironomidae	100	500	5	0.0232	0.1904	
9/19/2022	61	RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Chironomidae	100	500	5	0.0232		pupae
9/19/2022	38	RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Chironomus	100	500	5	0.0232		
9/19/2022	11	RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Cryptochironomus	100	500	5	0.0232		
9/19/2022	26	RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Tanytarsus	100	500	5	0.0232		
9/19/2022	47	RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Procladius	100	500	5	0.0232		
9/19/2022		RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Planorbidae	100	500	5	0.0232	0.0071	
9/19/2022	1	RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Gyraulus	100	500	5	0.0232		
9/19/2022		RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Pisidiidae	100	500	5	0.0232	1.8728	
9/19/2022	381	RG_GHP_BICA-05-2022-09-20	RG_GHP_BICA-05-2022-09-20	Petite Ponar	Pisidium (Cyclocalyx)	100	500	5	0.0232		
9/20/2022	298	RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Ostracoda	100	500	5	0.0232	0.0705	
9/20/2022		RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Gammaridae	100	500	5	0.0232	0.0366	

survey_date	quantity	observ_sample_code	LAB_SAMPLE_ID	BIC_SAMPLE_METHOD	BENCH_TAXON_NAME	PERCENT_SAMPLED	MESH	POOLED_REPS	AREA_PER_REP	MEASURED_BIOMASS	QC_COMMENTS
9/20/2022	3	RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Gammarus lacustris	100	500	5	0.0232		
9/20/2022		RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Phryganeidae	100	500	5	0.0232	0.0183	
9/20/2022	1	RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Phryganea	100	500	5	0.0232		
9/20/2022		RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Chaoboridae	100	500	5	0.0232	0.0644	
9/20/2022	17	RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Chaoborus flavicans	100	500	5	0.0232		
9/20/2022		RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Chironomidae	100	500	5	0.0232	0.3067	
9/20/2022	4	RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Chironomidae	100	500	5	0.0232		pupae
9/20/2022	51	RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Chironomus	100	500	5	0.0232		
9/20/2022	24	RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Cryptochironomus	100	500	5	0.0232		
9/20/2022	111	RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Tanytarsus	100	500	5	0.0232		
9/20/2022	1	RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Ablabesmyia	100	500	5	0.0232		
9/20/2022	113	RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Procladius	100	500	5	0.0232		
9/20/2022		RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Pisidiidae	100	500	5	0.0232	2.3928	
9/20/2022	541	RG_GHP_BICA-06-2022-09-20	RG_GHP_BICA-06-2022-09-20	Petite Ponar	Pisidium (Cyclocalyx)	100	500	5	0.0232		

TRICHANALYTICS - BENTHIC INVERTEBRATE TISSUE

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client: Amy Wiebe
Aquatic Scientist
Minnow Environmental
Phone: (250) 595-1627
Email: awiebe@minnow.ca

Date Received:	10 Mar 2022
Date of Analysis:	15 Mar 2022
Final Report Date:	16 Mar 2022
Project No.:	2022-315
Method No.:	MET-002.05

Client Project: GGCAMP (22-16)

Analytical Request: Composite-Taxa Benthic Invertebrate Tissues (total metals and moisture) - 4 samples.
See chain of custody form provided for sample identification numbers.

Notes:

Analytical results are expressed in parts per million (ppm) dry weight (equivalent to mg/kg)
Samples quantified using DORM-4, NIST-1566b, and NIST-2976 certified reference standards.
Aluminum concentrations above 1,000 ppm are outside linear range of the calibration curve.
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.
Client specific DQO for Selenium accuracy is 90-110% of the certified value; result achieved 110%.

This report provides the analytical results only for tissue samples noted above as received from the Client.

Reviewed and Approved by Jennie Christensen, PhD, RPBio

16 Mar 2022
Date

TrichAnalytics Inc.
207-1753 Sean Heights
Saanichton, BC V8M 0B3
www.trichanalytics.com

CALA
Testing
Accreditation No. A4196

Tissue Analysis Results

		Client ID	RG_GHBP_INV-01_2022-02-28	RG_GHBP_INV-03_2022-02-28	RG_GHBP_INV-05_2022-02-28	RG_GHBP_INVLUM-05_2022-02-28
		Lab ID	046	047	048	049
		Wet Weight (g)	0.3347	0.5297	0.3272	0.1842
		Dry Weight (g)	0.0543	0.0759	0.0558	0.0310
		Moisture (%)	83.8	85.7	82.9	83.2
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.002	0.007	2.6	1.0	0.731	2.8
11B	0.060	0.200	6.9	3.2	1.8	7.9
23Na	1.1	3.7	5,111	5,014	3,920	2,909
24Mg	0.015	0.050	2,763	2,453	2,168	1,672
27Al	0.022	0.073	6,600	1,737	1,199	10,483
31P	39	130	12,342	12,250	12,728	12,041
39K	1.2	4.0	10,870	8,693	9,410	10,735
44Ca	14	47	26,453	28,068	6,252	7,302
49Ti	0.125	0.417	478	95	66	690
51V	0.028	0.093	7.8	2.2	1.3	10
52Cr	0.376	1.3	19	6.9	2.4	25
55Mn	0.009	0.030	109	100	91	69
57Fe	0.454	1.5	1,470	448	247	2,325
59Co	0.004	0.013	1.7	0.815	0.568	4.8
60Ni	0.038	0.127	43	26	13	51
63Cu	0.004	0.013	27	24	19	13
66Zn	0.353	1.2	165	163	152	156
75As	0.366	1.2	1.2	0.814	0.458	8.9
77Se	0.431	1.4	23	27	21	248
88Sr	0.001	0.003	32	29	8.4	11
95Mo	0.001	0.003	0.487	0.442	0.261	0.902
107Ag	0.001	0.003	0.257	0.238	0.104	0.479
111Cd	0.048	0.160	0.654	0.606	0.510	11
118Sn	0.018	0.060	0.957	0.735	0.538	1.6
121Sb	0.047	0.157	0.122	0.091	0.061	0.292
137Ba	0.001	0.003	124	69	38	112
202Hg	0.023	0.077	0.098	0.101	0.098	0.624
205Tl	0.001	0.003	0.148	0.057	0.047	0.261
208Pb	0.002	0.007	1.2	0.589	0.425	1.6
238U	0.001	0.003	0.359	0.232	0.121	0.529

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Resources

Tissue QA/QC Relative Percent Difference Results

Client ID	RG_GHBP_INV-01_2022-02-28
Lab ID	046

Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.002	2.6	2.3	12
11B	0.060	6.9	5.8	17
23Na	1.1	5,111	5,155	0.9
24Mg	0.015	2,763	2,550	8.0
27Al	0.022	6,600	4,730	33
31P	39	12,342	11,586	6.3
39K	1.2	10,870	11,044	1.6
44Ca	14	26,453	34,428	26
49Ti	0.125	478	360	28
51V	0.028	7.8	7.0	11
52Cr	0.376	19	19	0.0
55Mn	0.009	109	114	4.5
57Fe	0.454	1,470	1,516	3.1
59Co	0.004	1.7	1.6	6.1
60Ni	0.038	43	47	8.9
63Cu	0.004	27	31	14
66Zn	0.353	165	142	15
75As	0.366	1.2	0.992	-
77Se	0.431	23	21	9.1
88Sr	0.001	32	30	6.5
95Mo	0.001	0.487	0.541	11
107Ag	0.001	0.257	0.245	4.8
111Cd	0.048	0.654	0.694	5.9
118Sn	0.018	0.957	0.754	24
121Sb	0.047	0.122	0.121	-
137Ba	0.001	124	89	33
202Hg	0.023	0.098	0.092	-
205Tl	0.001	0.148	0.124	18
208Pb	0.002	1.2	1.2	0.0
238U	0.001	0.359	0.393	9.0

Notes:

ppm = parts per million

RPD = relative percent difference

DL = detection limit

< = less than detection limit

% = percent

Data Quality Objectives:

Laboratory Duplicates - RPD ≤40% for all elements, except Ca and Sr, which are ≤60%

Minimum DQOs apply to individual samples at concentrations above 10x DL

Teck Resources

Tissue QA/QC Accuracy and Precision Results

Sample Group ID: 01

Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.002	1.21	1.3	104	7.1
11B	0.060	4.5	5.1	113	4.2
23Na	1.1	14,000	15,321	109	2.7
24Mg	0.015	910	1,053	116	4.5
27Al	0.022	197.2	225	114	10
31P	39	8,000	9,143	114	4.3
39K	1.2	15,500	17,293	112	3.9
44Ca	14	2,360	2,702	114	3.2
49Ti	0.125	12.24	14	118	15
51V	0.028	1.57	1.8	113	13
52Cr	0.376	1.87	2.2	116	6.2
55Mn	0.009	3.17	3.9	123	4.8
57Fe	0.454	343	403	118	4.6
59Co	0.004	0.25	0.300	120	5.6
60Ni	0.038	1.34	1.6	122	3.3
63Cu	0.004	15.7	19	121	5.3
66Zn	0.353	51.6	62	120	7.3
75As	0.366	6.87	7.8	113	3.7
77Se	0.431	3.45	3.8	110	0.0
88Sr	0.001	10.1	12	115	4.7
95Mo	0.001	0.29	0.321	111	5.0
107Ag	0.001	0.0252	0.030	118	6.0
111Cd	0.048	0.299	0.371	124	6.4
118Sn	0.018	0.061	0.066	109	6.5
121Sb	0.047	0.011	0.010	91	14
137Ba	0.001	8.6	9.1	106	5.7
202Hg	0.023	0.412	0.468	114	8.6
205Tl	0.001	0.0013	-	-	-
208Pb	0.002	0.404	0.427	106	8.4
238U	0.001	0.05	0.054	108	16

Notes:

ppm = parts per million; % = percent; DL = detection limit; RSD = relative standard deviation

Data Quality Objectives:

Accuracy: DQO of 60 - 140% of the certified values for B, Ti, Ag, Sn, Sb, and Ba.

Accuracy: DQO of 90 - 110% of the certified values for Se.

Accuracy: DQO of 70 - 130% of the certified values for all other elements provided.

Precision: DQO of ≤20% for all elements.

DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.

Tl certified concentration from NIST-2976.

Accuracy and precision for Tl are not reported as the certified concentration is too close to the reportable detection limit.

Teck Resources
Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	RG_GHBP_INV-01_2022-02-28	046	15 Mar 2022
	RG_GHBP_INV-03_2022-02-28	047	
	RG_GHBP_INV-05_2022-02-28	048	
	RG_GHBP_INVLUM-05_2022-02-28	049	

TrichAnalytics Inc. 207-1753 Sean Heights, Saanichton, BC, V8M 0B3 Ph: (250) 532-1084	Chain of Custody (COC) for LA-ICP-MS Analysis

Invoicing		Reporting (if different from Invoicing)	
Project Number: GGCAMP (22-16) (PO 748530)			
Company Name:	Teck Coal Limited	Company Name:	Minnow Environmental
Contact Name:	Giovanna Diaz	Contact Name:	Amy Wiebe
Address:	421 Pine Avenue	Address:	2 Lamb Street
City, Province:	Sparwood, BC	City, Province:	Georgetown, ON
Postal Code:	V0B 2G0	Postal Code:	L7G 2G7
Phone:	250-425-8202	Phone:	250-595-1627
Email:	mike.pope@teck.com	Email:	awiebe@minnow.ca

Sample Analysis Requested

Trich ID	Sample Identification:	Sample Type: Species	Sample type
046	1 RG_GHBP_INV-01_2022-02-28 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
047	2 RG_GHBP_INV-03_2022-02-28 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
048	3 RG_GHBP_INV-05_2022-02-28 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
049	4 RG_GHBP_INVLUM-05_2022-02-28 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
	5	Composite	Composite-taxa benthic invertebrate tissue samples
	6	Composite	Composite-taxa benthic invertebrate tissue samples
	7	Composite	Composite-taxa benthic invertebrate tissue samples
	8	Composite	Composite-taxa benthic invertebrate tissue samples
	9	Composite	Composite-taxa benthic invertebrate tissue samples
	10	Composite	Composite-taxa benthic invertebrate tissue samples
	11	Composite	Composite-taxa benthic invertebrate tissue samples
	12	Composite	Composite-taxa benthic invertebrate tissue samples
	13	Composite	Composite-taxa benthic invertebrate tissue samples
	14	Composite	Composite-taxa benthic invertebrate tissue samples
	15	Composite	Composite-taxa benthic invertebrate tissue samples
	16	Composite	Composite-taxa benthic invertebrate tissue samples
	17	Composite	Composite-taxa benthic invertebrate tissue samples
	18	Composite	Composite-taxa benthic invertebrate tissue samples
	19	Composite	Composite-taxa benthic invertebrate tissue samples
	20	Composite	Composite-taxa benthic invertebrate tissue samples

Sample(s) Released By: Maddy Stokes	Sample(s) Received By: Elliot Howell
Signature:	Signature:
Date Sent: 10-Mar-22	Date Received: 11 Mar 2022 (Proj # 2022-315)
Sample(s) Returned to Client By:	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client:	Giovanna Diaz Project Manager Teck Coal Limited	Date Received:	20 Sep 2022
		Date of Analysis:	26 Sep 2022 27 Sep 2022
Phone:	(250) 865-3048	Final Report Date:	06 Oct 2022
Email:	lisa.bowron@minnow.ca; awiebe@minnow.ca; giovanna.diaz@teck.com aquascilab@teck.com; teck.lab.results@teck.com; teckcoal@equisonline.com	Project No.:	2022-398
		Method No.:	MET-002.06

Client Project: REP_LAEMP_GC_2022-09 Regional Effects Program (PO 818999)

Analytical Request: Composite Benthic Invertebrate Tissue Microchemistry (total metals & moisture) - 23 samples. See chain of custody form provided for sample identification numbers.

Notes:
Analytical results are expressed in parts per million (ppm) dry weight (equivalent to mg/kg).
Samples quantified using DORM-4, NIST-1566b, and NIST-2976 certified reference standards.
Aluminum concentrations above 1,000 ppm are outside linear range of the calibration curve.
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.
Client specific DQO for Selenium accuracy is 90-110% of the certified value; result achieved 96% (ranging from 94-97%).

This report provides the analytical results only for tissue samples noted above as received from the Client.

Reviewed and Approved by Jennie Christensen, PhD, RPBio

06 Oct 2022
Date

TrichAnalytics Inc.
207-1753 Sean Heights
Saanichton, BC V8M 0B3
www.trichanalytics.com

CALA Testing Accreditation No. A4196

Teck Coal Limited

Tissue Analysis Results

		Client ID	RG_GANF_INV-1_2022-09-13_N	RG_GANF_INV-3_2022-09-13_N	RG_GANF_INV-5_2022-09-13_N	RG_GAUT_INV-1_2022-09-14_N	RG_GAUT_INV-3_2022-09-14_N
		Lab ID	174	175	176	177	178
		Wet Weight (g)	0.6012	0.3354	0.3324	0.2490	0.2395
		Dry Weight (g)	0.1345	0.0700	0.0822	0.0391	0.0542
		Moisture (%)	77.6	79.1	75.3	84.3	77.4
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.019	0.063	1.7	1.9	2.6	5.2	11
11B	0.060	0.200	3.1	3.0	3.8	13	23
23Na	5.7	19	3,245	3,983	2,465	3,655	4,131
24Mg	0.078	0.260	1,798	2,761	2,516	2,182	2,987
27Al	0.087	0.290	3,197	3,193	4,057	12,497	21,316
31P	88	293	9,093	11,555	8,285	9,035	10,073
39K	2.8	9.3	9,576	12,870	10,659	12,773	18,525
44Ca	6.1	20	8,589	18,424	13,761	5,451	6,405
49Ti	0.001	0.003	608	208	338	914	1,682
51V	0.036	0.120	5.4	4.7	9.3	20	49
52Cr	0.061	0.203	13	17	18	70	241
55Mn	0.008	0.027	36	30	41	117	169
57Fe	0.801	2.7	883	1,098	1,388	3,941	9,639
59Co	0.014	0.047	0.670	0.815	1.5	2.9	13
60Ni	0.052	0.173	22	33	32	113	307
63Cu	0.018	0.060	16	16	19	25	35
66Zn	0.230	0.767	98	108	101	225	241
75As	0.431	1.4	<0.431	0.741	0.860	1.5	3.1
77Se	0.579	1.9	2.9	2.2	2.7	7.3	5.8
88Sr	0.001	0.003	12	16	24	21	29
95Mo	0.001	0.003	0.448	0.211	0.395	1.7	1.1
107Ag	0.001	0.003	0.165	0.117	0.213	0.261	0.412
111Cd	0.070	0.233	0.307	0.284	0.331	3.1	1.6
118Sn	0.022	0.073	0.388	0.490	0.470	0.870	1.4
121Sb	0.004	0.013	0.113	0.123	0.134	0.379	0.759
137Ba	0.001	0.003	59	66	112	190	321
202Hg	0.022	0.073	0.069	0.064	0.075	0.237	0.173
205Tl	0.001	0.003	0.021	0.013	0.028	0.083	0.155
208Pb	0.001	0.003	0.772	0.551	0.705	2.2	5.4
238U	0.001	0.003	0.106	0.154	0.239	0.339	0.596

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited

Tissue Analysis Results

		Client ID	RG_GAUT_INV-5_2022-09-14_N	RG_GHBP_INVOLI-1_2022-09-12_N	RG_GHBP_COMPOLI-1_2022-09-12_N	RG_GHBP_INV-3_2022-09-12_N	RG_GHBP_INVOLI-5_2022-09-12_N
		Lab ID	179	180	181	182	183
		Wet Weight (g)	0.3593	0.2633	0.9351	1.0061	0.0663
		Dry Weight (g)	0.0670	0.0686	0.2031	0.1809	0.0210
		Moisture (%)	81.4	73.9	78.3	82.0	68.3
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.019	0.063	5.4	3.7	6.3	2.3	3.4
11B	0.060	0.200	11	8.5	13	2.2	7.2
23Na	5.7	19	3,096	2,599	2,535	4,665	2,813
24Mg	0.078	0.260	2,081	2,923	3,158	2,515	2,678
27Al	0.087	0.290	11,064	7,501	10,772	1,494	6,987
31P	88	293	10,654	8,666	8,694	11,912	9,523
39K	2.8	9.3	13,101	11,778	11,354	10,234	11,191
44Ca	6.1	20	4,114	10,506	20,645	22,831	19,057
49Ti	0.001	0.003	885	626	777	104	493
51V	0.036	0.120	24	13	19	2.8	13
52Cr	0.061	0.203	88	27	25	13	21
55Mn	0.008	0.027	127	87	104	66	104
57Fe	0.801	2.7	4,454	3,395	3,843	691	2,605
59Co	0.014	0.047	4.0	3.9	2.8	2.1	4.4
60Ni	0.052	0.173	124	73	61	29	62
63Cu	0.018	0.060	28	14	22	35	15
66Zn	0.230	0.767	257	247	178	171	180
75As	0.431	1.4	1.6	5.1	4.1	0.817	6.4
77Se	0.579	1.9	5.2	97	63	24	111
88Sr	0.001	0.003	18	15	30	26	19
95Mo	0.001	0.003	0.712	0.923	1.3	0.348	0.858
107Ag	0.001	0.003	0.268	0.179	0.316	0.314	0.262
111Cd	0.070	0.233	1.4	4.3	2.2	1.8	7.4
118Sn	0.022	0.073	0.886	0.510	0.606	0.294	0.942
121Sb	0.004	0.013	0.405	0.335	0.399	0.073	0.305
137Ba	0.001	0.003	192	125	196	76	139
202Hg	0.022	0.073	0.179	0.277	0.211	0.102	0.376
205Tl	0.001	0.003	0.081	0.086	0.105	0.073	0.283
208Pb	0.001	0.003	2.4	2.0	2.5	0.600	2.4
238U	0.001	0.003	0.309	0.470	0.760	0.141	0.426

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

		Client ID	RG_GHBP_COMPOLI-5_2022-09-12_N	RG_GHDT_INV-1_2022-09-16_N	RG_GHDT_INV-3_2022-09-16_N	RG_GHDT_INV-5_2022-09-16_N	RG_GHFF_INV-1_2022-09-08_N
		Lab ID	184	185	186	187	188
		Wet Weight (g)	0.9756	0.5071	0.7129	0.6679	0.3606
		Dry Weight (g)	0.1841	0.1105	0.1387	0.1195	0.0727
		Moisture (%)	81.1	78.2	80.5	82.1	79.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.019	0.063	1.4	1.9	1.8	2.7	1.6
11B	0.060	0.200	1.3	3.3	2.6	4.5	3.0
23Na	5.7	19	4,537	4,582	5,149	5,169	3,837
24Mg	0.078	0.260	1,239	2,814	2,433	2,678	2,144
27Al	0.087	0.290	817	2,782	1,986	3,631	2,677
31P	88	293	8,950	14,709	15,294	14,584	12,280
39K	2.8	9.3	8,943	11,673	13,434	13,188	10,134
44Ca	6.1	20	11,965	16,241	16,204	20,817	24,230
49Ti	0.001	0.003	55	188	129	246	206
51V	0.036	0.120	1.4	4.8	4.0	6.9	5.6
52Cr	0.061	0.203	8.4	25	22	24	20
55Mn	0.008	0.027	33	55	49	62	36
57Fe	0.801	2.7	376	1,194	947	1,423	1,120
59Co	0.014	0.047	0.917	1.1	1.7	2.0	1.6
60Ni	0.052	0.173	16	65	54	61	46
63Cu	0.018	0.060	25	20	21	21	14
66Zn	0.230	0.767	120	168	179	153	92
75As	0.431	1.4	0.723	0.910	1.0	1.1	0.548
77Se	0.579	1.9	15	13	11	7.3	7.6
88Sr	0.001	0.003	12	10	9.7	13	16
95Mo	0.001	0.003	0.186	0.534	0.209	0.255	0.278
107Ag	0.001	0.003	0.134	0.148	0.140	0.198	0.157
111Cd	0.070	0.233	0.733	1.3	1.2	1.4	0.908
118Sn	0.022	0.073	0.201	0.621	0.363	0.875	1.5
121Sb	0.004	0.013	0.050	0.110	0.104	0.136	0.119
137Ba	0.001	0.003	33	55	45	69	76
202Hg	0.022	0.073	0.071	0.090	0.090	0.090	0.076
205Tl	0.001	0.003	0.047	0.081	0.066	0.084	0.063
208Pb	0.001	0.003	0.334	0.905	0.745	1.3	1.4
238U	0.001	0.003	0.067	0.302	0.222	0.291	0.255

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

		Client ID	RG_GHFF_INV-3_2022-09-09_N	RG_GHFF_INV-5_2022-09-09_N	RG_GHNF_INV-1_2022-09-09_N	RG_GHNF_INV-3_2022-09-10_N	RG_GHNF_INV-5_2022-09-10_N
		Lab ID	189	190	191	192	193
		Wet Weight (g)	0.3387	0.3683	0.0735	0.1888	0.2495
		Dry Weight (g)	0.0735	0.0671	0.0119	0.0304	0.0376
		Moisture (%)	78.3	81.8	83.8	83.9	84.9
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.019	0.063	1.3	1.7	0.931	1.7	2.6
11B	0.060	0.200	1.8	2.4	1.3	1.4	3.0
23Na	5.7	19	3,226	4,950	1,091	6,843	5,623
24Mg	0.078	0.260	1,745	2,912	1,323	2,608	2,768
27Al	0.087	0.290	1,950	1,957	1,692	1,337	3,922
31P	88	293	11,775	16,394	5,697	20,272	16,341
39K	2.8	9.3	9,140	13,932	3,384	15,082	14,037
44Ca	6.1	20	19,765	26,079	14,686	14,101	22,457
49Ti	0.001	0.003	126	153	110	81	257
51V	0.036	0.120	3.8	3.9	3.3	2.5	7.3
52Cr	0.061	0.203	13	26	15	22	25
55Mn	0.008	0.027	24	32	23	46	74
57Fe	0.801	2.7	826	999	645	735	1,313
59Co	0.014	0.047	1.1	1.1	1.1	1.0	2.1
60Ni	0.052	0.173	32	54	27	44	47
63Cu	0.018	0.060	16	23	7.5	24	14
66Zn	0.230	0.767	131	137	104	187	141
75As	0.431	1.4	<0.431	0.630	0.630	0.560	1.2
77Se	0.579	1.9	6.4	8.7	4.4	9.5	7.8
88Sr	0.001	0.003	11	14	7.4	7.1	12
95Mo	0.001	0.003	0.186	0.487	0.116	0.464	0.325
107Ag	0.001	0.003	0.157	0.174	0.105	0.099	0.105
111Cd	0.070	0.233	2.2	0.838	1.0	2.4	5.0
118Sn	0.022	0.073	0.749	0.587	0.498	0.832	0.871
121Sb	0.004	0.013	0.103	0.112	0.095	0.085	0.139
137Ba	0.001	0.003	57	65	36	31	66
202Hg	0.022	0.073	0.080	0.080	0.052	0.111	0.062
205Tl	0.001	0.003	0.041	0.056	0.059	0.091	0.119
208Pb	0.001	0.003	0.796	0.774	0.559	0.614	1.3
238U	0.001	0.003	0.206	0.265	0.191	0.200	0.339

Notes:

ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

		Client ID	RG_GHUT_INV-1_2022-09-15_N	RG_GHUT_INV-3_2022-09-15_N	RG_GHUT_INV-5_2022-09-15_N
		Lab ID	194	195	196
		Wet Weight (g)	0.5133	0.4218	0.4737
		Dry Weight (g)	0.0859	0.0685	0.0784
		Moisture (%)	83.3	83.8	83.4
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)
7Li	0.019	0.063	2.5	2.8	2.6
11B	0.060	0.200	3.2	2.7	3.9
23Na	5.7	19	6,433	6,259	4,212
24Mg	0.078	0.260	2,310	2,432	2,725
27Al	0.087	0.290	4,068	3,984	5,446
31P	88	293	18,262	19,084	14,728
39K	2.8	9.3	15,492	12,728	11,504
44Ca	6.1	20	19,492	10,735	15,755
49Ti	0.001	0.003	312	286	376
51V	0.036	0.120	7.6	7.5	9.6
52Cr	0.061	0.203	23	26	28
55Mn	0.008	0.027	63	75	62
57Fe	0.801	2.7	1,313	1,657	1,662
59Co	0.014	0.047	2.3	2.3	2.6
60Ni	0.052	0.173	48	49	52
63Cu	0.018	0.060	19	18	27
66Zn	0.230	0.767	191	195	216
75As	0.431	1.4	0.898	1.1	0.957
77Se	0.579	1.9	9.2	11	7.8
88Sr	0.001	0.003	11	9.3	12
95Mo	0.001	0.003	0.383	0.371	0.406
107Ag	0.001	0.003	0.067	0.105	0.093
111Cd	0.070	0.233	6.9	8.5	6.1
118Sn	0.022	0.073	0.548	0.626	1.0
121Sb	0.004	0.013	0.153	0.145	0.188
137Ba	0.001	0.003	63	53	71
202Hg	0.022	0.073	0.076	0.111	0.123
205Tl	0.001	0.003	0.112	0.154	0.130
208Pb	0.001	0.003	1.5	1.4	1.8
238U	0.001	0.003	0.330	0.196	0.309

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited

Tissue QA/QC Relative Percent Difference Results

	Client ID	RG_GHBP_COMPOLI-1_2022-09-12_N			RG_GHDT_INV-3_2022-09-16_N			RG_GHUT_INV-5_2022-09-15_N		
	Lab ID	181			186			196		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.019	6.3	5.5	14	1.8	2.2	20	2.6	2.7	3.8
11B	0.060	13	11	17	2.6	3.5	30	3.9	3.7	5.3
23Na	5.7	2,535	2,490	1.8	5,149	4,761	7.8	4,212	4,279	1.6
24Mg	0.078	3,158	2,481	24	2,433	2,616	7.2	2,725	2,683	1.6
27Al	0.087	10,772	8,715	21	1,986	2,950	39	5,446	5,903	8.1
31P	88	8,694	10,016	14	15,294	14,127	7.9	14,728	15,458	4.8
39K	2.8	11,354	10,289	9.8	13,434	12,570	6.6	11,504	11,652	1.3
44Ca	6.1	20,645	19,443	6.0	16,204	18,289	12	15,755	14,117	11
49Ti	0.001	777	632	21	129	134	3.8	376	340	10
51V	0.036	19	15	24	4.0	5.6	33	9.6	8.8	8.7
52Cr	0.061	25	20	22	22	22	0.0	28	26	7.4
55Mn	0.008	104	81	25	49	50	2.0	62	58	6.7
57Fe	0.801	3,843	2,816	31	947	1,351	35	1,662	1,632	1.8
59Co	0.014	2.8	2.3	20	1.7	1.8	5.7	2.6	2.5	3.9
60Ni	0.052	61	58	5.0	54	55	1.8	52	48	8.0
63Cu	0.018	22	23	4.4	21	19	10	27	24	12
66Zn	0.230	178	208	16	179	162	10	216	184	16
75As	0.431	4.1	4.2	-	1.0	1.0	-	0.957	1.1	-
77Se	0.579	63	68	7.6	11	11	0.0	7.8	8.2	5.0
88Sr	0.001	30	33	9.5	9.7	10	3.0	12	11	8.7
95Mo	0.001	1.3	1.1	17	0.209	0.232	10	0.406	0.394	3.0
107Ag	0.001	0.316	0.351	11	0.140	0.145	3.5	0.093	0.093	0.0
111Cd	0.070	2.2	2.1	4.7	1.2	1.2	0.0	6.1	6.1	0.0
118Sn	0.022	0.606	0.594	2.0	0.363	0.455	23	1.0	1.0	0.0
121Sb	0.004	0.399	0.281	35	0.104	0.120	14	0.188	0.182	3.2
137Ba	0.001	196	192	2.1	45	60	29	71	69	2.9
202Hg	0.022	0.211	0.254	-	0.090	0.090	-	0.123	0.118	-
205Tl	0.001	0.105	0.097	7.9	0.066	0.083	23	0.130	0.152	16
208Pb	0.001	2.5	2.1	17	0.745	1.0	29	1.8	1.8	0.0
238U	0.001	0.760	0.517	38	0.222	0.310	33	0.309	0.313	1.3

Notes:

ppm = parts per million

RPD = relative percent difference

DL = detection limit

< = less than detection limit

% = percent

Data Quality Objectives:

Laboratory Duplicates - RPD ≤40% for all elements, except Ca and Sr, which are ≤60%

Minimum DQOs apply to individual samples at concentrations above 10x DL

Teck Coal Limited

Tissue QA/QC Accuracy and Precision Results

Sample Group ID			01			02		
Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.019	1.21	1.2	98	7.1	1.2	99	8.3
11B	0.060	4.5	4.2	92	2.7	4.4	98	4.5
23Na	5.7	14,000	12,697	91	2.4	14,166	101	8.9
24Mg	0.078	910	837	92	3.1	919	101	8.0
27Al	0.087	197.2	164	83	5.9	209	106	2.4
31P	88	8,000	7,328	92	1.1	8,406	105	10
39K	2.8	15,500	14,336	92	2.9	15,204	98	8.4
44Ca	6.1	2,360	2,223	94	4.5	2,503	106	5.5
49Ti	0.001	12.24	10	83	16	13	105	12
51V	0.036	1.57	1.4	87	8.4	1.6	101	12
52Cr	0.061	1.87	1.7	90	5.0	1.9	102	6.4
55Mn	0.008	3.17	3.1	98	3.2	3.4	108	5.3
57Fe	0.801	343	332	97	4.2	357	104	5.8
59Co	0.014	0.25	0.225	90	8.4	0.267	107	8.3
60Ni	0.052	1.34	1.3	97	5.4	1.5	110	7.4
63Cu	0.018	15.7	15	97	2.9	17	106	9.1
66Zn	0.230	51.6	48	93	5.9	54	104	5.2
75As	0.431	6.87	6.4	94	3.0	6.8	98	7.7
77Se	0.579	3.45	3.3	97	3.5	3.2	94	11
88Sr	0.001	10.1	9.7	96	8.7	11	107	7.7
95Mo	0.001	0.29	0.300	104	4.7	0.302	104	5.5
107Ag	0.001	0.0252	0.023	93	14	0.029	115	17
111Cd	0.070	0.299	0.297	99	9.2	0.338	113	15
118Sn	0.022	0.061	0.062	102	13	0.056	92	20
121Sb	0.004	0.011	0.013	120	17	0.011	98	15
137Ba	0.001	8.6	6.8	79	5.7	8.5	99	5.5
202Hg	0.022	0.412	0.414	101	9.4	0.413	100	5.9
205Tl	0.001	0.0013	-	-	-	-	-	-
208Pb	0.001	0.404	0.308	76	4.3	0.382	95	10
238U	0.001	0.05	0.041	82	3.2	0.051	102	10

Notes:

ppm = parts per million; % = percent; DL = detection limit; RSD = relative standard deviation

Data Quality Objectives:

Accuracy: DQO of 60 - 140% of the certified values for B, Ti, Ag, Sn, Sb, and Ba.
Accuracy: DQO of 90 - 110% of the certified values for Se.
Accuracy: DQO of 70 - 130% of the certified values for all other elements provided.
Precision: DQO of ≤20% for all elements.
DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.
Tl certified concentration from NIST-2976.
Accuracy and precision for Tl are not reported as the certified concentration is too close to the reportable detection limit.

Teck Coal Limited
Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	RG_GANF_INV-1_2022-09-13_N	174	26 Sep 2022
	RG_GANF_INV-3_2022-09-13_N	175	
	RG_GANF_INV-5_2022-09-13_N	176	
	RG_GAUT_INV-1_2022-09-14_N	177	
	RG_GAUT_INV-3_2022-09-14_N	178	
	RG_GAUT_INV-5_2022-09-14_N	179	
	RG_GHBP_INVOLI-1_2022-09-12_N	180	
	RG_GHBP_COMPOLI-1_2022-09-12_N	181	
02	RG_GHBP_INV-3_2022-09-12_N	182	27 Sep 2022
	RG_GHBP_INVOLI-5_2022-09-12_N	183	
	RG_GHBP_COMPOLI-5_2022-09-12_N	184	
	RG_GHDT_INV-1_2022-09-16_N	185	
	RG_GHDT_INV-3_2022-09-16_N	186	
	RG_GHDT_INV-5_2022-09-16_N	187	
	RG_GHFF_INV-1_2022-09-08_N	188	
	RG_GHFF_INV-3_2022-09-09_N	189	
	RG_GHFF_INV-5_2022-09-09_N	190	
	RG_GHNF_INV-1_2022-09-09_N	191	
	RG_GHNF_INV-3_2022-09-10_N	192	
	RG_GHNF_INV-5_2022-09-10_N	193	
	RG_GHUT_INV-1_2022-09-15_N	194	
	RG_GHUT_INV-3_2022-09-15_N	195	
	RG_GHUT_INV-5_2022-09-15_N	196	

Teck

COC ID: **REP_LAEMP_GC_2022-09_TRICH**

TURNAROUND TIME:

RUSH:

PROJECT/CLIENT INFO			
Facility Name / Job#	Regional Effects Program		
Project Manager	Giovanna Diaz		
Email	giovanna.diaz@teck.com		
Address	421 Pine Ave		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	1-250-865-3048		

LABORATORY			
Lab Name	TrichAnalytics Inc.		
Lab Contact	Jennie Christensen		
Email	jennie.christensen@trichanalytics		
Address	207-1753 Sean Heights		
City	Saanichton	Province	BC
Postal Code			
Phone Number			

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	Lisa.Bowron@minnow.ca	X	X	X
Email 5:	Awiebe@minnow.ca	X	X	X
Email 6:	Giovanna.Diaz@Teck.com	X	X	X
PO number	VPO00818999			

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Teck ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
174	RG_GANF_INV-1_2022-09-13_N ✓	RG_GANF	TA		13-Sep-22	9:00	INV	Composite	Composite	1	X	X	X
175	RG_GANF_INV-3_2022-09-13_N ✓	RG_GANF	TA		13-Sep-22	10:00	INV	Composite	Composite	1	X	X	X
176	RG_GANF_INV-5_2022-09-13_N ✓	RG_GANF	TA		13-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
177	RG_GAUT_INV-1_2022-09-14_N ✓	RG_GAUT	TA		14-Sep-22	9:00	INV	Composite	Composite	1	X	X	X
178	RG_GAUT_INV-3_2022-09-14_N ✓	RG_GAUT	TA		14-Sep-22	10:00	INV	Composite	Composite	1	X	X	X
179	RG_GAUT_INV-5_2022-09-14_N ✓	RG_GAUT	TA		14-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
180	RG_GHBP_INVOLI-1_2022-09-12_N ✓	RG_GHBP	TA		12-Sep-22	9:00	INV	INVOLI	Composite	1	X	X	X
181	RG_GHBP_COMPOLI-1_2022-09-12_N ✓	RG_GHBP	TA		12-Sep-22	10:00	INV	COMPOLI	Composite	1	X	X	X
182	RG_GHBP_INV-3_2022-09-12_N ✓	RG_GHBP	TA		12-Sep-22	10:00	INV	Composite	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Jennifer Ings	###############	Alex Wade	21 Sep 2022 / 14:40
				(Project #: 2022-398)

SERVICE REQUEST (rush - subject to availability)					
Regular (default)	Sampler's Name	Jennifer Ings	Mobile #	5195003444
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature	[signature]	Date/Time	September 19, 2022
For Emergency <1 Day, ASAP or Weekend				

Teck

COC ID:	REP_LAEMP_GC_2022-09 TRICH	TURNAROUND TIME:		RUSH:

PROJECT/CLIENT INFO			
Facility Name / Job#	Regional Effects Program		
Project Manager	Giovanna Diaz		
Email	giovanna.diaz@teck.com		
Address	421 Pine Ave		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	1-250-865-3048		

LABORATORY			
Lab Name	TrichAnalytics Inc.		
Lab Contact	Jennie Christensen		
Email	jennie.christensen@trichanalytics		
Address	207-1753 Sean Heights		
City	Saanichton	Province	BC
Postal Code			
Phone Number			

OTHER INFO		Excel	PDF	EDD
Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	TeckLabResults@teck.com	X	X	X
Email 4:	Lisa.Bowron@minnow.ca	X	X	X
Email 5:	Awiebe@minnow.ca	X	X	X
Email 6:	Giovanna.Diaz@Teck.com	X	X	X
PO number	VPO00818999			

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

SAMPLE DETAILS / ANALYSIS REQUESTED

Trich ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
183	RG_GHBP_INVOLI-5_2022-09-12_N	RG_GHBP	TA		12-Sep-22	11:00	INV	INVOLI	Composite	1	X	X	X
184	RG_GHBP_COMPOLI-5_2022-09-12_N	RG_GHBP	TA		12-Sep-22	11:00	INV	COMPOLI	Composite	1	X	X	X
185	RG_GHDT_INV-1_2022-09-16_N	RG_GHDT	TA		16-Sep-22	9:00	INV	Composite	Composite	1	X	X	X
186	RG_GHDT_INV-3_2022-09-16_N	RG_GHDT	TA		16-Sep-22	10:00	INV	Composite	Composite	1	X	X	X
187	RG_GHDT_INV-5_2022-09-16_N	RG_GHDT	TA		16-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
188	RG_GHFF_INV-1_2022-09-08_N	RG_GHFF	TA		8-Sep-22	9:00	INV	Composite	Composite	1	X	X	X
189	RG_GHFF_INV-3_2022-09-09_N	RG_GHFF	TA		8-Sep-22	10:00	INV	Composite	Composite	1	X	X	X
190	RG_GHFF_INV-5_2022-09-09_N	RG_GHFF	TA		9-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
191	RG_GHNF_INV-1_2022-09-09_N	RG_GHNF	TA		9-Sep-22	9:00	INV	Composite	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Jennifer Ings	##############	Alex Wade	21Sep2022 / 14:40
				(Project #: 2022-398)

SERVICE REQUEST (rush - subject to availability)				
Regular (default)	Sampler's Name	Jennifer Ings	Mobile #	5195003444
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature		Date/Time	September 19, 2022
For Emergency <1 Day, ASAP or Weekend				

Teck

COC ID: REP_LAEMP_GC_2022-09_TRICH

TURNAROUND TIME:

RUSH:

PROJECT/CLIENT INFO

Facility Name / Job#	Regional Effects Program
Project Manager	Giovanna Diaz
Email	giovanna.diaz@teck.com
Address	421 Pine Ave
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	1-250-865-3048

LABORATORY

Lab Name	TrichAnalytics Inc.
Lab Contact	Jennie Christensen
Email	jennie.christensen@trichanalytics
Address	207-1753 Sean Heights
City	Saanichton
Province	BC
Postal Code	
Phone Number	

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	Lisa.Bowron@minnow.ca	X	X	X
Email 5:	Awiebe@minnow.ca	X	X	X
Email 6:	Giovanna.Diaz@Teck.com	X	X	X
PO number	VPO00818999			

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

SAMPLE DETAILS / ANALYSIS REQUESTED

Field ID	Sample ID	Sample Location (sys loc code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
92	RG_GHNF_INV-3_2022-09-10_N	RG_GHNF	TA		10-Sep-22	10:00	INV	Composite	Composite	1	X	X	X
93	RG_GHNF_INV-5_2022-09-10_N	RG_GHNF	TA		10-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
94	RG_GHUT_INV-1_2022-09-15_N	RG_GHUT	TA		15-Sep-22	9:00	INV	Composite	Composite	1	X	X	X
95	RG_GHUT_INV-3_2022-09-15_N	RG_GHUT	TA		15-Sep-22	10:00	INV	Composite	Composite	1	X	X	X
96	RG_GHUT_INV-5_2022-09-15_N	RG_GHUT	TA		15-Sep-22	11:00	INV	Composite	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

PO 818999

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Jennifer Ings	###############	Alex Wade	21Sep2022 / 14:40

Project #: 2022-398

SERVICE REQUEST (rush - subject to availability)

Regular (default)					
Priority (2-3 business days) - 50% surcharge	Sampler's Name	Jennifer Ings	Mobile #	5195003444
Emergency (1 Business Day) - 100% surcharge				
For Emergency <1 Day, ASAP or Weekend	Sampler's Signature		Date/Time	September 19, 2022

T r i c h A n a l y t i c s I n c .

Tissue Microchemistry Analysis Report

Client: Giovanna Diaz
Project Manager
Teck Coal Limited
Phone: (250) 865-3048
Email: giovanna.diaz@teck.com; awiebe@minnow.ca; lbowron@minnow.ca; teckcoal@equisonline.com; teck.lab.results@teck.com; aquascilab@teck.com

Date Received:	28 Sep 2022
Date of Analysis:	19 Oct 2022
Final Report Date:	25 Oct 2022
Project No.:	2022-415
Method No.:	MET-002.06

Client Project: REP_LAEMP_GC_2022-09 Regional Effects Program (PO 818999)

Analytical Request: Composite Benthic Invertebrate Tissue Microchemistry (total metals & moisture) - 5 samples. See chain of custody form provided for sample identification numbers.

Notes:
Analytical results are expressed in parts per million (ppm) dry weight (equivalent to mg/kg).
Samples quantified using DORM-4, NIST-1566b, and NIST-2976 certified reference standards.
Aluminum concentrations above 1,000 ppm are outside linear range of the calibration curve.
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.
Client specific DQO for Selenium accuracy is 90-110% of the certified value; result achieved 101%.
Sample ID 813 was divided into two samples: 813A was shrimp and 813B was clams with shells.
Sample ID 815 was divided into two samples: 815A was shrimp & tiny worms and 815B was clams with shells.
Moisture content for sample ID 813A, B and 815A, B represents whole sample (i.e., ID 813 and 815 before separating tissues).

This report provides the analytical results only for tissue samples noted above as received from the Client.

Reviewed and Approved by Jennie Christensen, PhD, RPBio

25 Oct 2022
Date

TrichAnalytics Inc.
207-1753 Sean Heights
Saanichton, BC V8M 0B3
www.trichanalytics.com

CALA
Testing Accreditation No. A4196

Teck Coal Limited
Tissue Analysis Results

		Client ID	RG_GHP_INV-5_2022-09-19_N	RG_GHP_INVBIV-5_2022-09-19_N	RG_GHP_INVBIV-6_2022-09-20_N	RG_GHP_INV-3_2022-09-19_N	RG_GHP_INVBIV-3_2022-09-19_N
		Lab ID	813A	813B	814	815A	815B
		Wet Weight (g)	0.8351	0.8351	0.5869	0.5206	0.5206
		Dry Weight (g)	0.2631	0.2631	0.2226	0.1335	0.1335
		Moisture (%)	68.5	68.5	62.1	74.4	74.4
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.022	0.073	5.8	4.5	6.6	9.0	2.4
11B	0.107	0.357	13	12	21	27	6.8
23Na	4.6	15	1,328	1,337	838	3,835	1,592
24Mg	0.062	0.207	3,623	1,387	1,269	3,989	783
27Al	0.063	0.210	12,097	13,719	17,305	17,565	5,346
31P	60	200	19,706	1,993	1,010	7,805	1,702
39K	2.4	8.0	5,535	4,091	6,122	9,435	2,550
44Ca	3.1	10	84,225	174,784	182,701	34,842	226,246
49Ti	0.001	0.003	1,117	1,275	1,941	2,109	465
51V	0.028	0.093	23	25	44	44	10
52Cr	0.064	0.213	13	30	21	54	14
55Mn	0.008	0.027	273	116	67	225	55
57Fe	0.795	2.7	3,316	3,206	4,835	6,754	2,016
59Co	0.019	0.063	3.3	3.6	3.1	5.5	1.5
60Ni	0.001	0.003	36	62	38	110	27
63Cu	0.029	0.097	40	23	12	60	12
66Zn	0.216	0.720	81	41	36	153	36
75As	0.398	1.3	4.9	1.6	2.0	2.7	0.758
77Se	0.375	1.2	12	6.8	4.9	27	5.3
88Sr	0.001	0.003	95	83	97	52	119
95Mo	0.001	0.003	0.761	0.865	0.870	1.1	0.363
107Ag	0.001	0.003	1.3	0.306	0.140	0.582	0.144
111Cd	0.068	0.227	0.965	0.408	0.482	3.9	0.835
118Sn	0.020	0.067	1.1	0.449	0.913	1.8	0.394
121Sb	0.003	0.010	0.299	0.376	0.507	0.513	0.135
137Ba	0.001	0.003	332	186	309	395	115
202Hg	0.027	0.090	0.092	0.036	0.057	0.373	0.075
205Tl	0.001	0.003	0.239	0.192	0.265	0.329	0.080
208Pb	0.001	0.003	2.7	2.5	5.9	5.1	1.4
238U	0.001	0.003	0.618	0.447	0.617	0.888	0.205

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

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Tissue QA/QC Relative Percent Difference Results

	Client ID	RG_GHP_INVBIV-5_2022-09-19_N		
	Lab ID	813B		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.022	4.5	6.1	30
11B	0.107	12	17	35
23Na	4.6	1,337	1,527	13
24Mg	0.062	1,387	2,016	37
27Al	0.063	13,719	15,622	13
31P	60	1,993	2,002	0.5
39K	2.4	4,091	5,617	31
44Ca	3.1	174,784	194,352	11
49Ti	0.001	1,275	1,523	18
51V	0.028	25	30	18
52Cr	0.064	30	28	6.9
55Mn	0.008	116	121	4.2
57Fe	0.795	3,206	4,455	33
59Co	0.019	3.6	4.4	20
60Ni	0.001	62	52	18
63Cu	0.029	23	26	12
66Zn	0.216	41	52	24
75As	0.398	1.6	1.6	-
77Se	0.375	5.7	5.8	1.7
88Sr	0.001	83	85	2.4
95Mo	0.001	0.865	0.924	6.6
107Ag	0.001	0.306	0.257	17
111Cd	0.068	0.408	0.501	-
118Sn	0.020	0.449	0.659	38
121Sb	0.003	0.376	0.447	17
137Ba	0.001	186	218	16
202Hg	0.027	0.036	0.036	-
205Tl	0.001	0.192	0.222	15
208Pb	0.001	2.5	3.3	28
238U	0.001	0.447	0.435	2.7

Notes:

ppm = parts per million

RPD = relative percent difference

DL = detection limit

< = less than detection limit

% = percent

Data Quality Objectives:

Laboratory Duplicates - RPD ≤40% for all elements, except Ca and Sr, which are ≤60%

Minimum DQOs apply to individual samples at concentrations above 10x DL

Teck Coal Limited
Tissue QA/QC Accuracy and Precision Results

Sample Group ID: 01

Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.022	1.21	1.1	89	4.1
11B	0.107	4.5	4.1	92	3.2
23Na	4.6	14,000	12,984	93	5.6
24Mg	0.062	910	848	93	3.6
27Al	0.063	197.2	189	96	5.8
31P	60	8,000	7,474	93	3.8
39K	2.4	15,500	14,851	96	2.8
44Ca	3.1	2,360	2,259	96	6.3
49Ti	0.001	12.24	11	90	9.3
51V	0.028	1.57	1.6	103	8.0
52Cr	0.064	1.87	1.8	96	6.8
55Mn	0.008	3.17	3.0	95	4.1
57Fe	0.795	343	331	96	3.0
59Co	0.019	0.25	0.273	109	3.9
60Ni	0.001	1.34	1.4	104	5.1
63Cu	0.029	15.7	16	103	2.8
66Zn	0.216	51.6	50	97	2.8
75As	0.398	6.87	7.0	102	2.0
77Se	0.375	3.45	3.5	101	6.6
88Sr	0.001	10.1	9.4	93	1.5
95Mo	0.001	0.29	0.290	100	12
107Ag	0.001	0.0252	0.024	97	13
111Cd	0.068	0.299	0.327	109	16
118Sn	0.020	0.061	0.064	105	7.4
121Sb	0.003	0.011	0.009	80	11
137Ba	0.001	8.6	7.6	88	3.5
202Hg	0.027	0.412	0.471	114	11
205Tl	0.001	0.0013	-	-	-
208Pb	0.001	0.404	0.350	87	12
238U	0.001	0.05	0.045	91	7.1

Notes:

ppm = parts per million; % = percent; DL = detection limit; RSD = relative standard deviation

Data Quality Objectives:

Accuracy: DQO of 60 - 140% of the certified values for B, Ti, Ag, Sn, Sb, and Ba.
Accuracy: DQO of 90 - 110% of the certified values for Se.
Accuracy: DQO of 70 - 130% of the certified values for all other elements provided.
Precision: DQO of ≤20% for all elements.
DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.
Tl certified concentration from NIST-2976.
Accuracy and precision for Tl are not reported as the certified concentration is too close to the reportable detection limit.

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	RG_GHP_INV-5_2022-09-19_N	813A	19 Oct 2022
	RG_GHP_INVBIV-5_2022-09-19_N	813B	
	RG_GHP_INVBIV-6_2022-09-20_N	814	
	RG_GHP_INV-3_2022-09-19_N	815A	
	RG_GHP_INVBIV-3_2022-09-19_N	815B	

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COC ID:	REP_LAEMP_GC_2022-09_TRICH	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO			
Facility Name / Job#	Regional Effects Program		
Project Manager	Giovanna Diaz		
Email	giovanna.diaz@teck.com		
Address	421 Pine Ave		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	1-250-865-3048		

LABORATORY			
Lab Name	TrichAnalytics Inc.		
Lab Contact	Jennie Christensen		
Email	jennie.christensen@trichanalytics		
Address	207-1753 Sean Heights		
City	Saanichton	Province	BC
Postal Code			
Phone Number			

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	lbowron@minnow.ca	X	X	X
Email 5:	Awiebe@minnow.ca	X	X	X
Email 6:	Giovanna.Diaz@Teck.com	X	X	X
PO number	VPO00818999			

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Trich ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
513A	RG_GHP_INV-5_2022-09-19_N	RG_GHP	TA		19-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
514	RG_GHP_INVBIV-6_2022-09-20_N	RG_GHP	TA		20-Sep-22	11:05	INV	INVBIV	Composite	1	X	X	X
515A	RG_GHP_INV-3_2022-09-19_N	RG_GHP	TA		19-Sep-22	11:10	INV	Composite	Composite	1	X	X	X
513B	RG_GHP_INVBIV-5_2022-09-19_N	RG_GHP	TA		19-Sep-22	11:00	INV	INVBIV	Composite	1	X	X	X
515B	RG_GHP_INVBIV-3_2022-09-19_N	RG_GHP	TA		19-Sep-22	11:10	INV	INVBIV	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Jennifer Ings	###############	Alex Wade	19Oct2022 / 11:00
				(Project #: 2022-415)

SERVICE REQUEST (rush - subject to availability)				
Regular (default)	Sampler's Name	Jennifer Ings	Mobile #	5195003444
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature		Date/Time	September 26, 2022
For Emergency <1 Day, ASAP or Weekend				

ELECTRONIC COPY OF NEW COC
AW 19OCT2022

Teck

COC ID: REP_LAEMP_GC_2022-09_TRICH

TURNAROUND TIME:

RUSH:

PROJECT/CLIENT INFO			
Facility Name / Job#	Regional Effects Program		
Project Manager	Giovanna Diaz		
Email	giovanna.diaz@teck.com		
Address	421 Pine Ave		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	1-250-865-3048		

LABORATORY			
Lab Name	TrichAnalytics Inc.		
Lab Contact	Jennie Christensen		
Email	jennie.christensen@trichanalytics		
Address	207-1753 Sean Heights		
City	Saanichton	Province	BC
Postal Code			
Phone Number			

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	lbowron@minnow.ca	X	X	X
Email 5:	Awiebe@minnow.ca	X	X	X
Email 6:	Giovanna.Diaz@Teck.com	X	X	X
PO number	VPO00818999			

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Fac ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
313	RG_GHP_INV-1_2022-09-19_N	RG_GHP ✓	TA		19-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
314	RG_GHP_INV-2_2022-09-19_N	RG_GHP ✓	TA		19-Sep-22	11:05	INV	Composite	Composite	1	X	X	X
315	RG_GHP_INV-3_2022-09-19_N	RG_GHP ✓	TA		19-Sep-22	11:10	INV	Composite	Composite	1	X	X	X

SUPERCEDED aw 19OCT2022

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Jennifer Ings	###############	Geriene LaBine	29 Sep 2022 / 10:50
				(Project # 2022-~~407~~ 415)
				GOL09OCT2022.

SERVICE REQUEST (rush - subject to availability)

Regular (default) / Priority (2-3 business days) - 50% surcharge	Sampler's Name	Jennifer Ings	Mobile #	5195003444
Emergency (1 Business Day) - 100% surcharge / For Emergency <1 Day, ASAP or Weekend	Sampler's Signature		Date/Time	September 26, 2022

APPENDIX E

WATER QUALITY

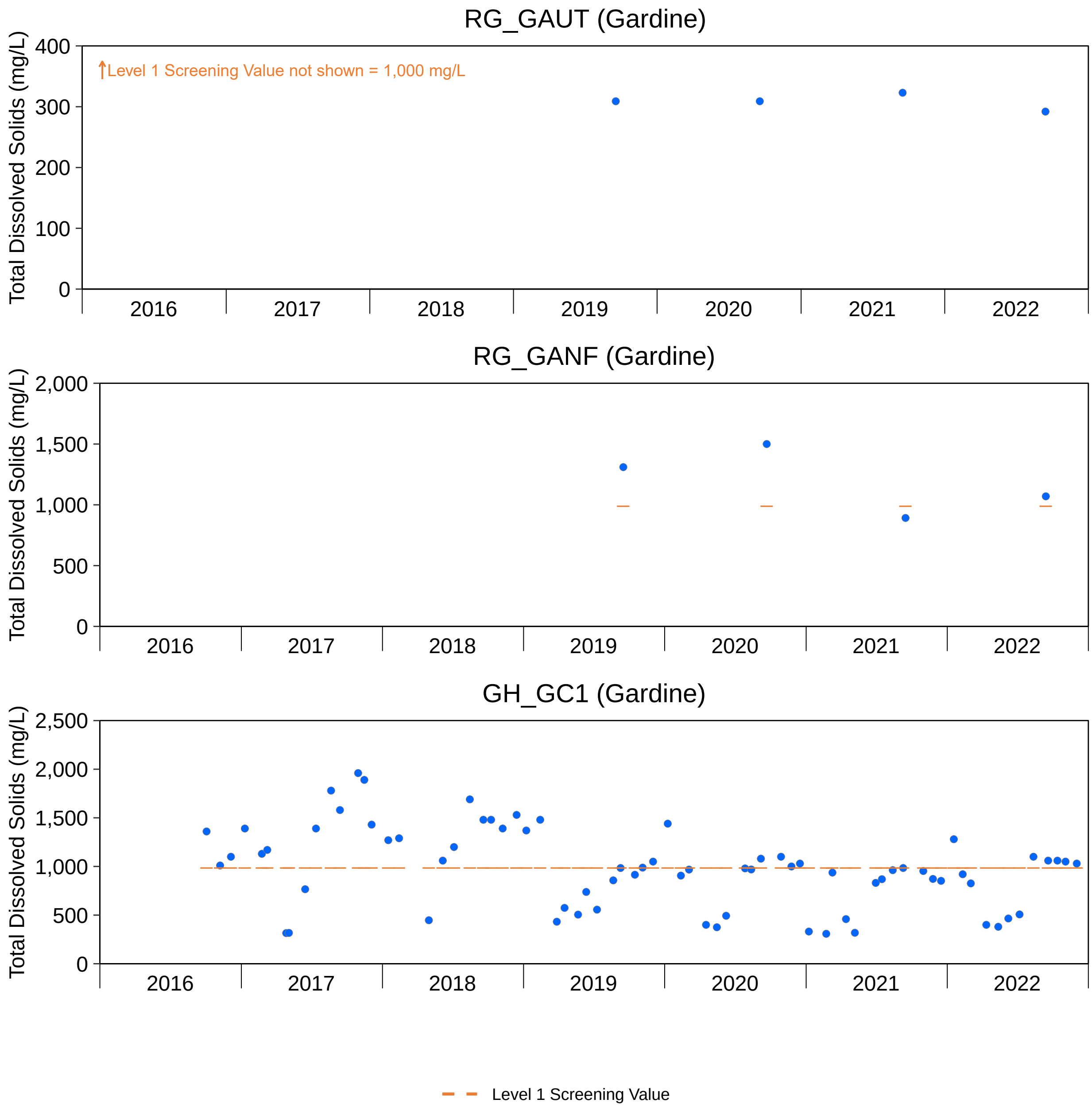
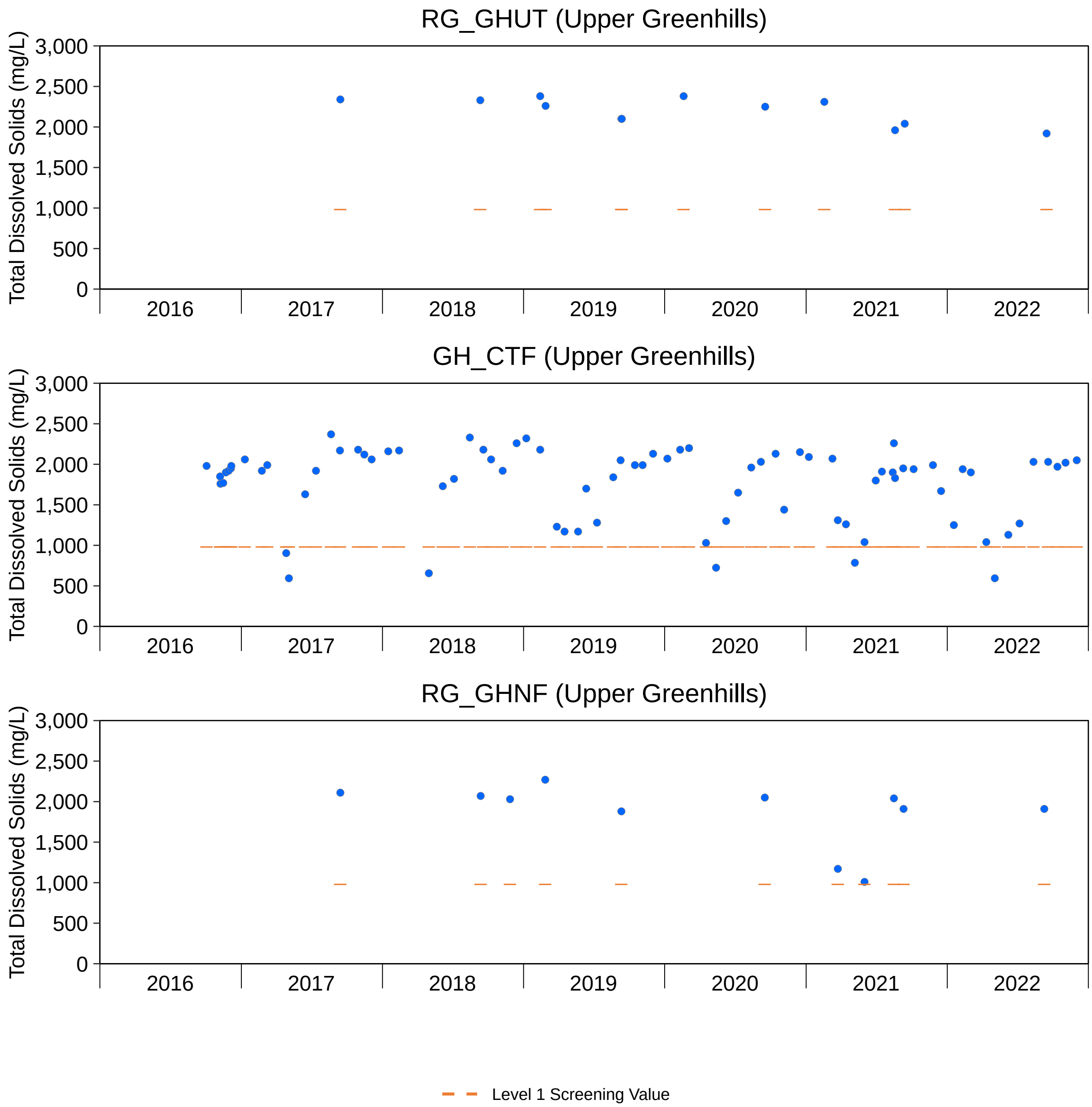


Figure E.1: Total Dissolved Solids Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).



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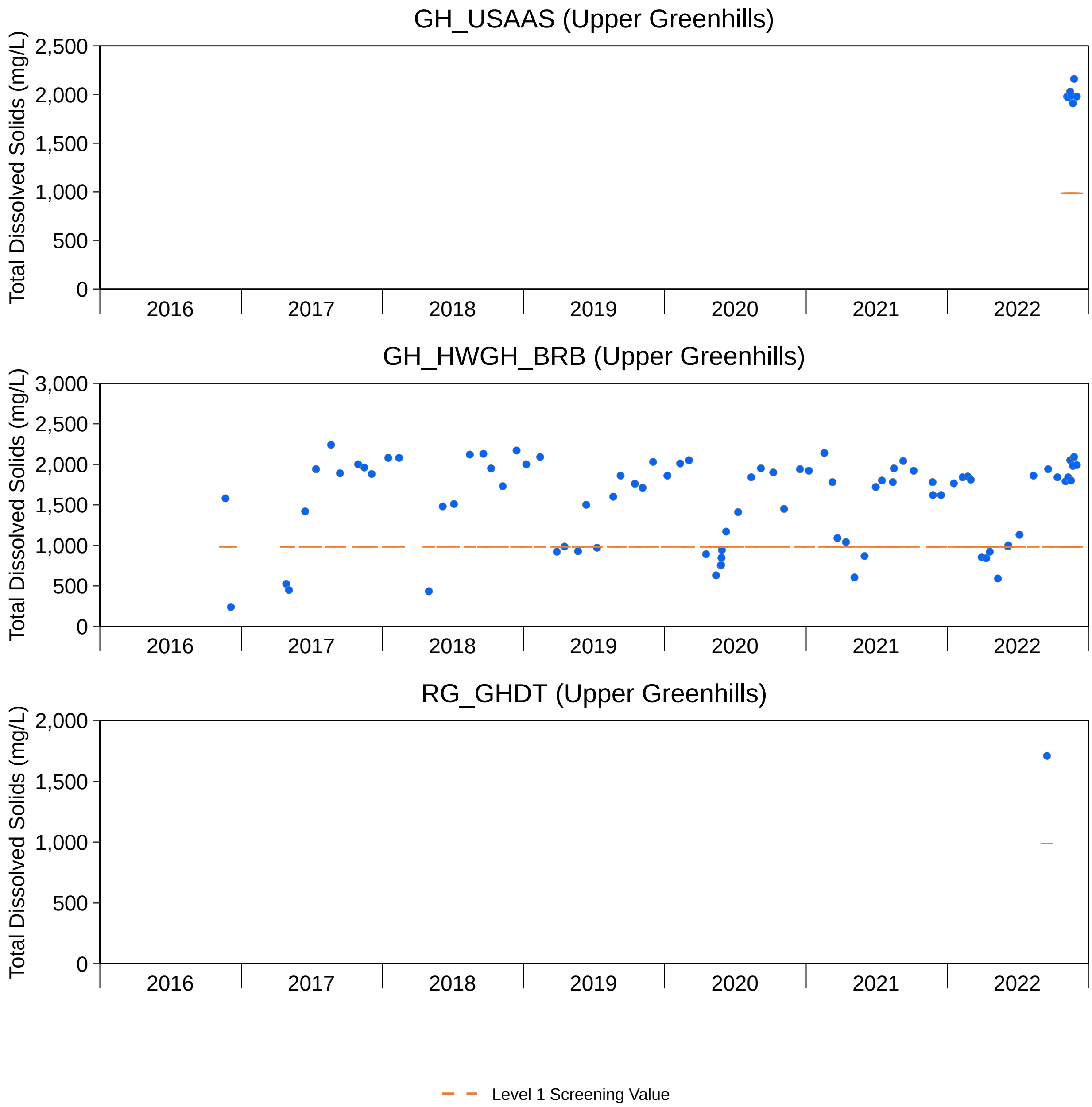

Figure E.1: Total Dissolved Solids Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

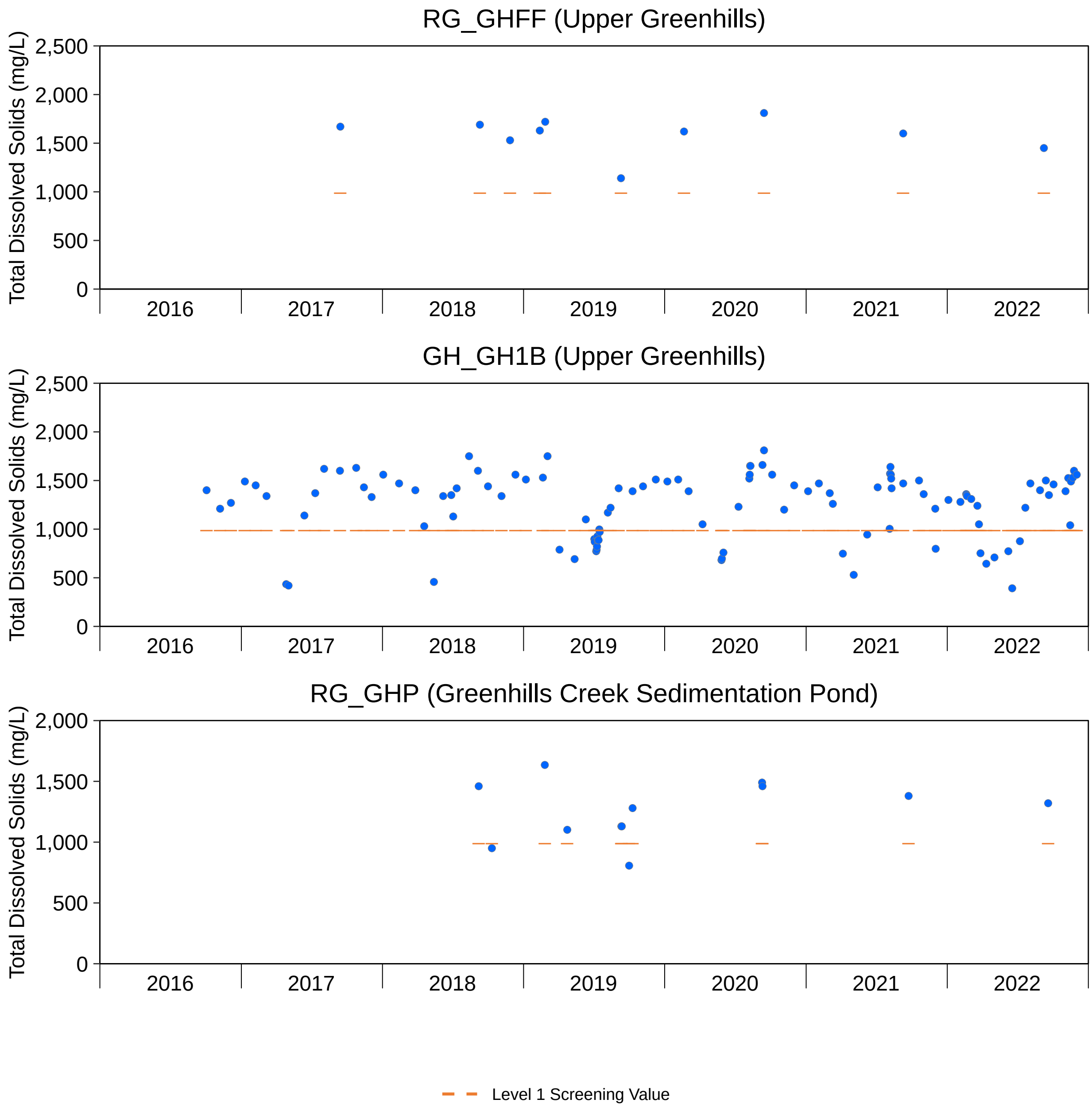

Figure E.1: Total Dissolved Solids Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

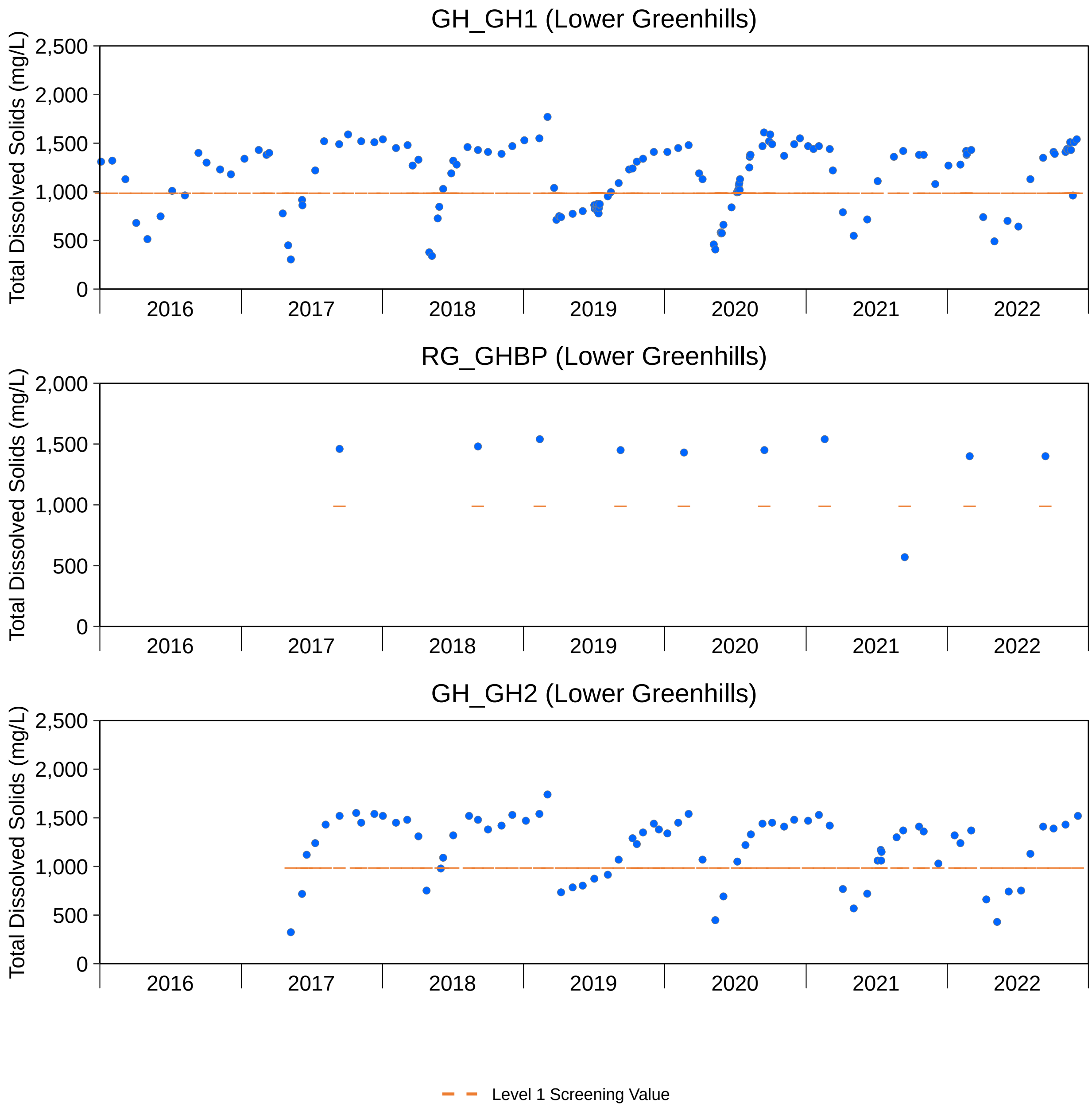

Figure E.1: Total Dissolved Solids Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

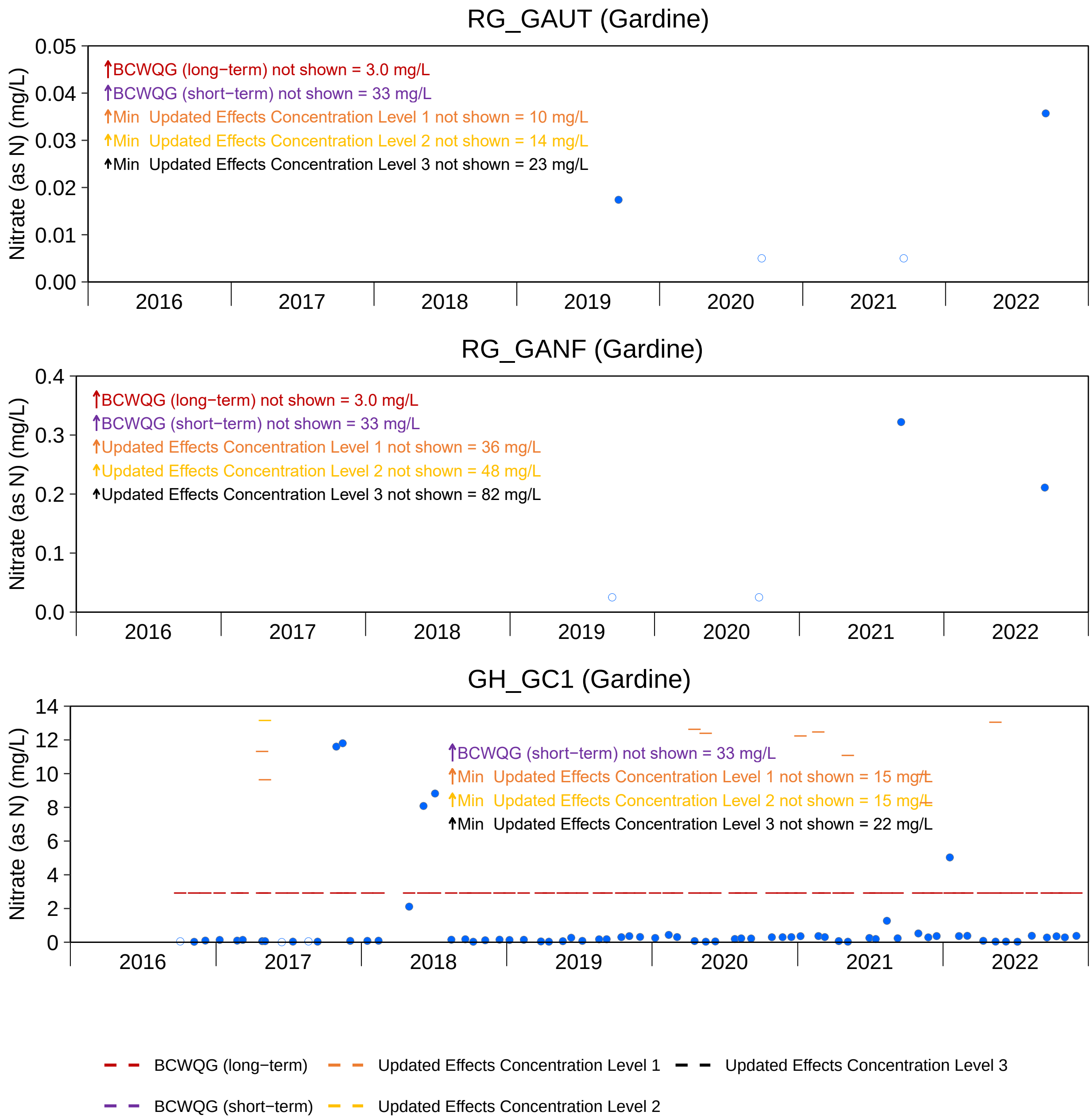

Figure E.2: Nitrate Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines and Updated Effects Concentrations are dependent on water hardness. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

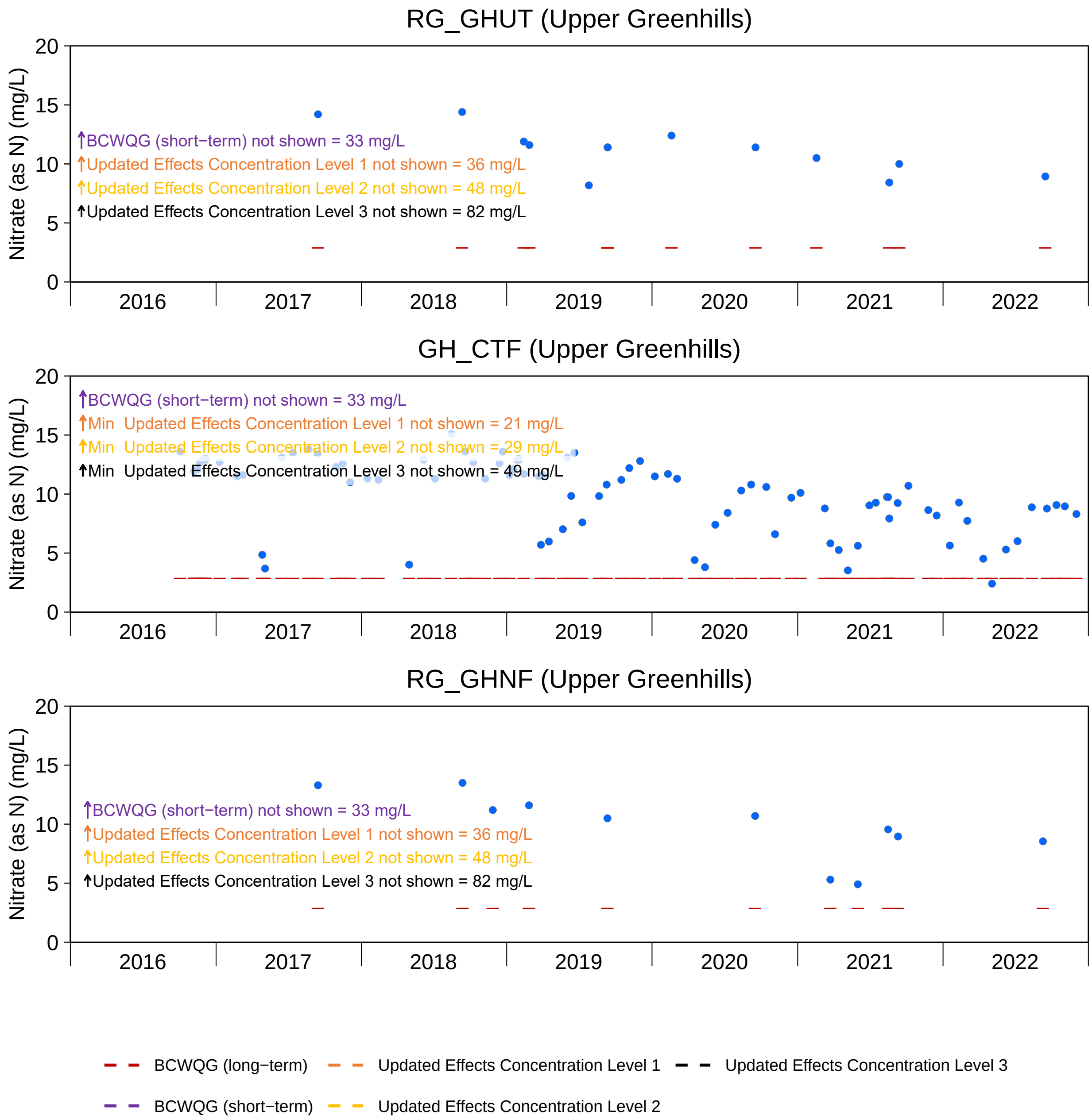

Figure E.2: Nitrate Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines and Updated Effects Concentrations are dependent on water hardness. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

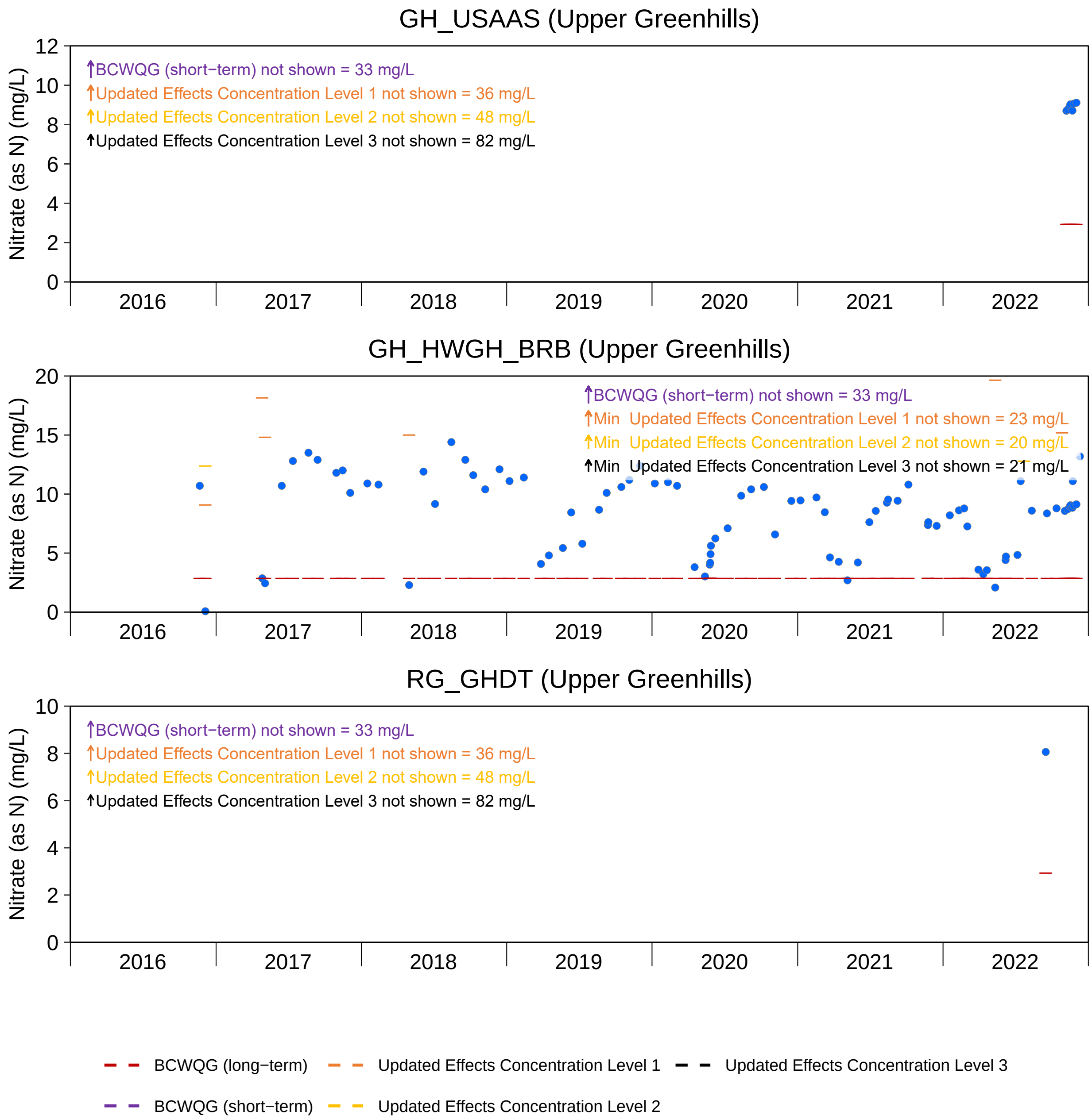

Figure E.2: Nitrate Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines and Updated Effects Concentrations are dependent on water hardness. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

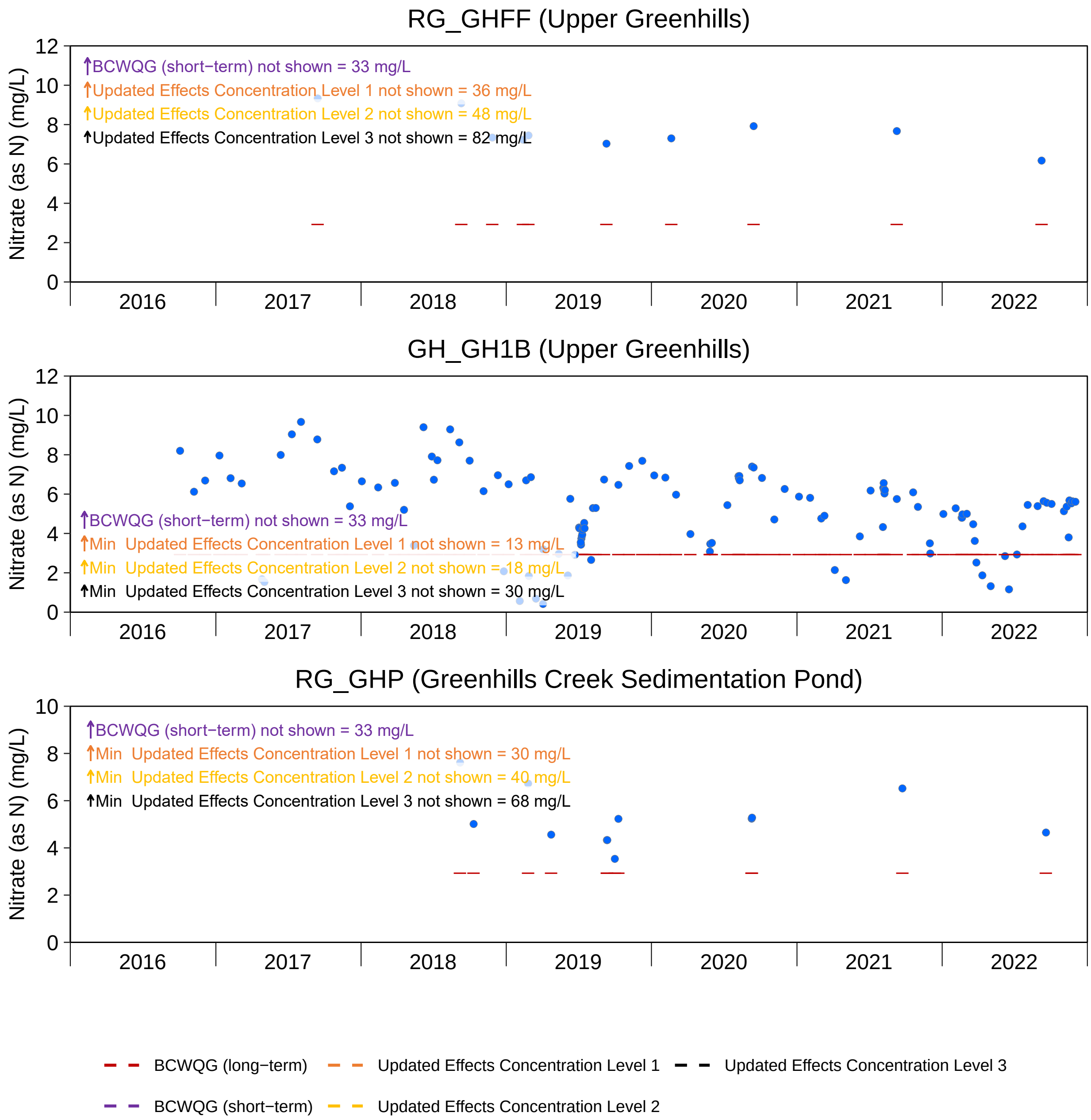

Figure E.2: Nitrate Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines and Updated Effects Concentrations are dependent on water hardness. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

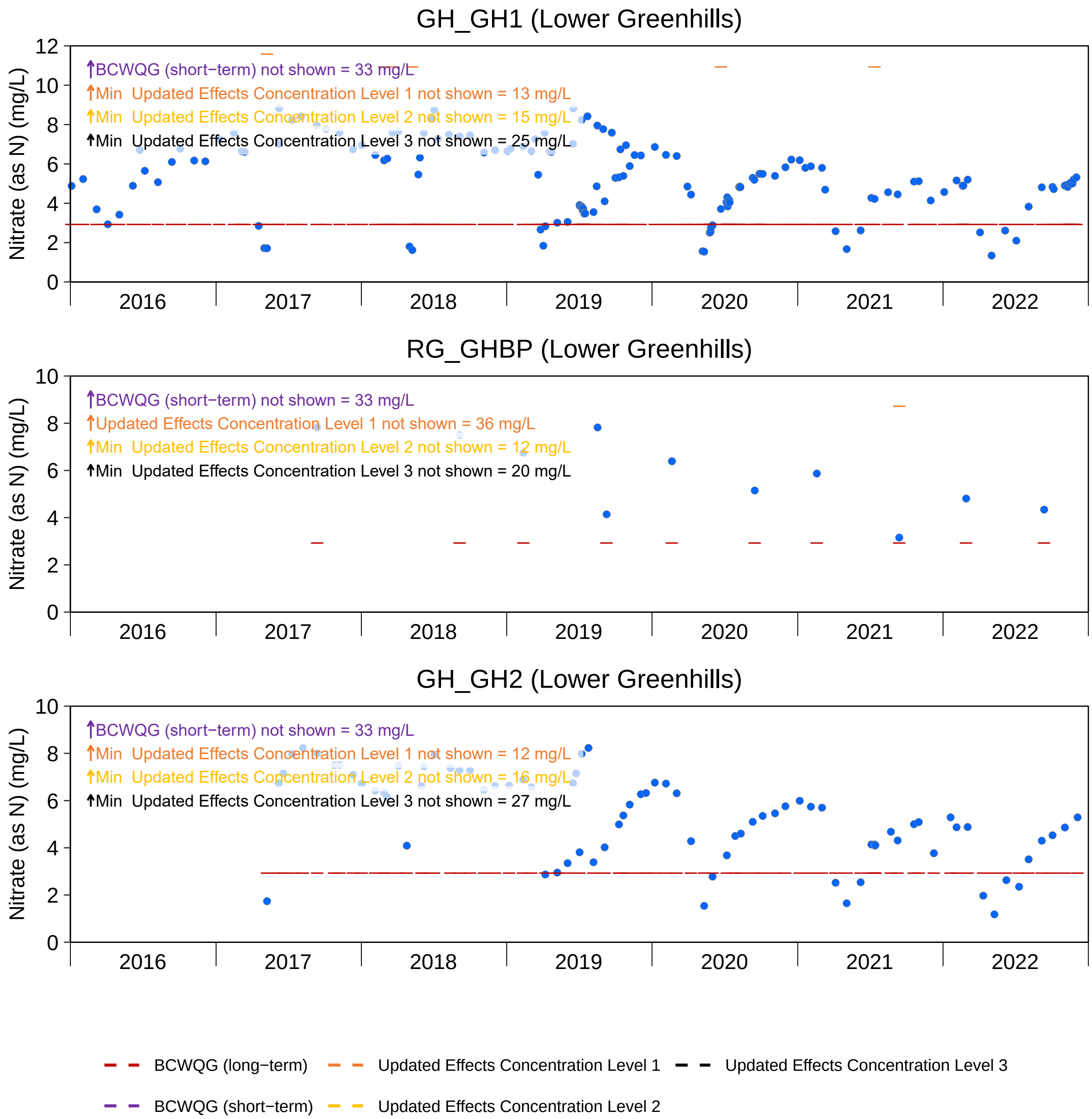

Figure E.2: Nitrate Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines and Updated Effects Concentrations are dependent on water hardness. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

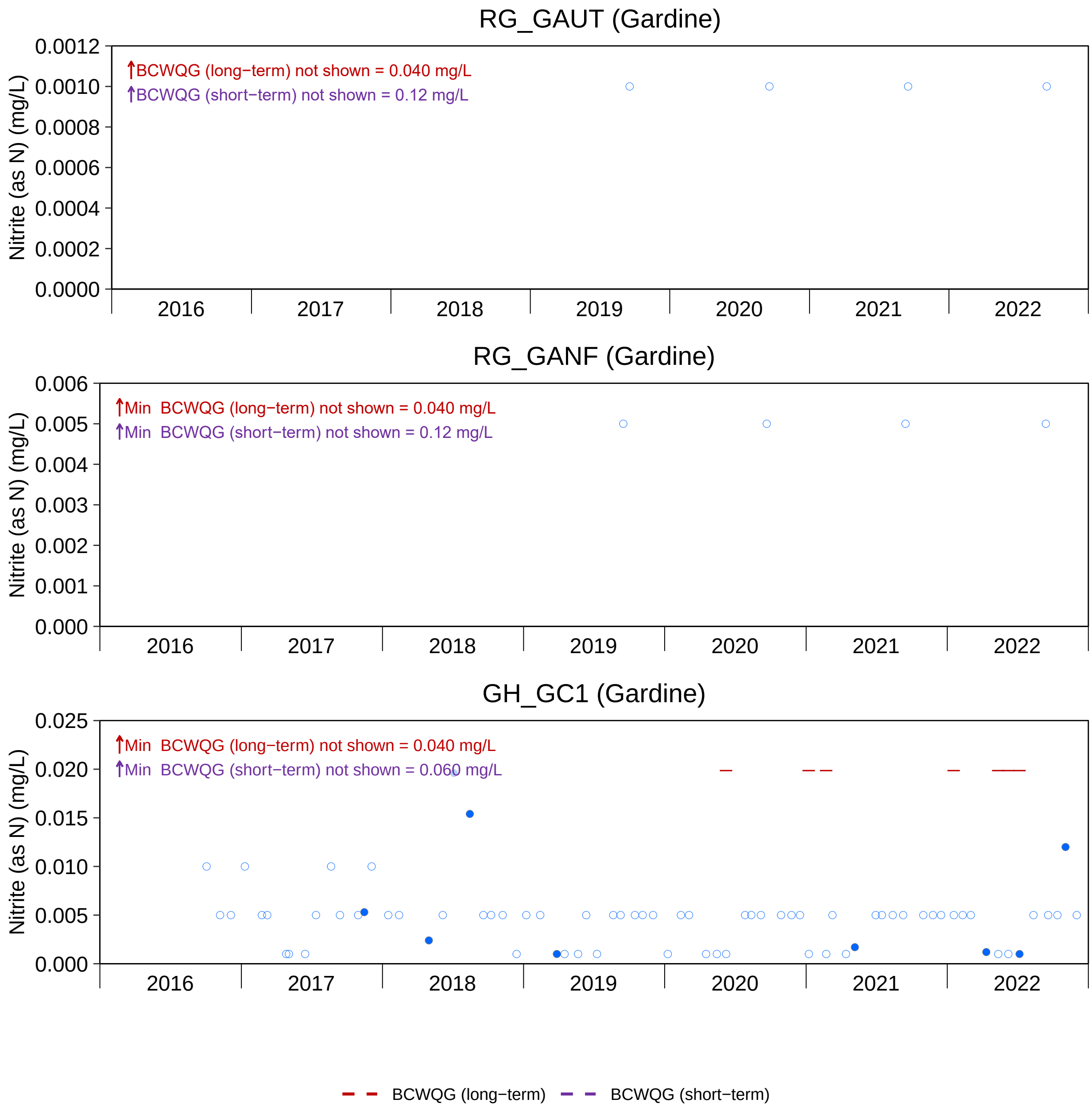

Figure E.3: Nitrite Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

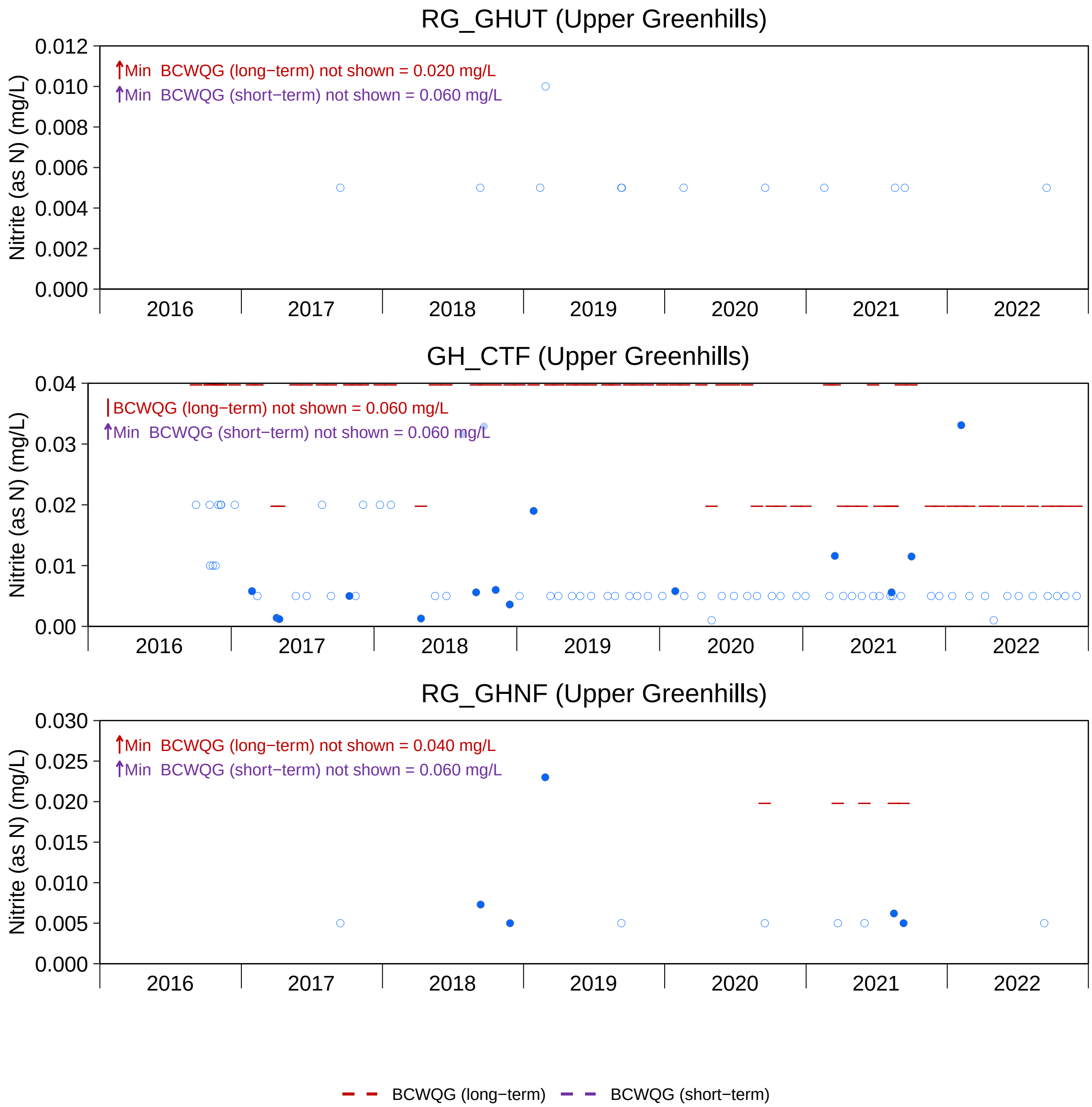

Figure E.3: Nitrite Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

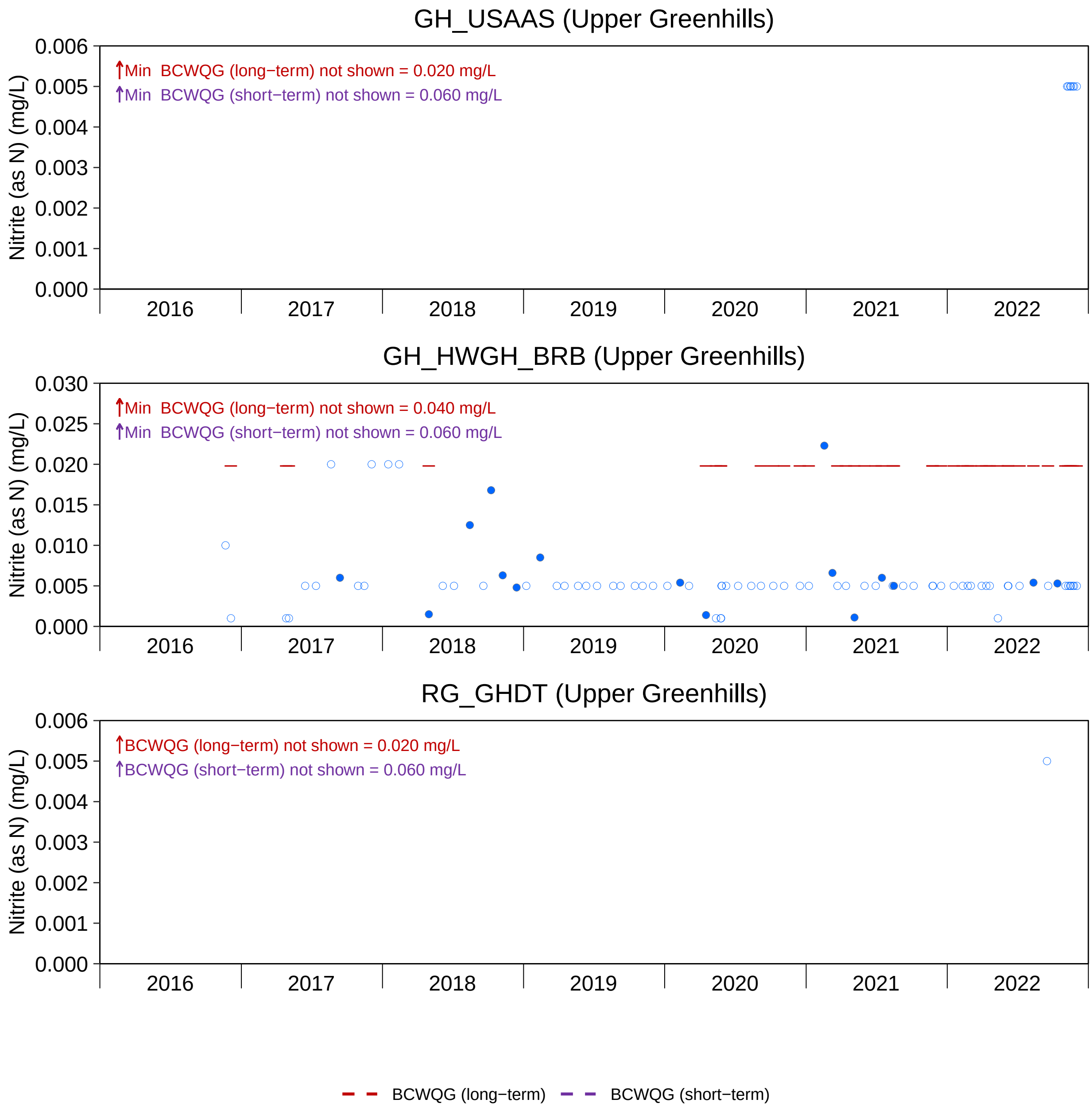

Figure E.3: Nitrite Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

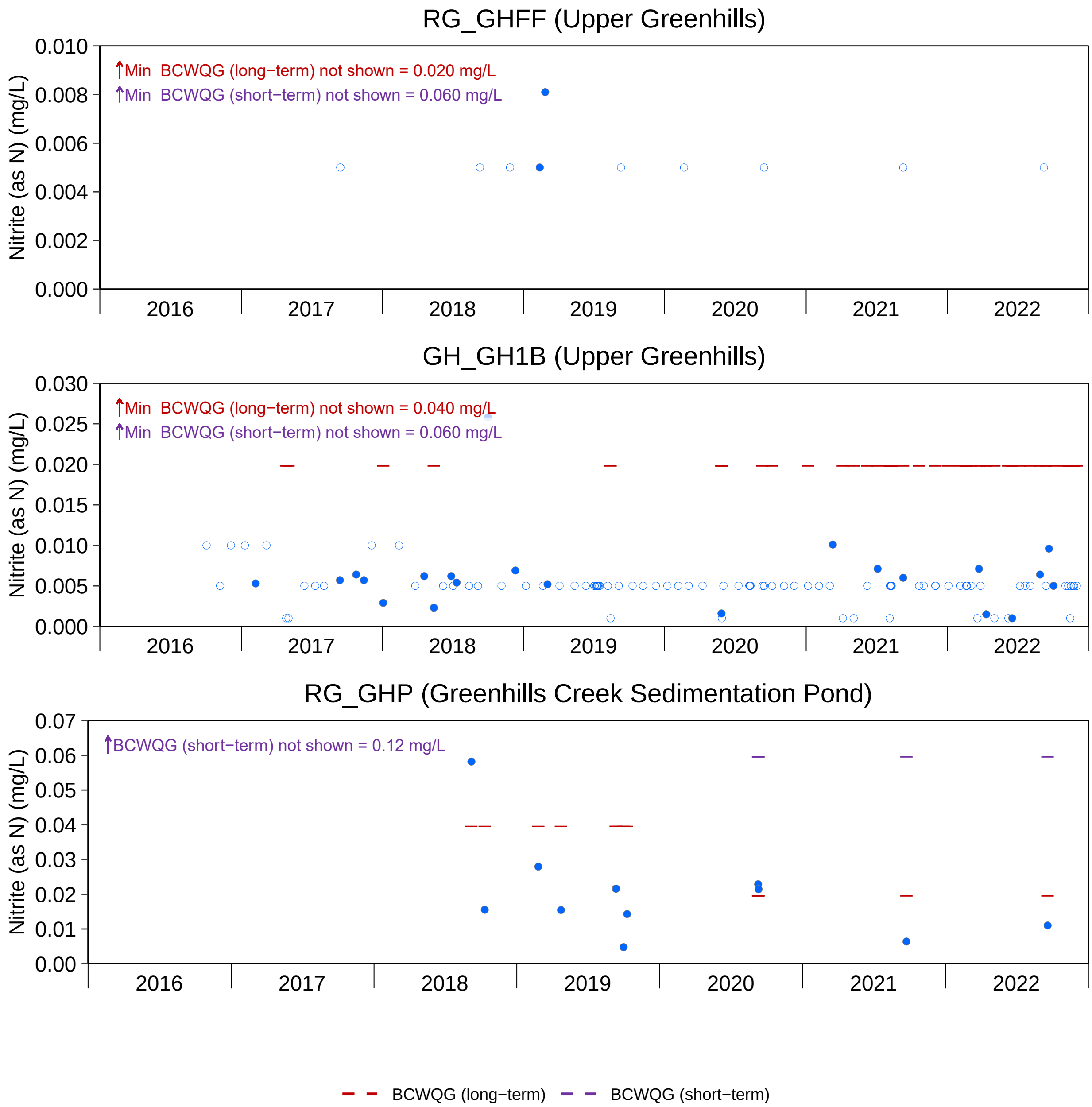

Figure E.3: Nitrite Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

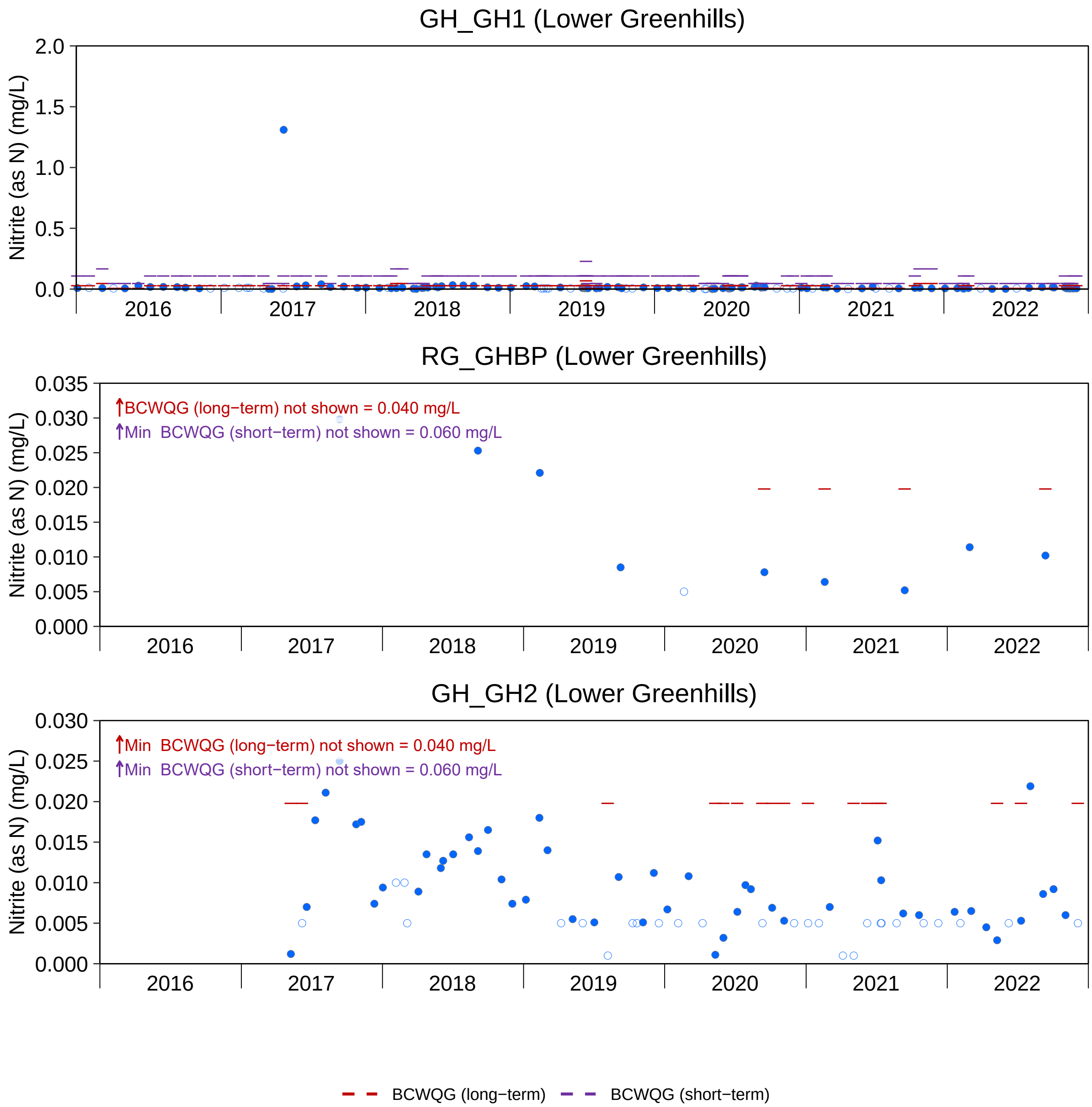

Figure E.3: Nitrite Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

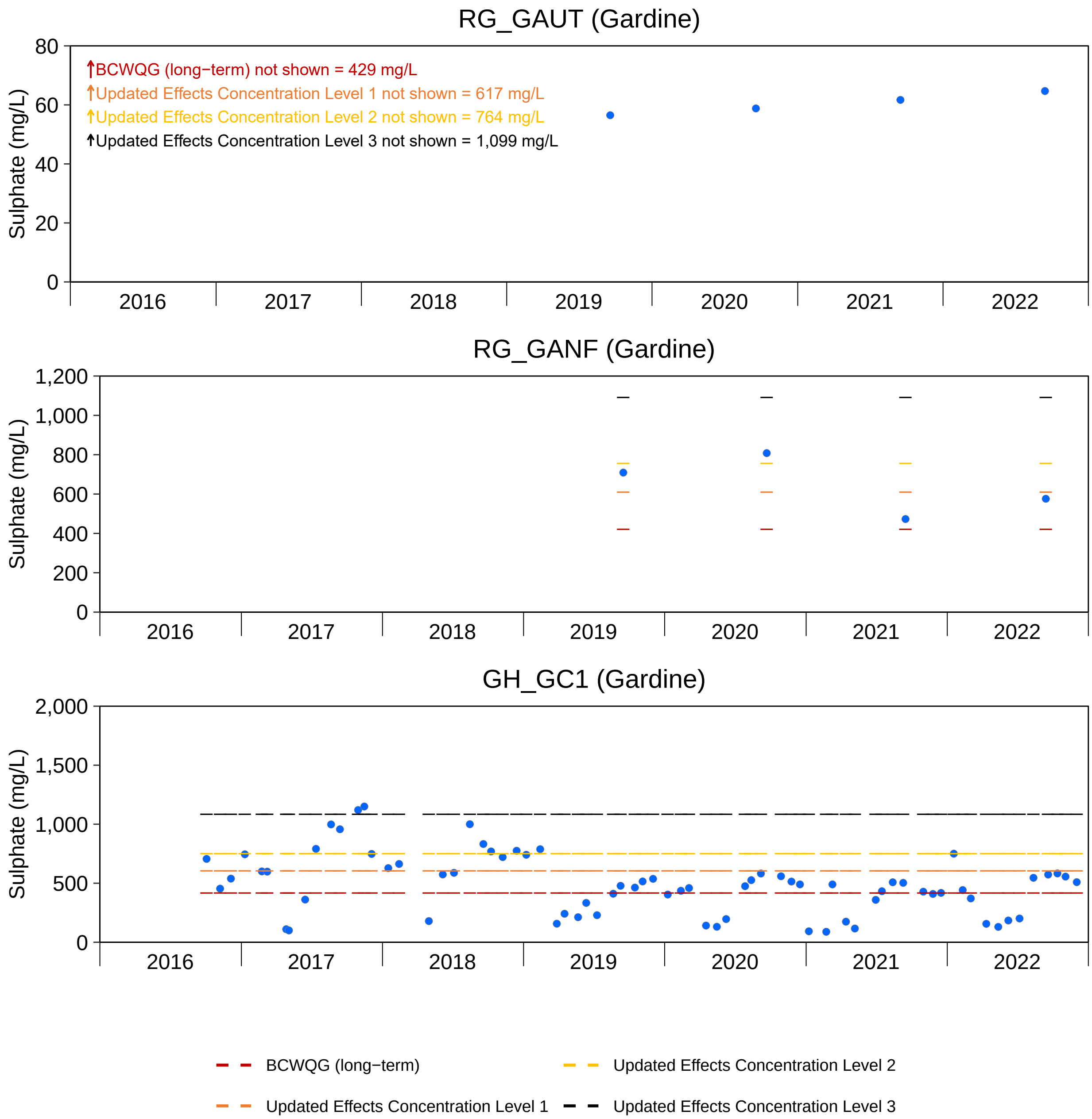

Figure E.4: Sulphate Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

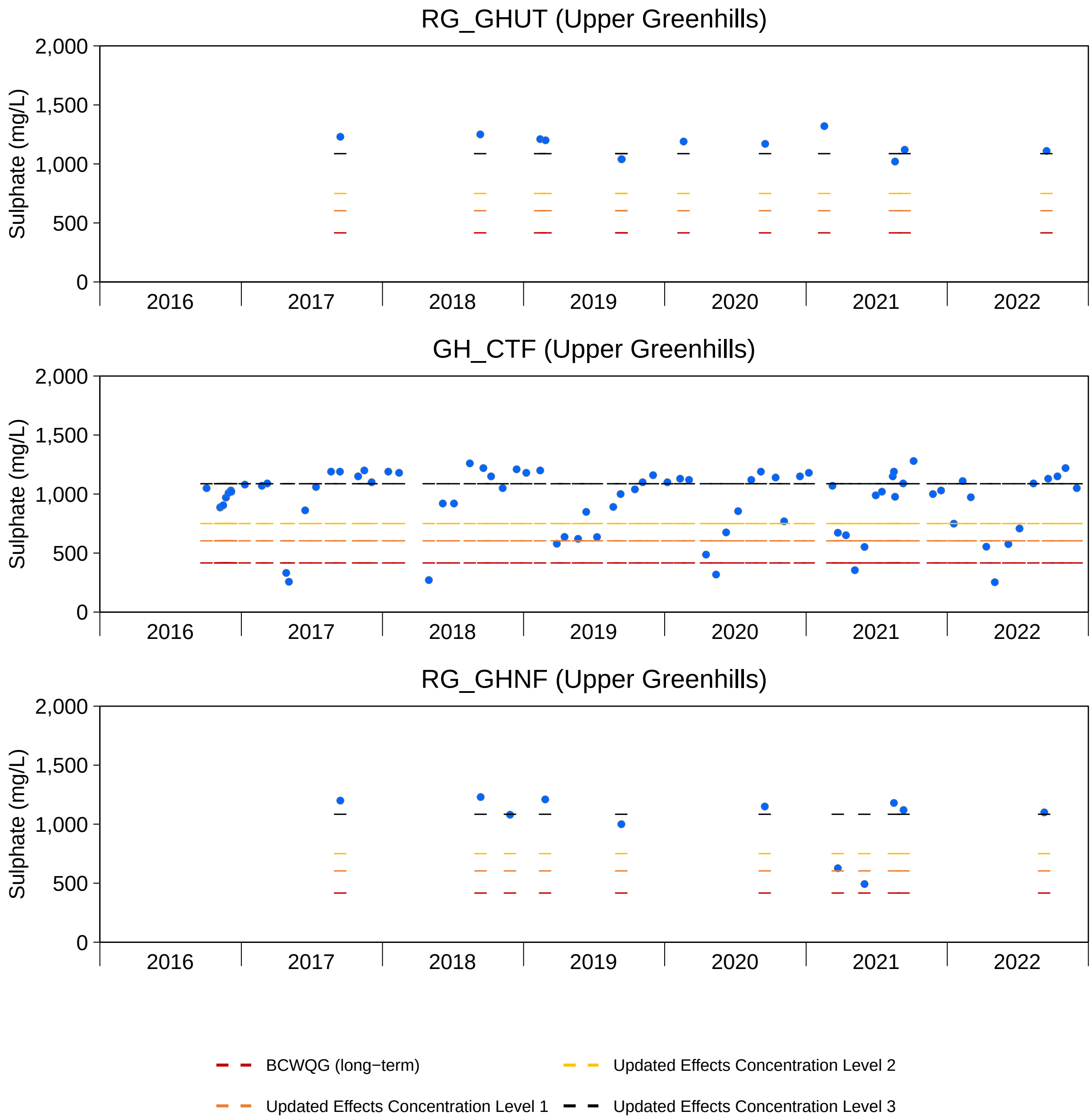

Figure E.4: Sulphate Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

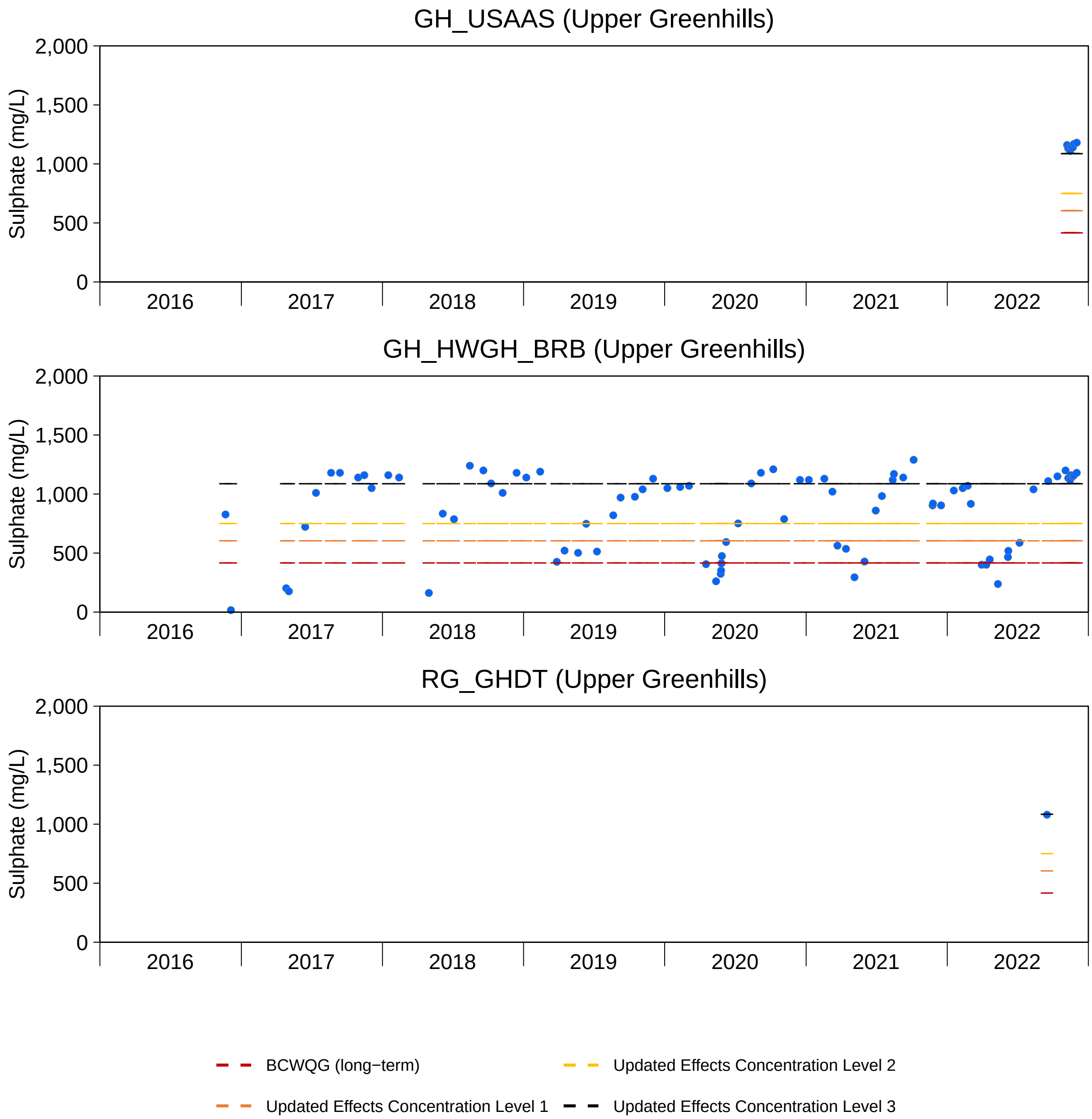

Figure E.4: Sulphate Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

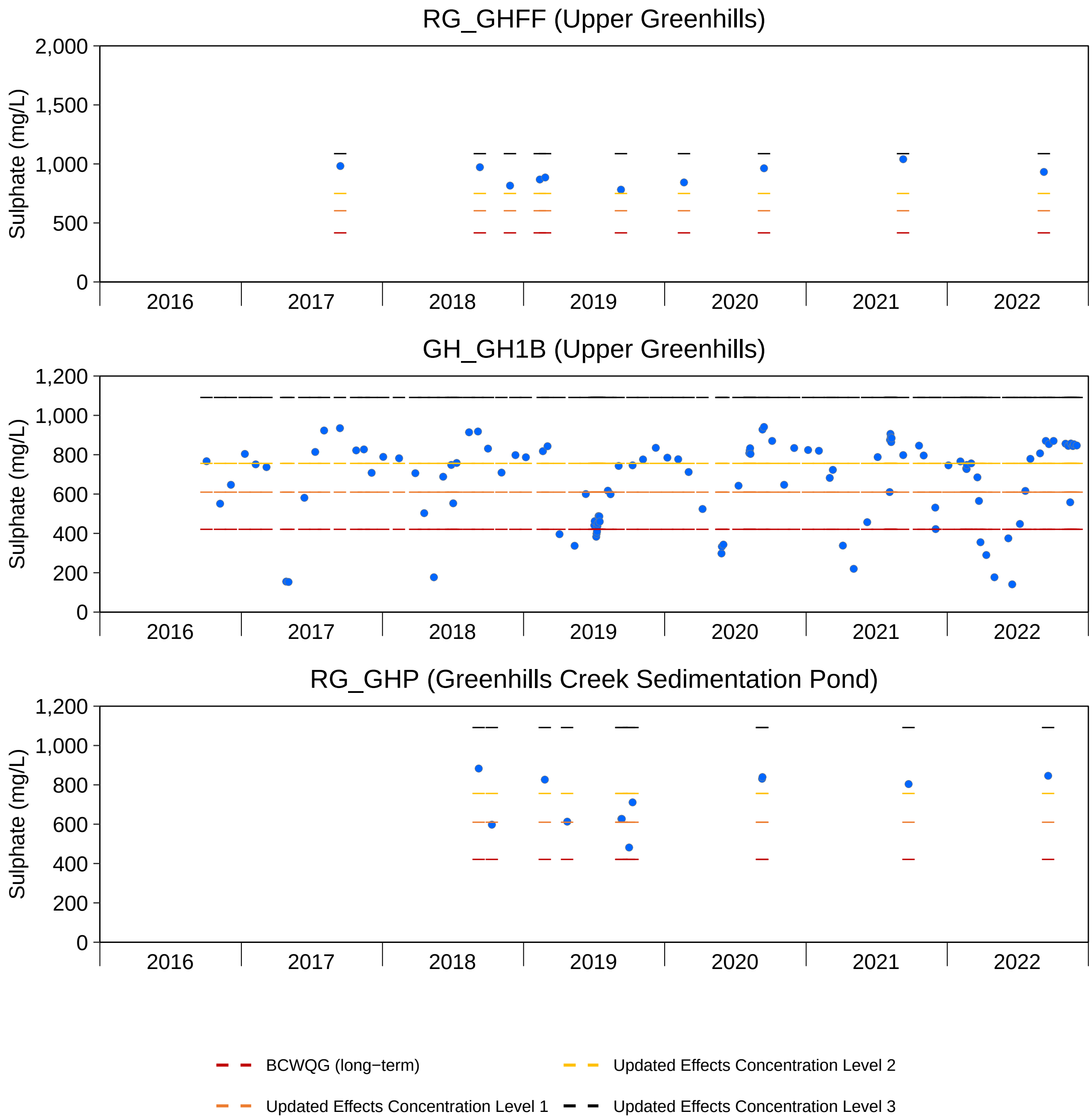

Figure E.4: Sulphate Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

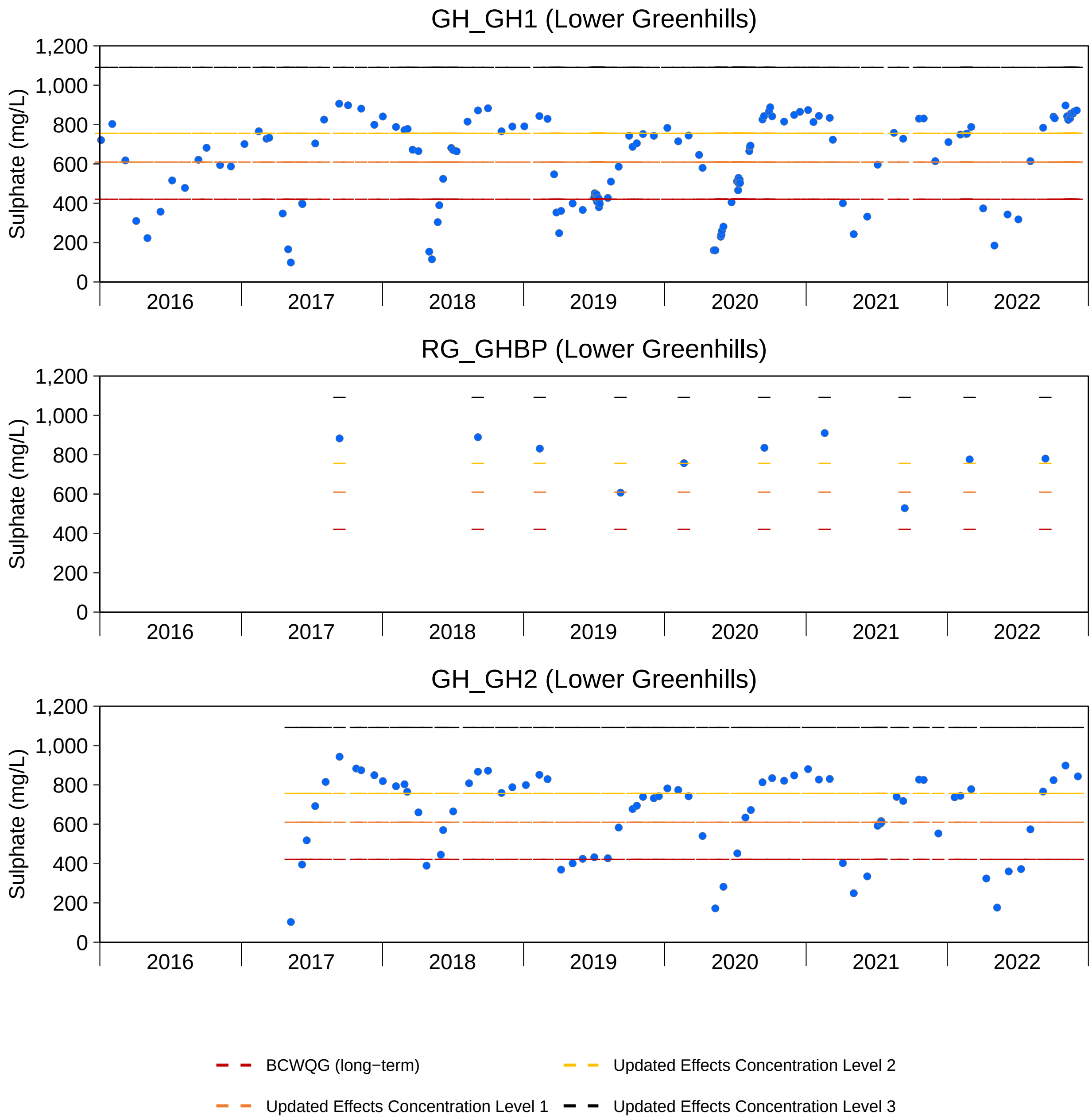

Figure E.4: Sulphate Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

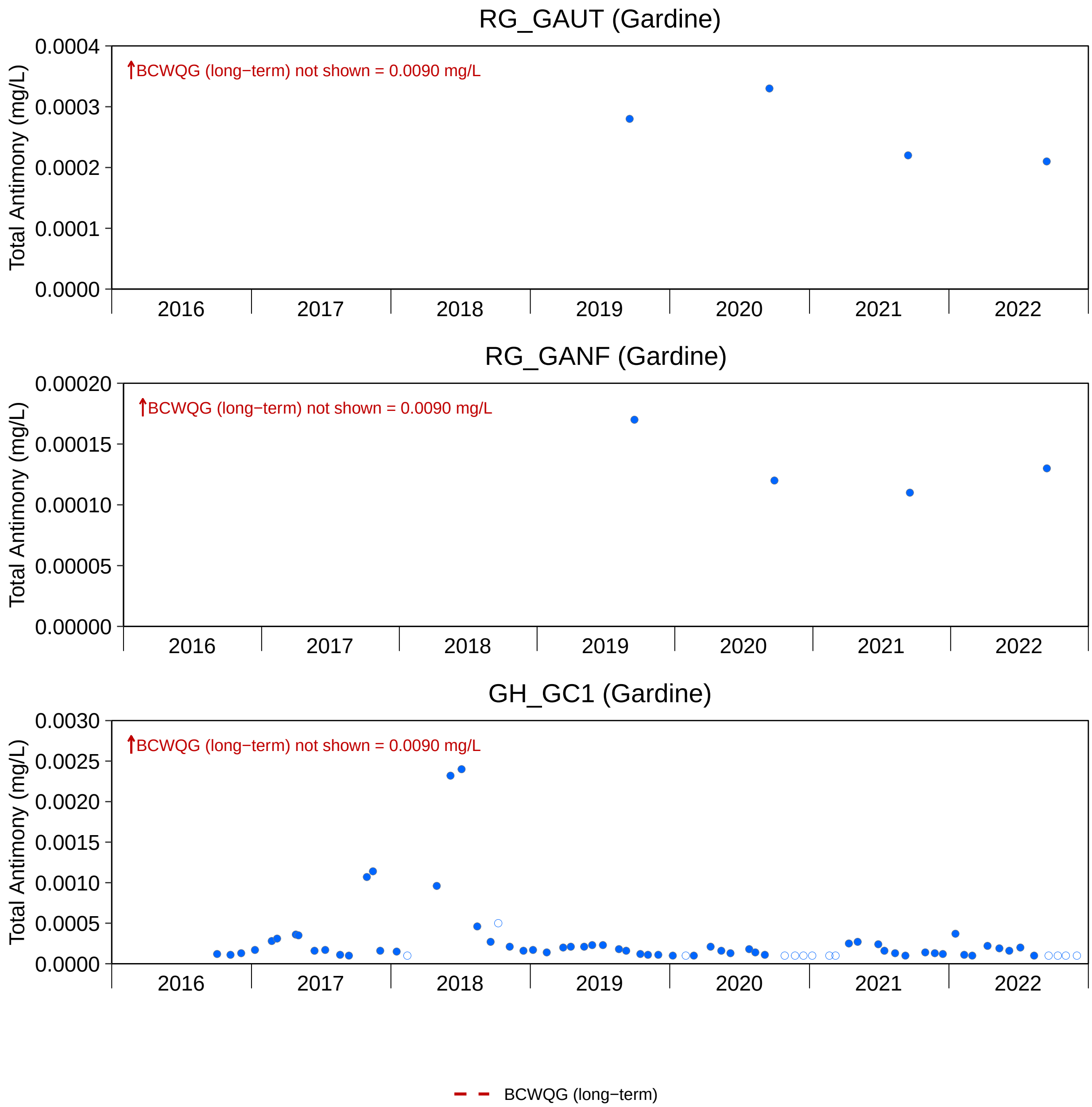

Figure E.5: Total Antimony Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

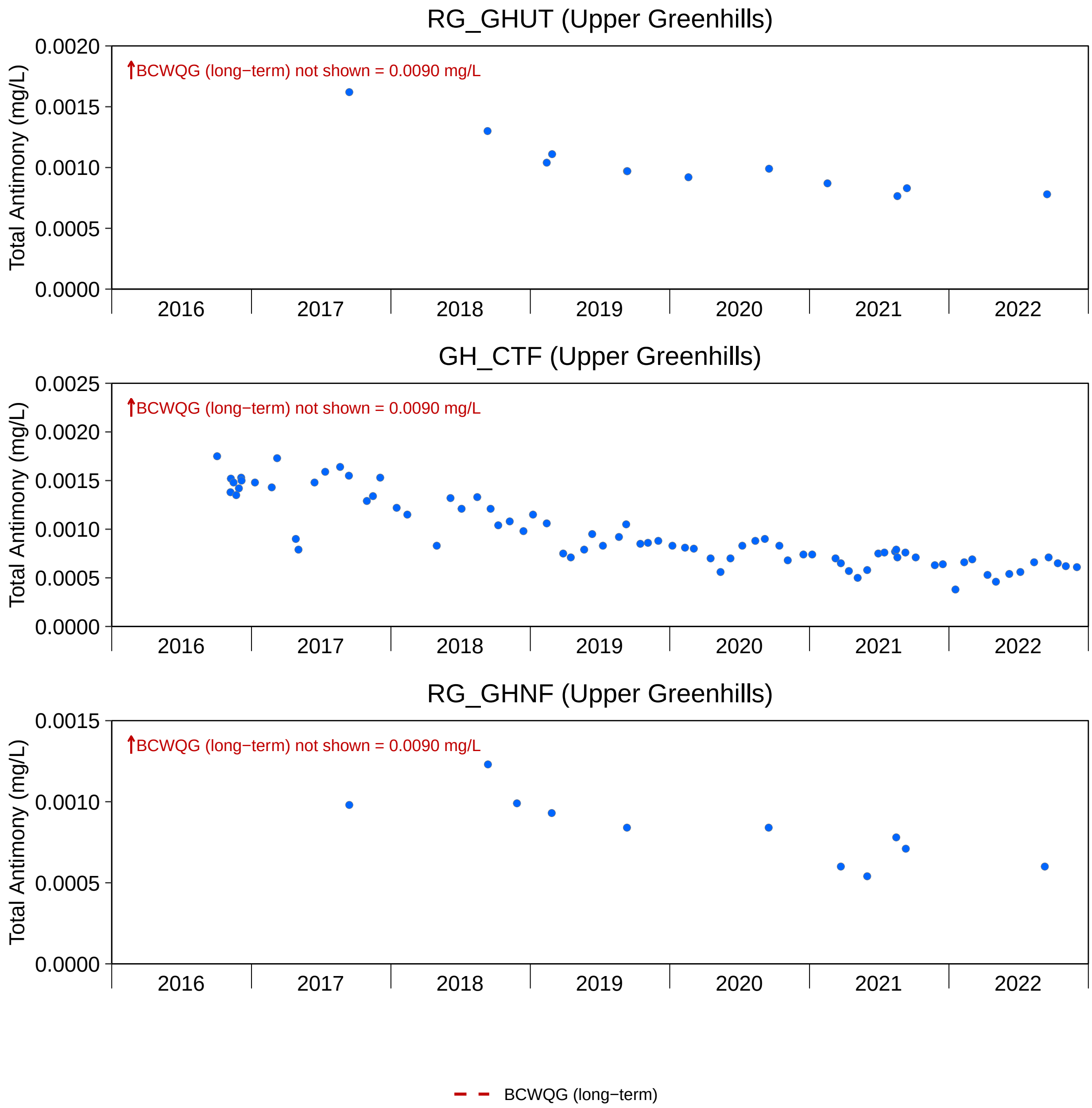

Figure E.5: Total Antimony Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

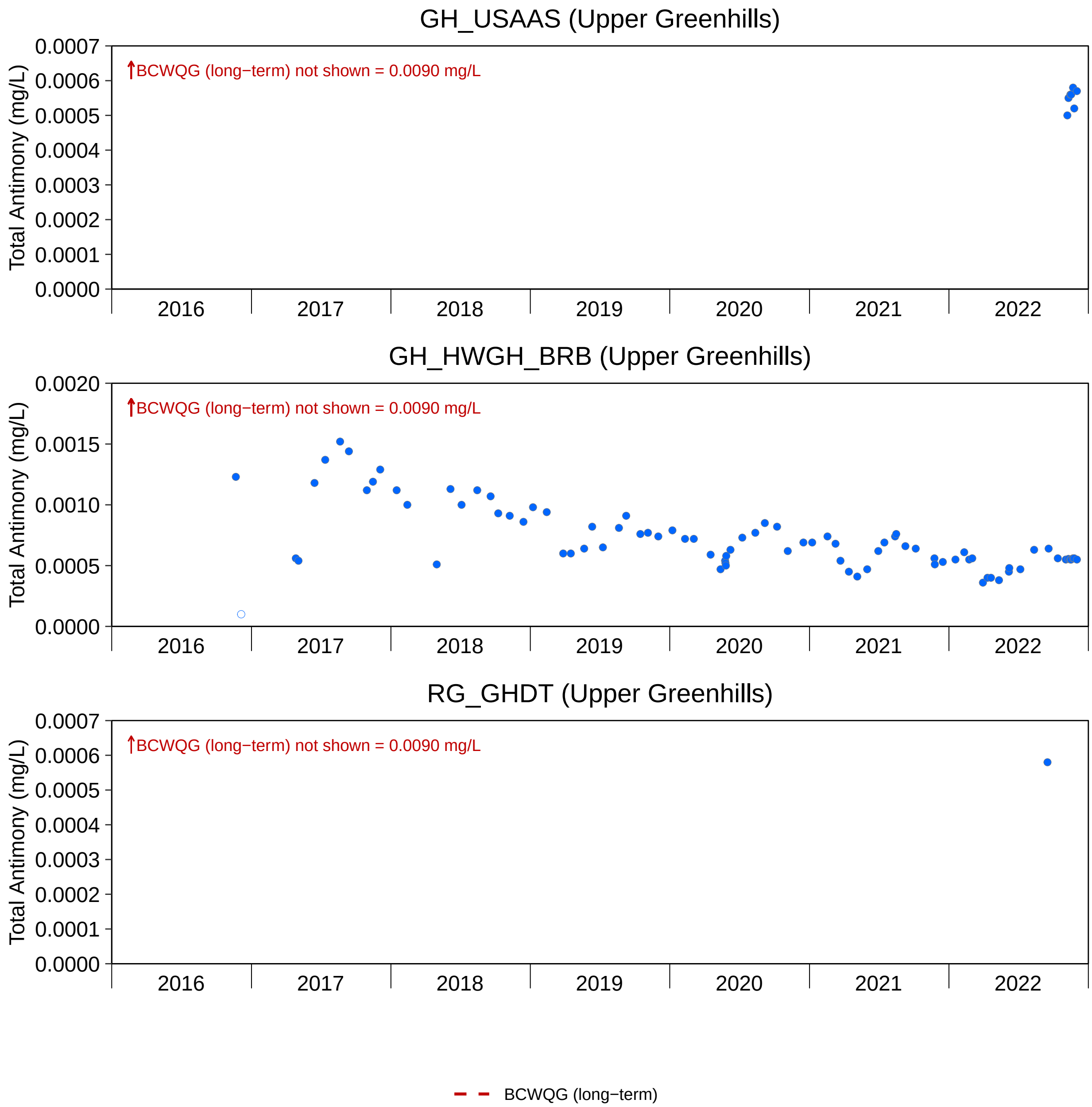

Figure E.5: Total Antimony Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

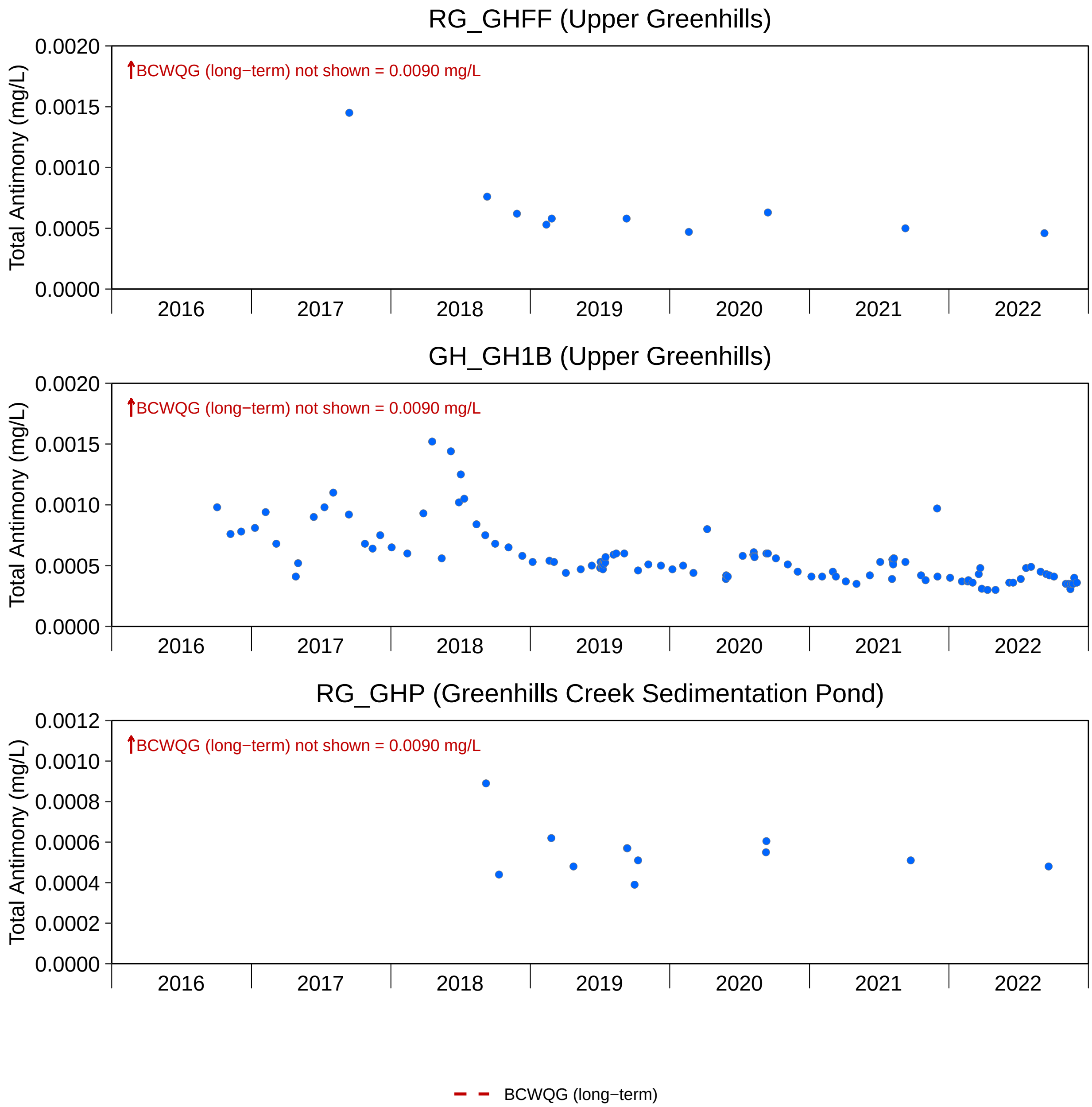

Figure E.5: Total Antimony Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

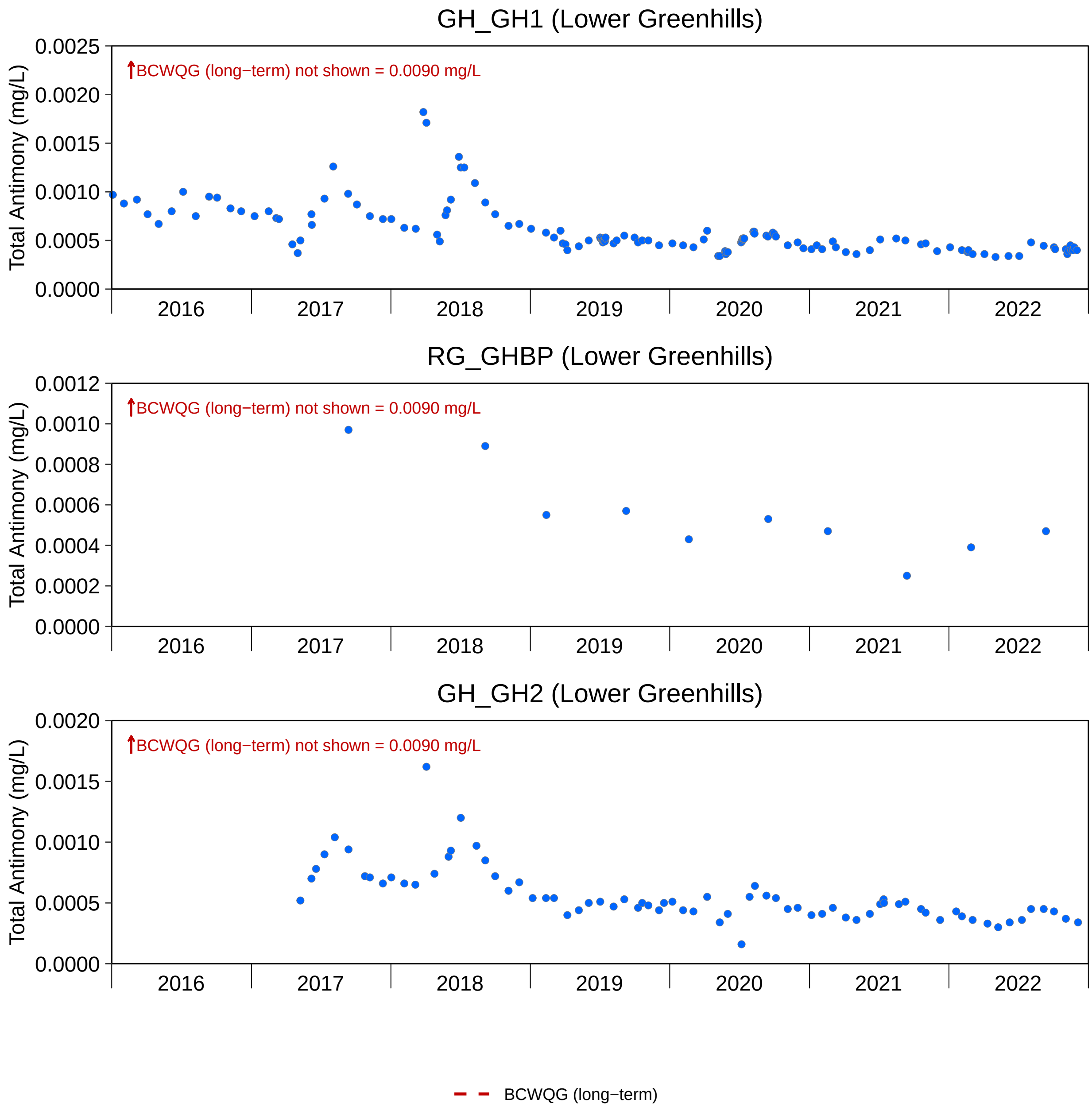

Figure E.5: Total Antimony Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

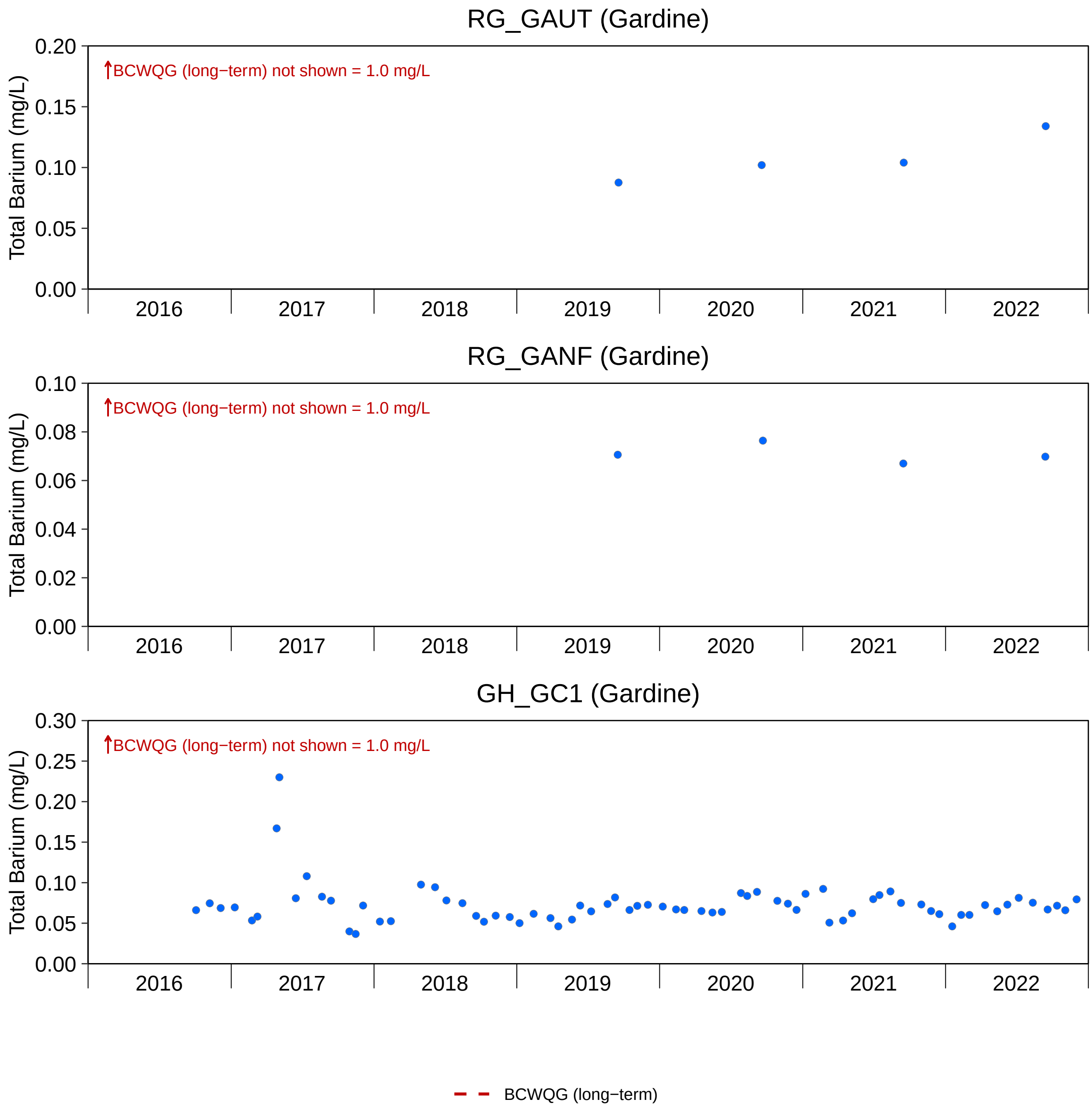

Figure E.6: Total Barium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

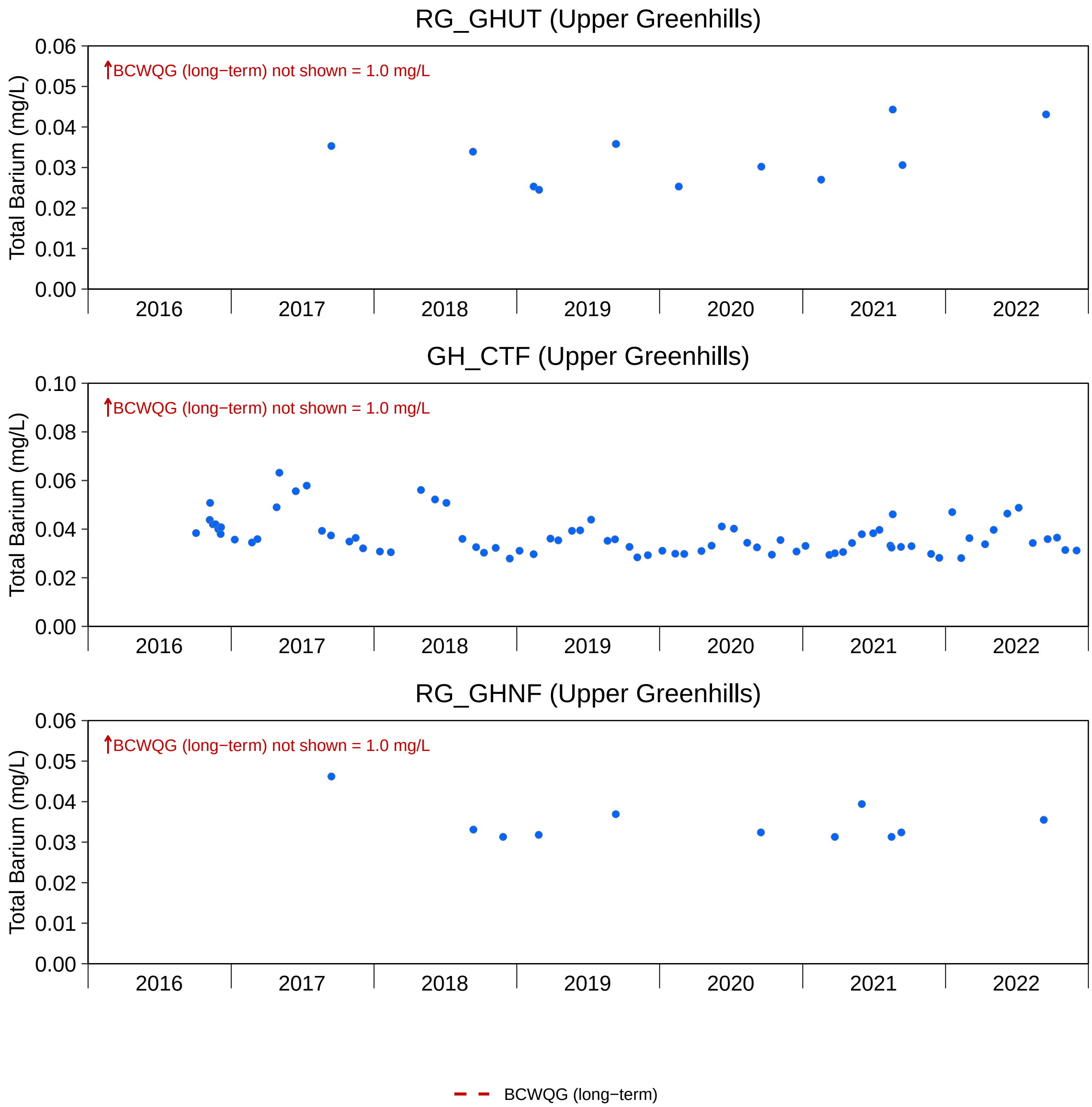

Figure E.6: Total Barium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

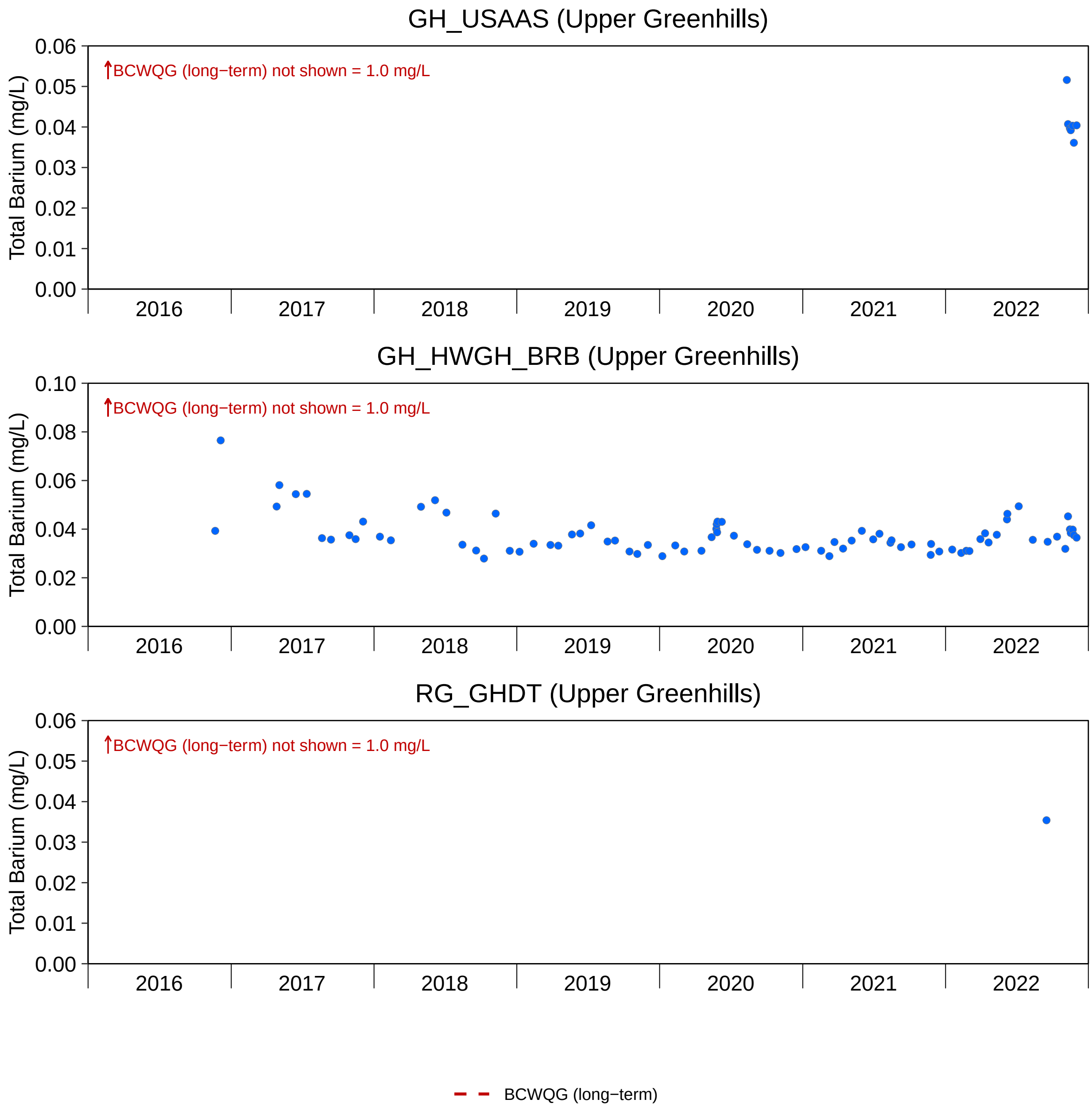

Figure E.6: Total Barium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

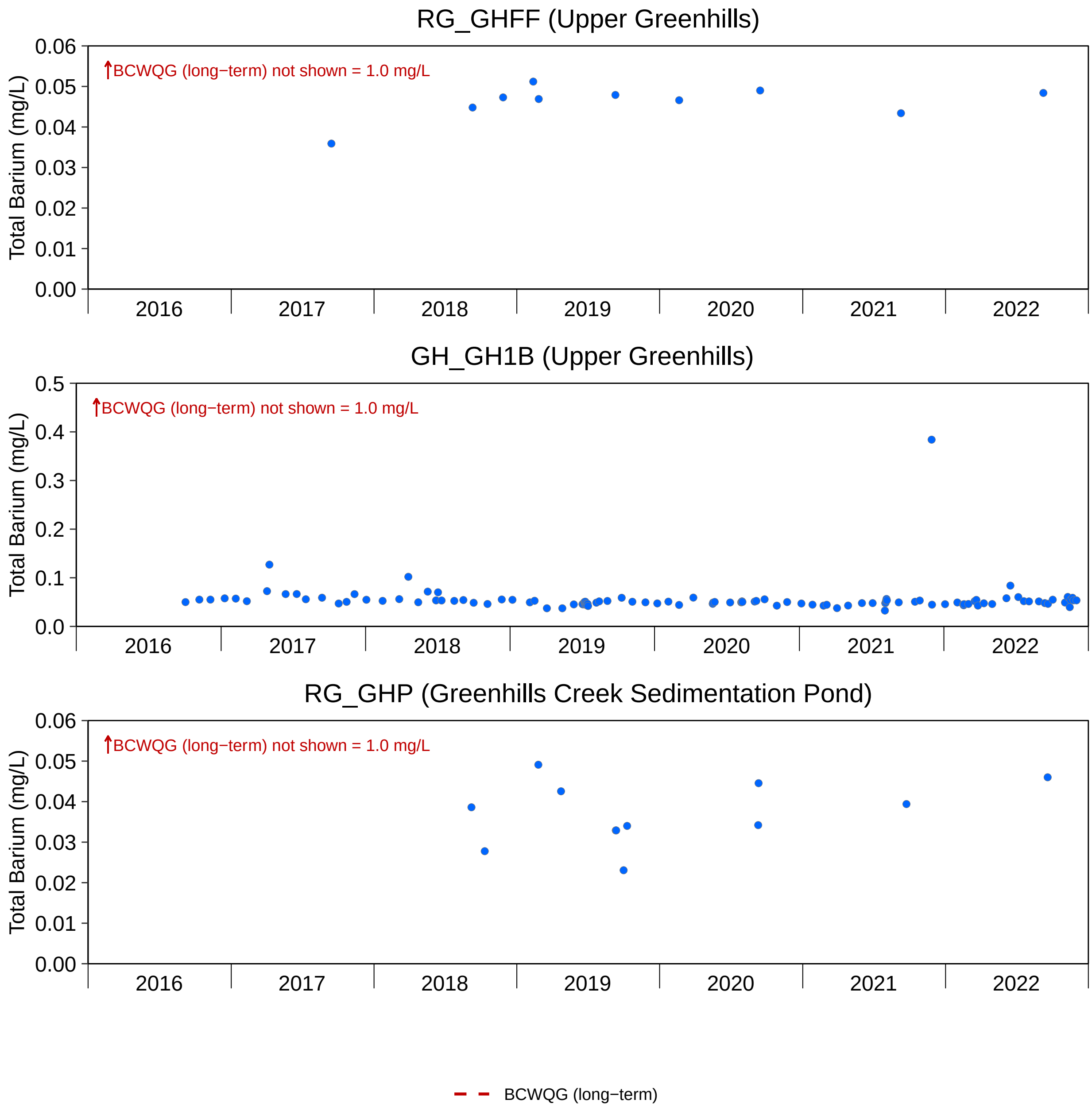

Figure E.6: Total Barium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

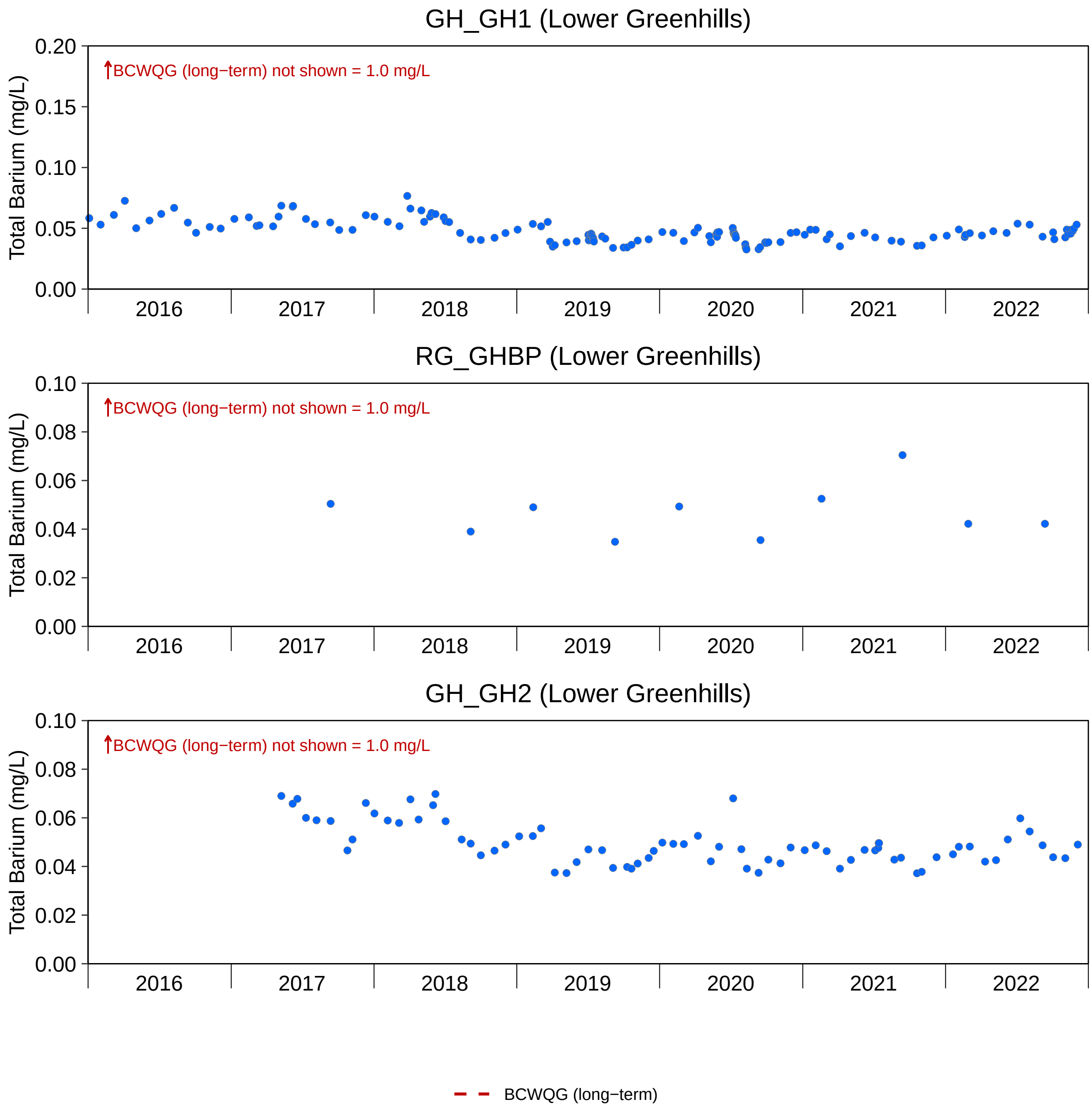

Figure E.6: Total Barium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

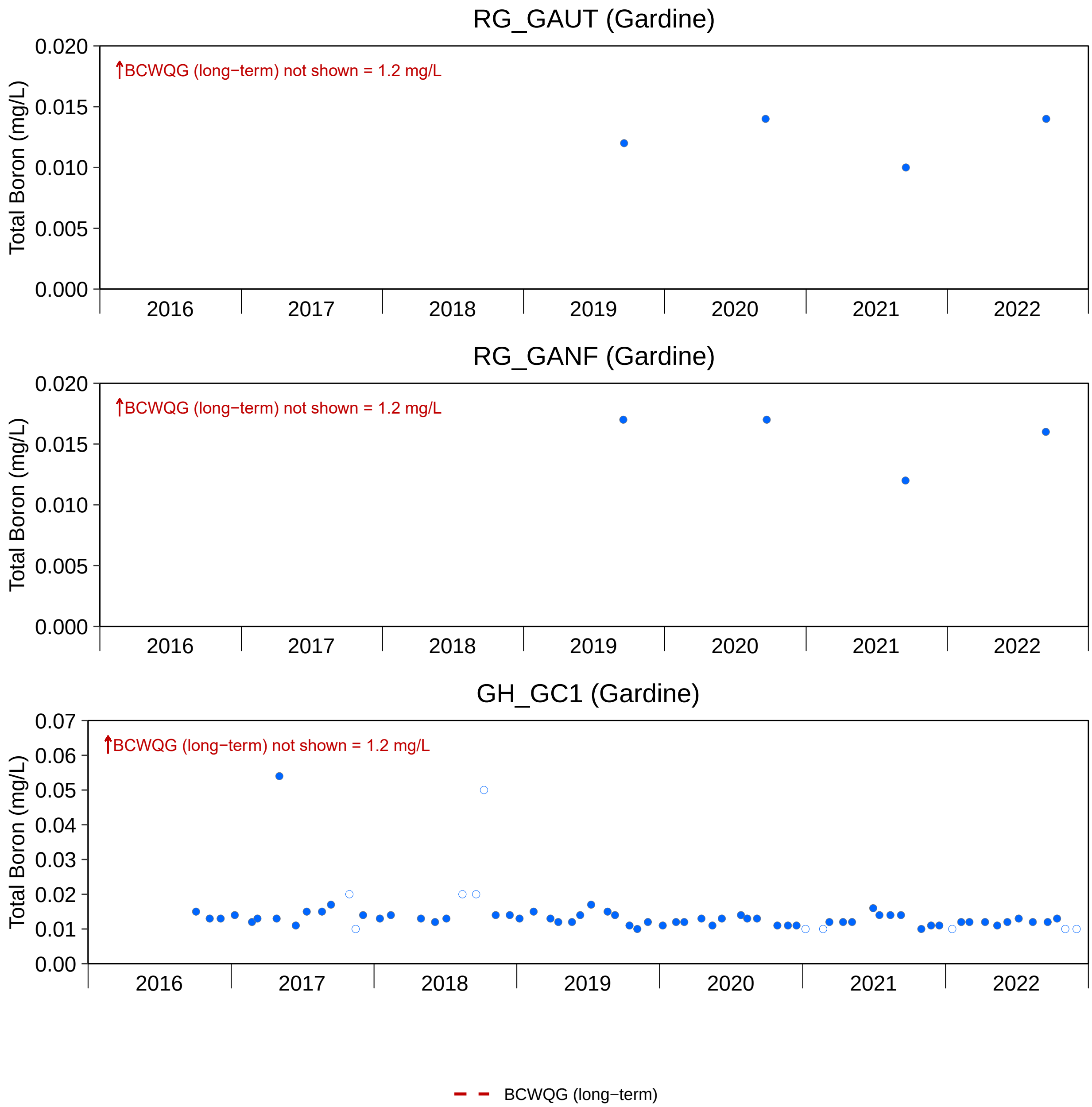

Figure E.7: Total Boron Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

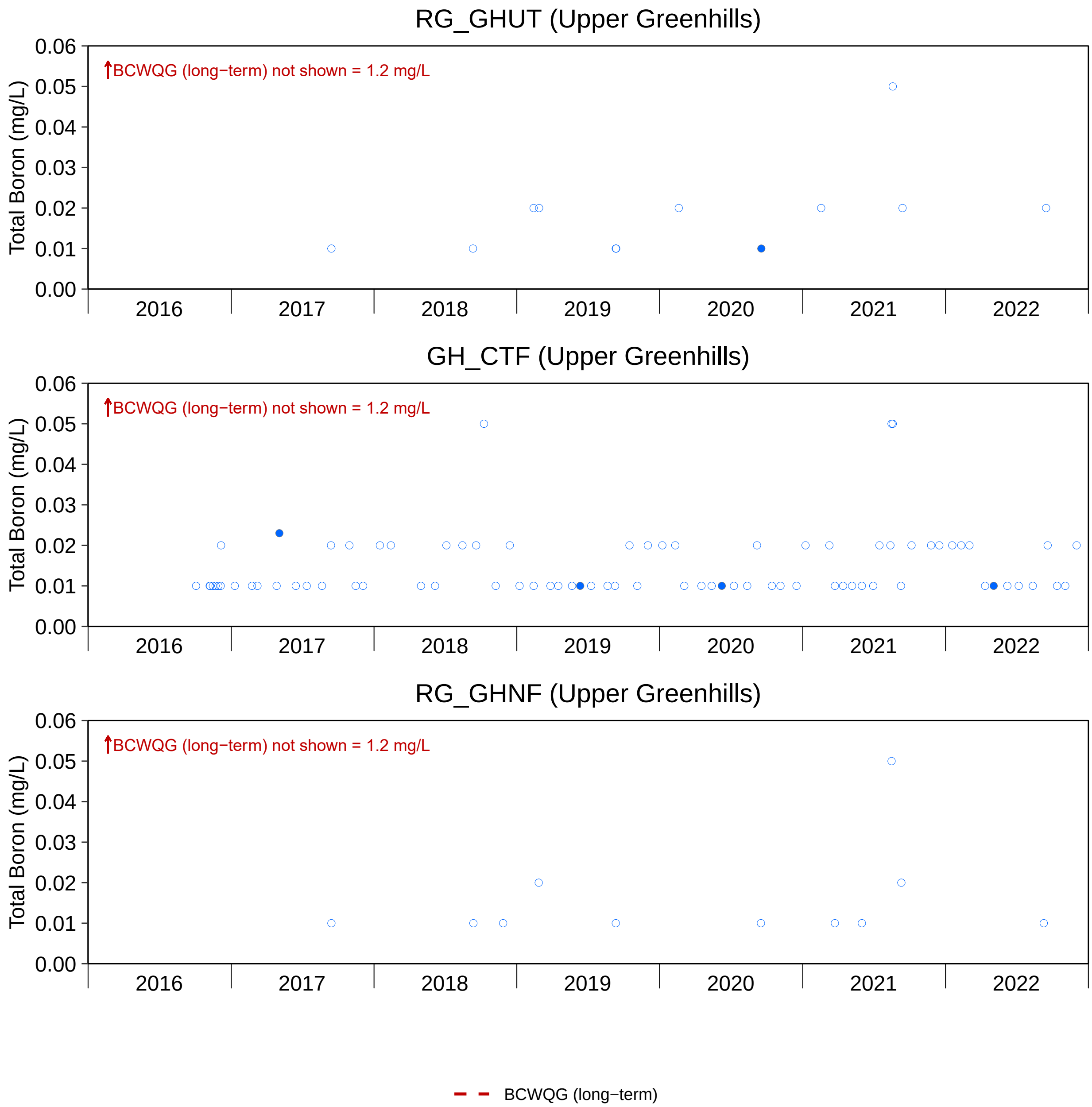

Figure E.7: Total Boron Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

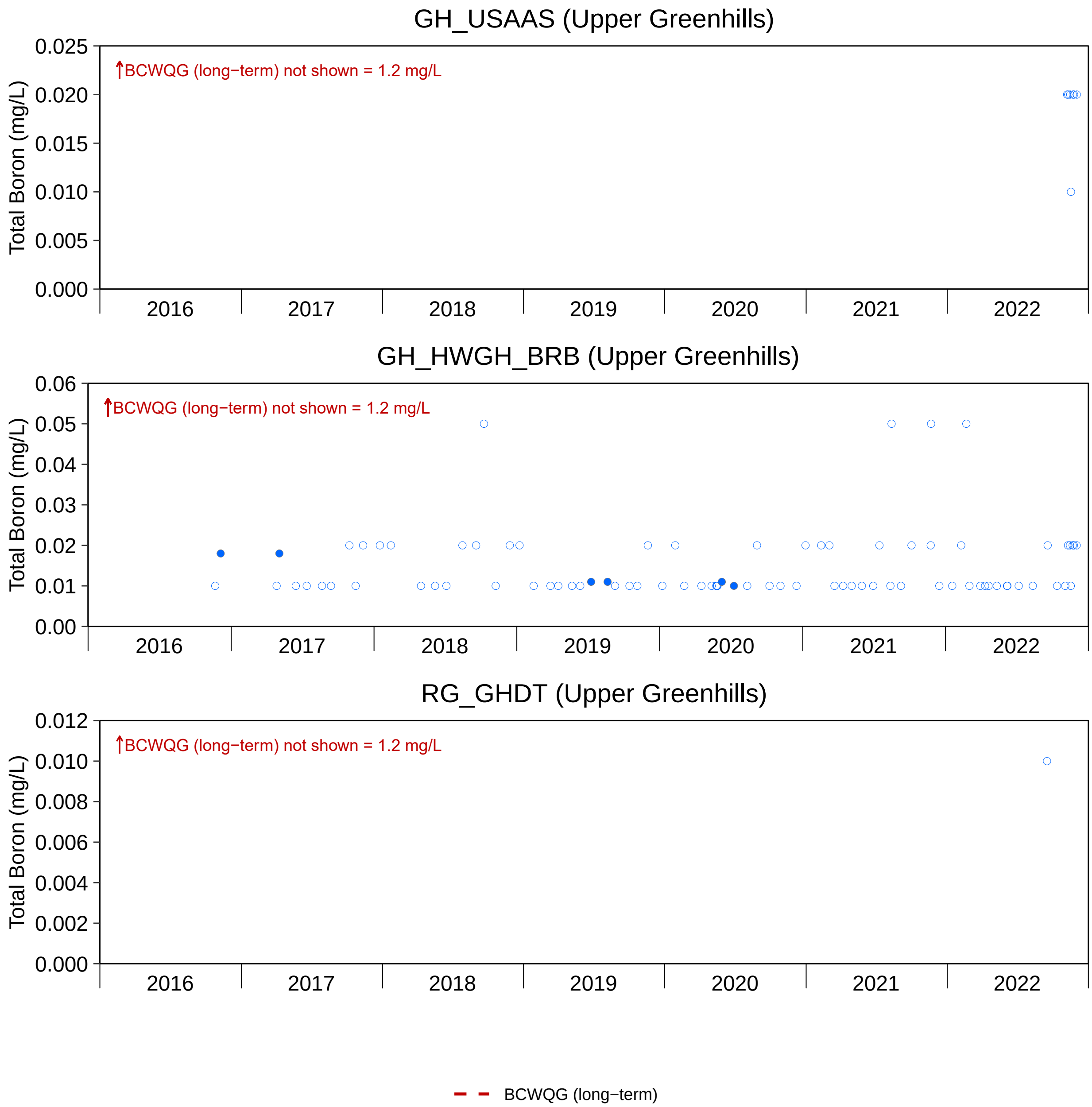

Figure E.7: Total Boron Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

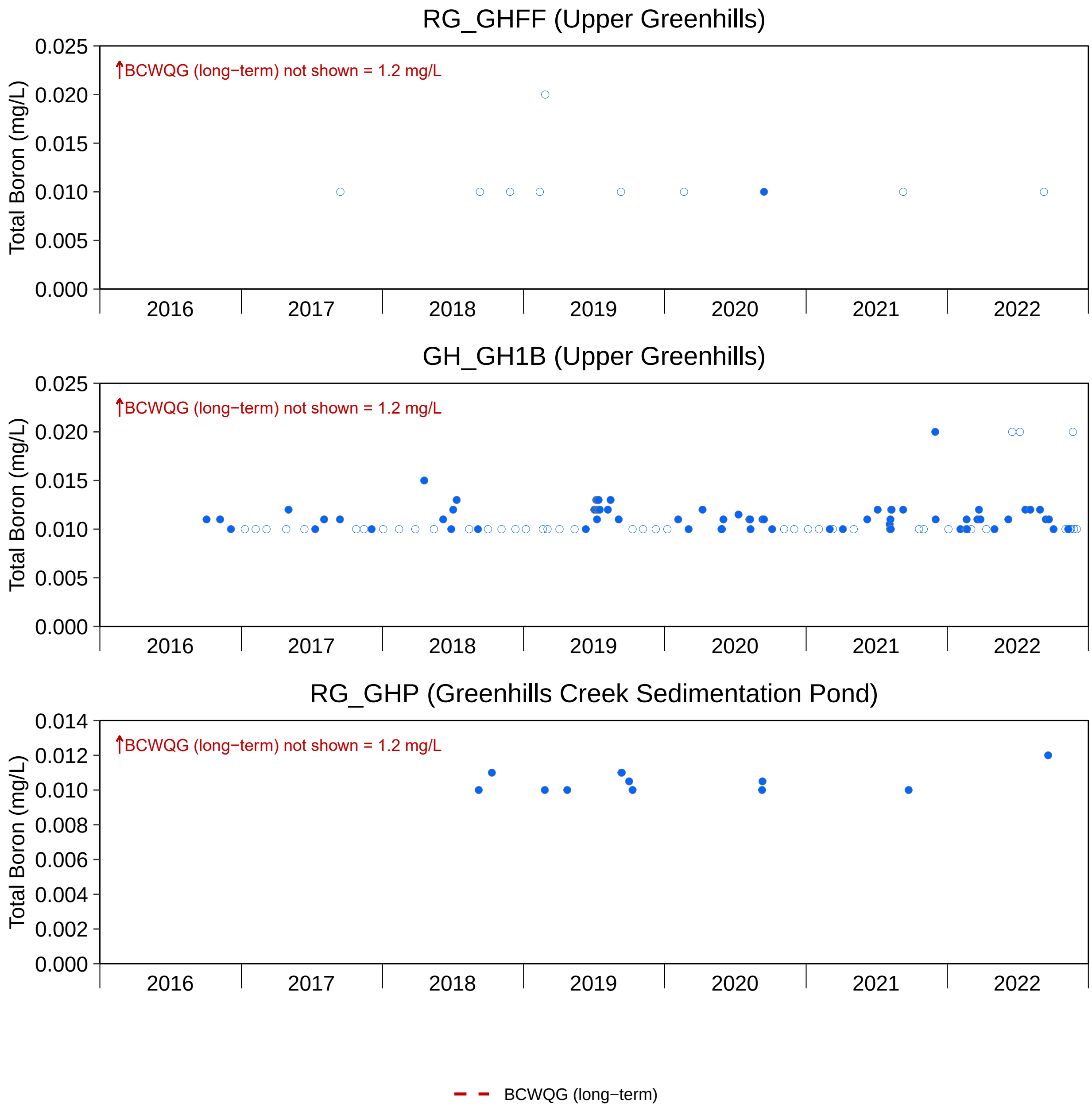

Figure E.7: Total Boron Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

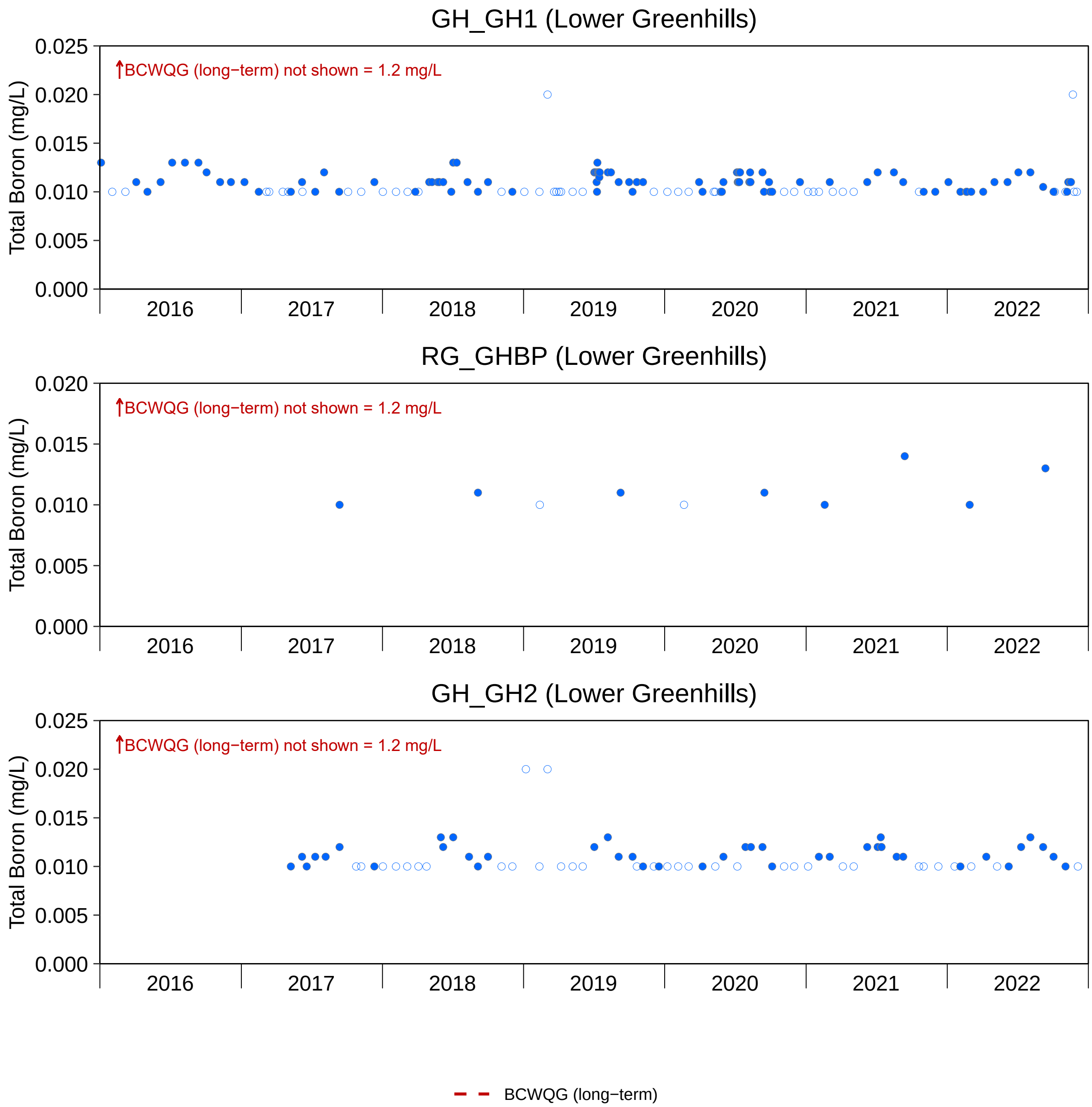

Figure E.7: Total Boron Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

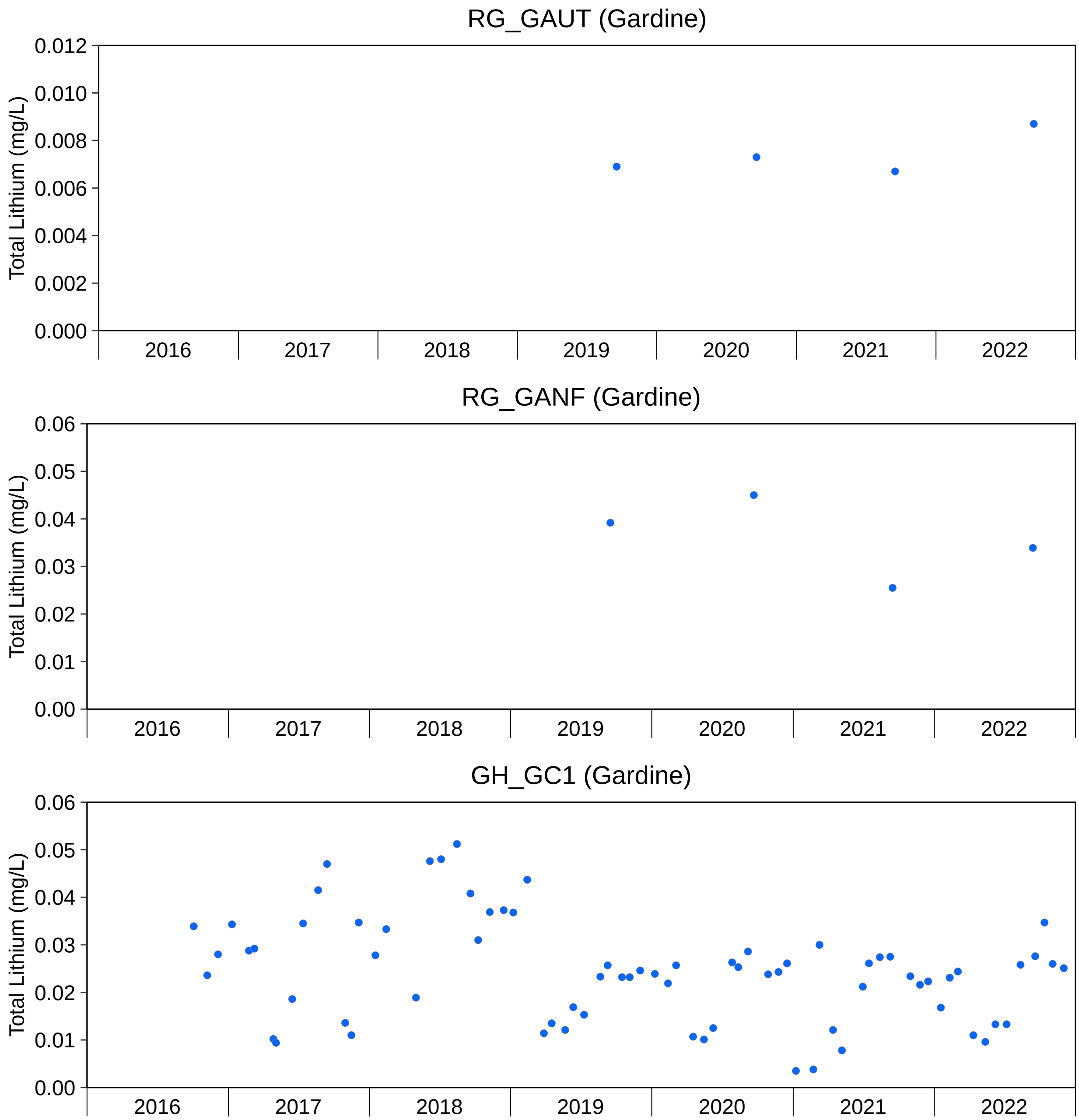

Figure E.8: Total Lithium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

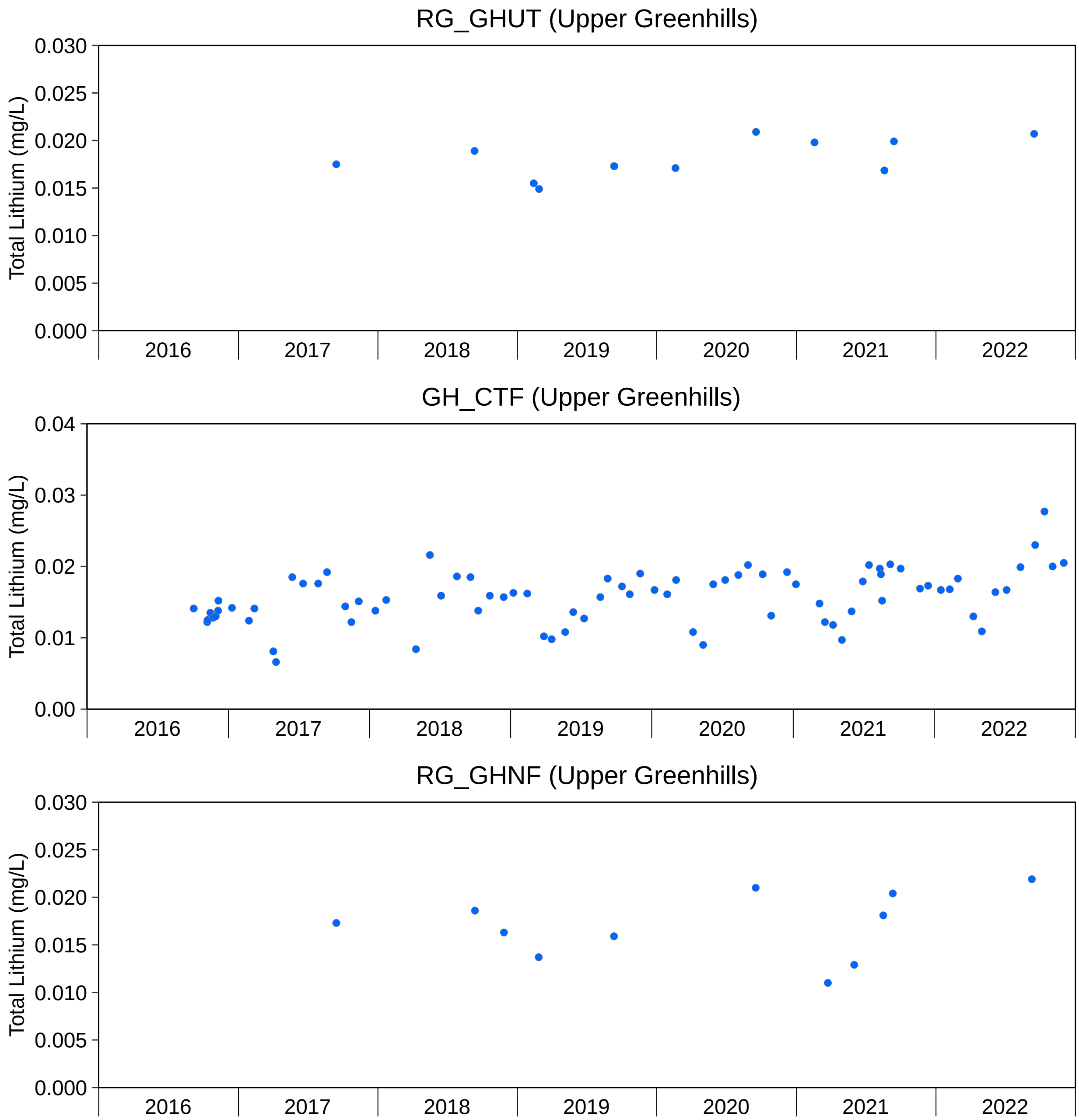

Figure E.8: Total Lithium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

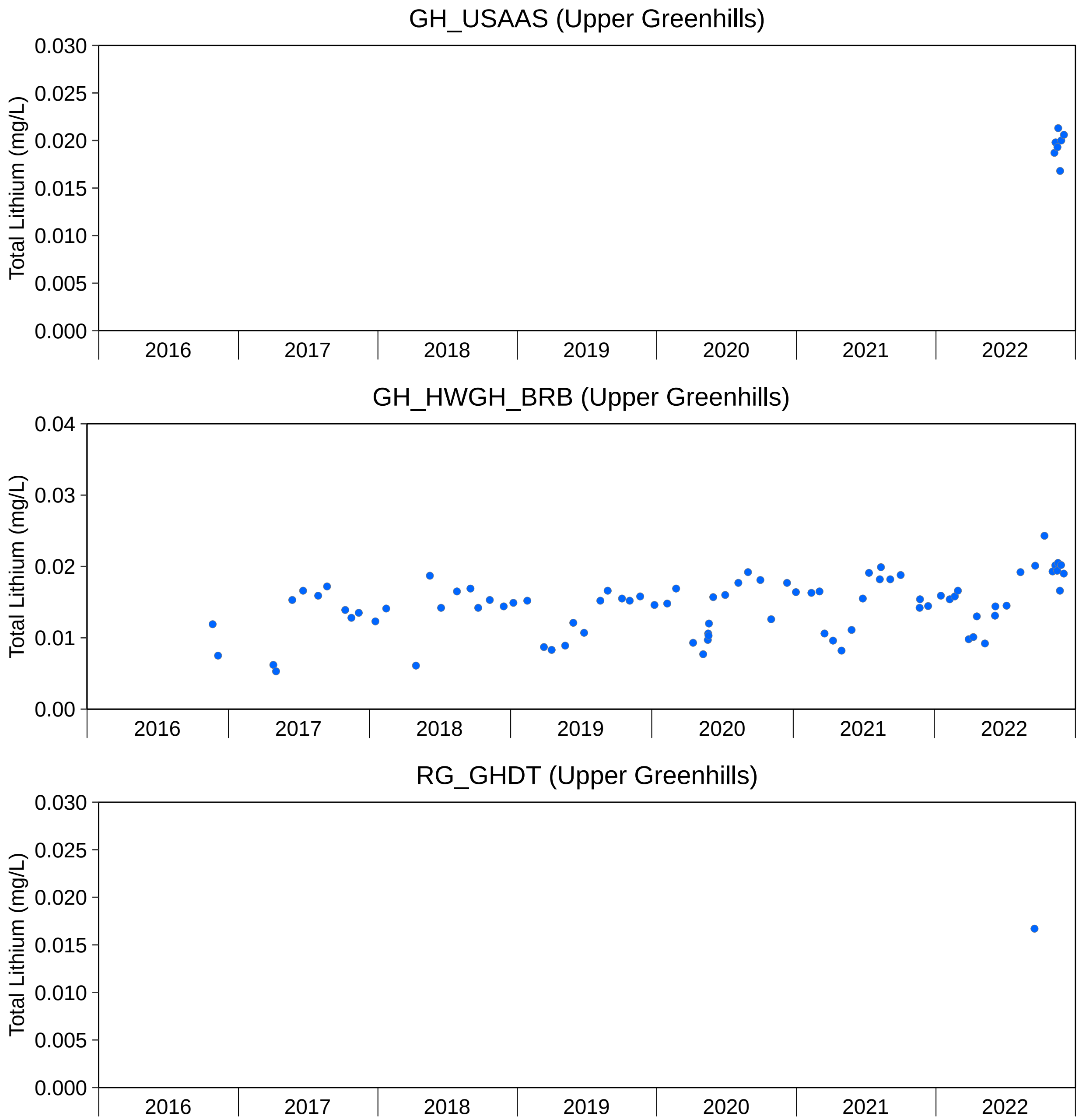

Figure E.8: Total Lithium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

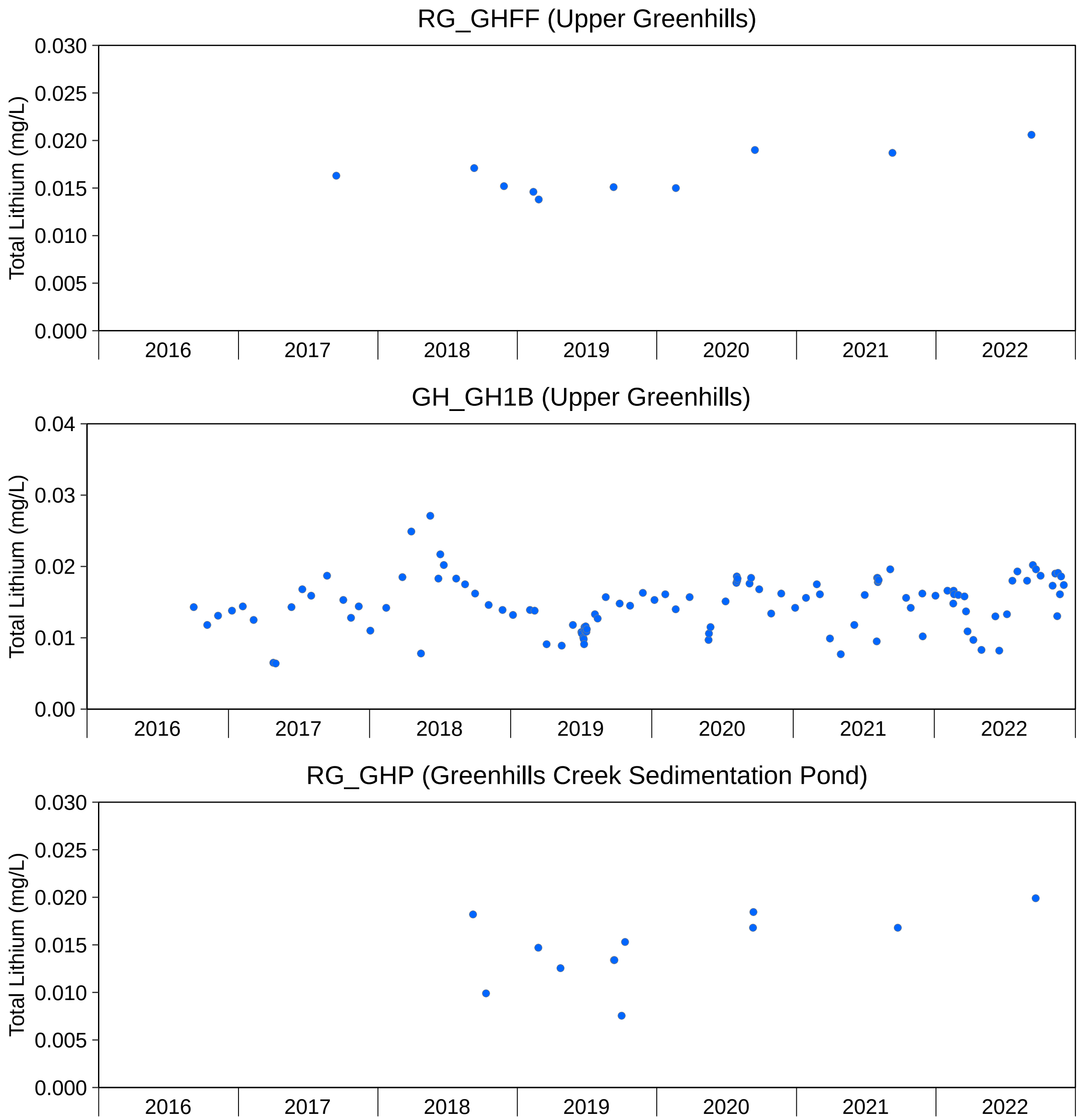

Figure E.8: Total Lithium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

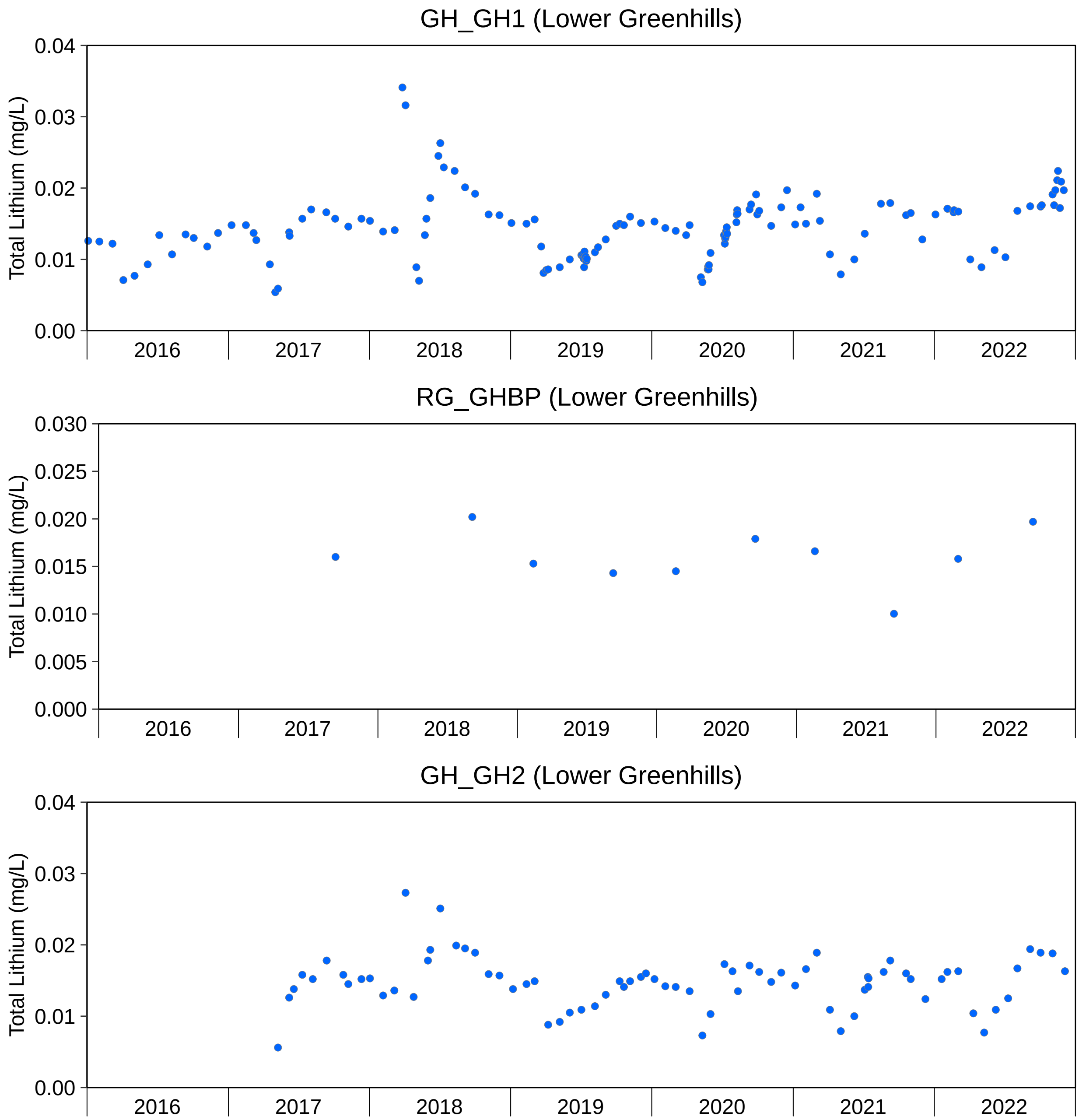

Figure E.8: Total Lithium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

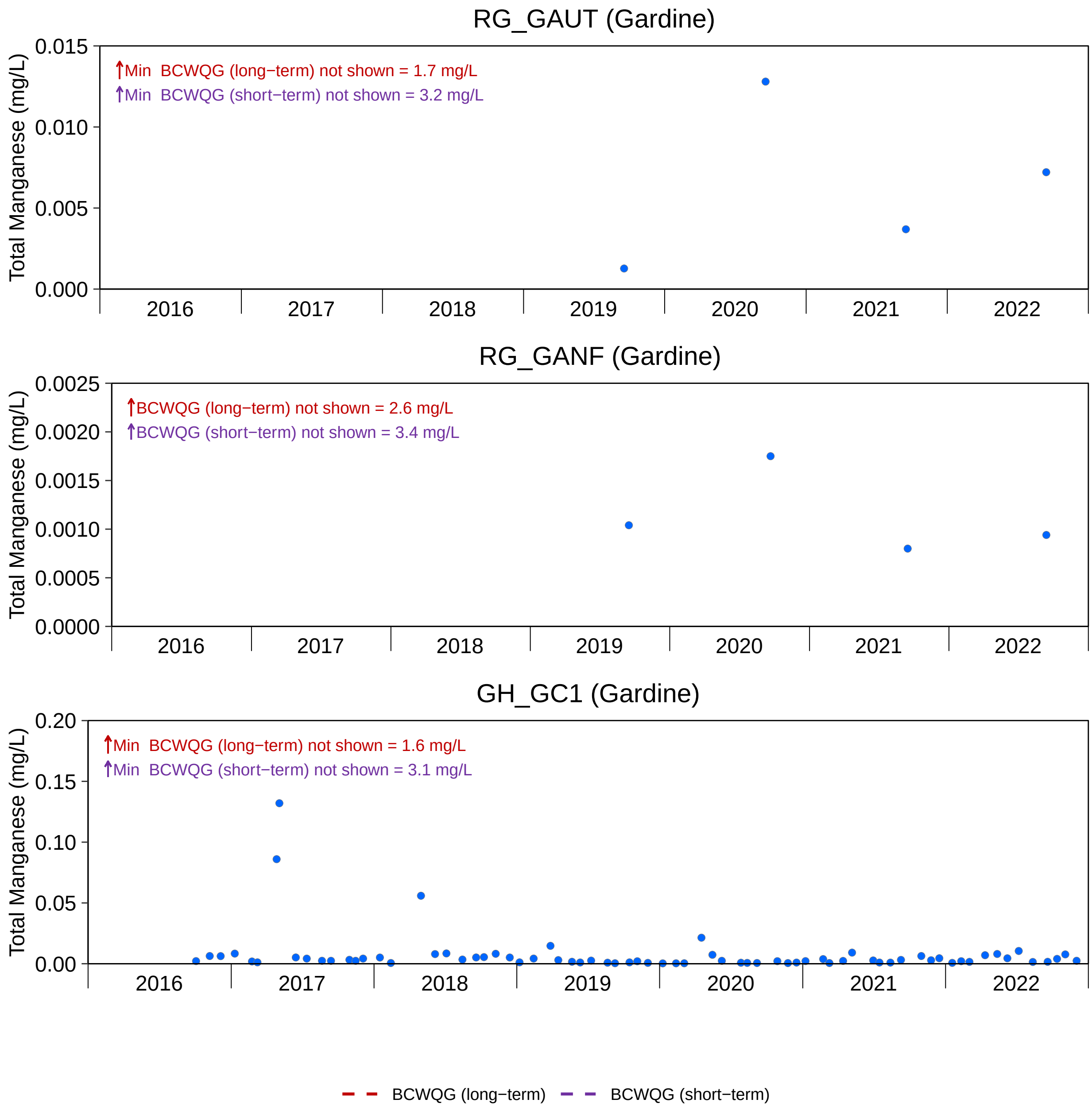

Figure E.9: Total Manganese Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

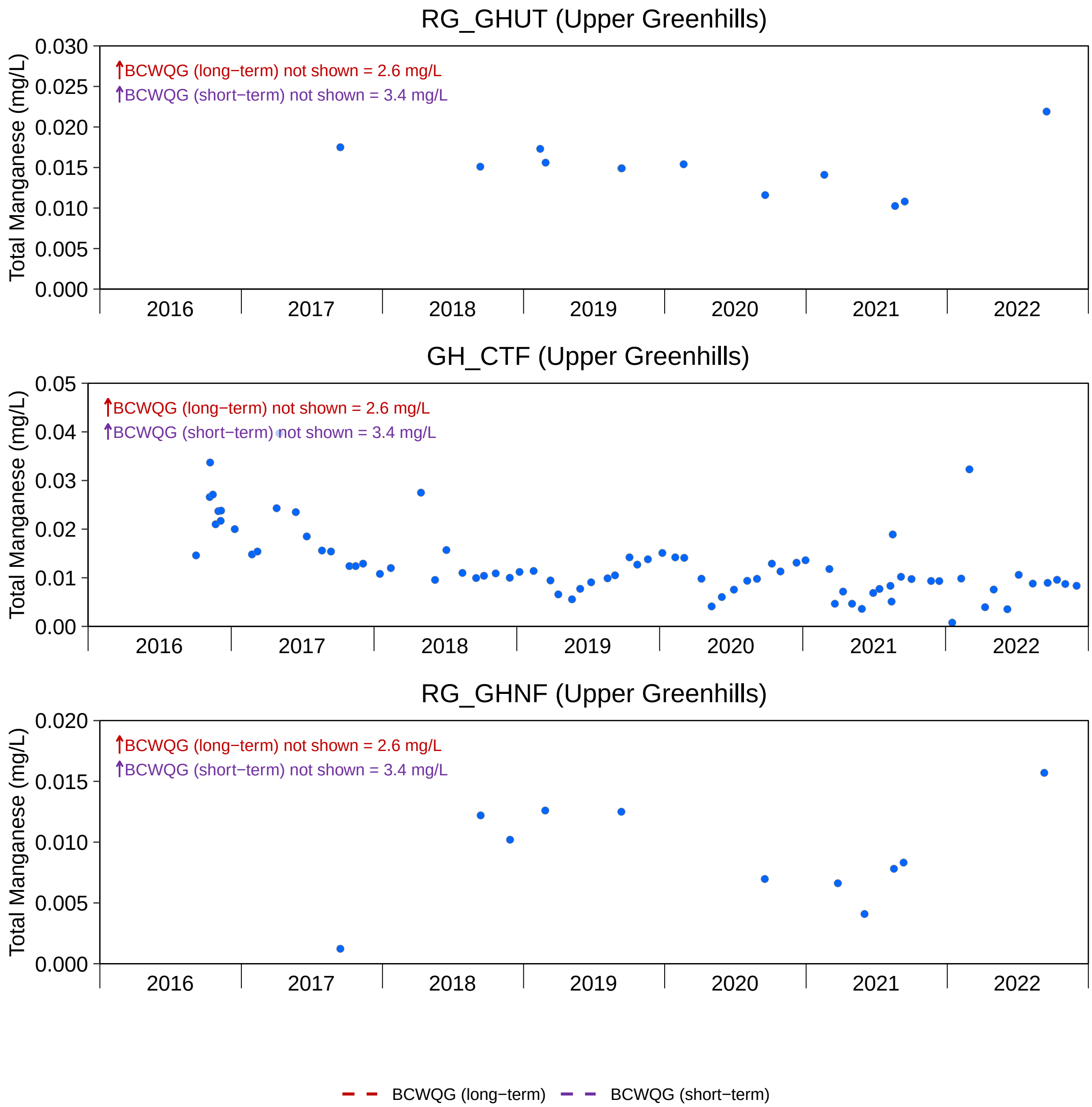

Figure E.9: Total Manganese Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

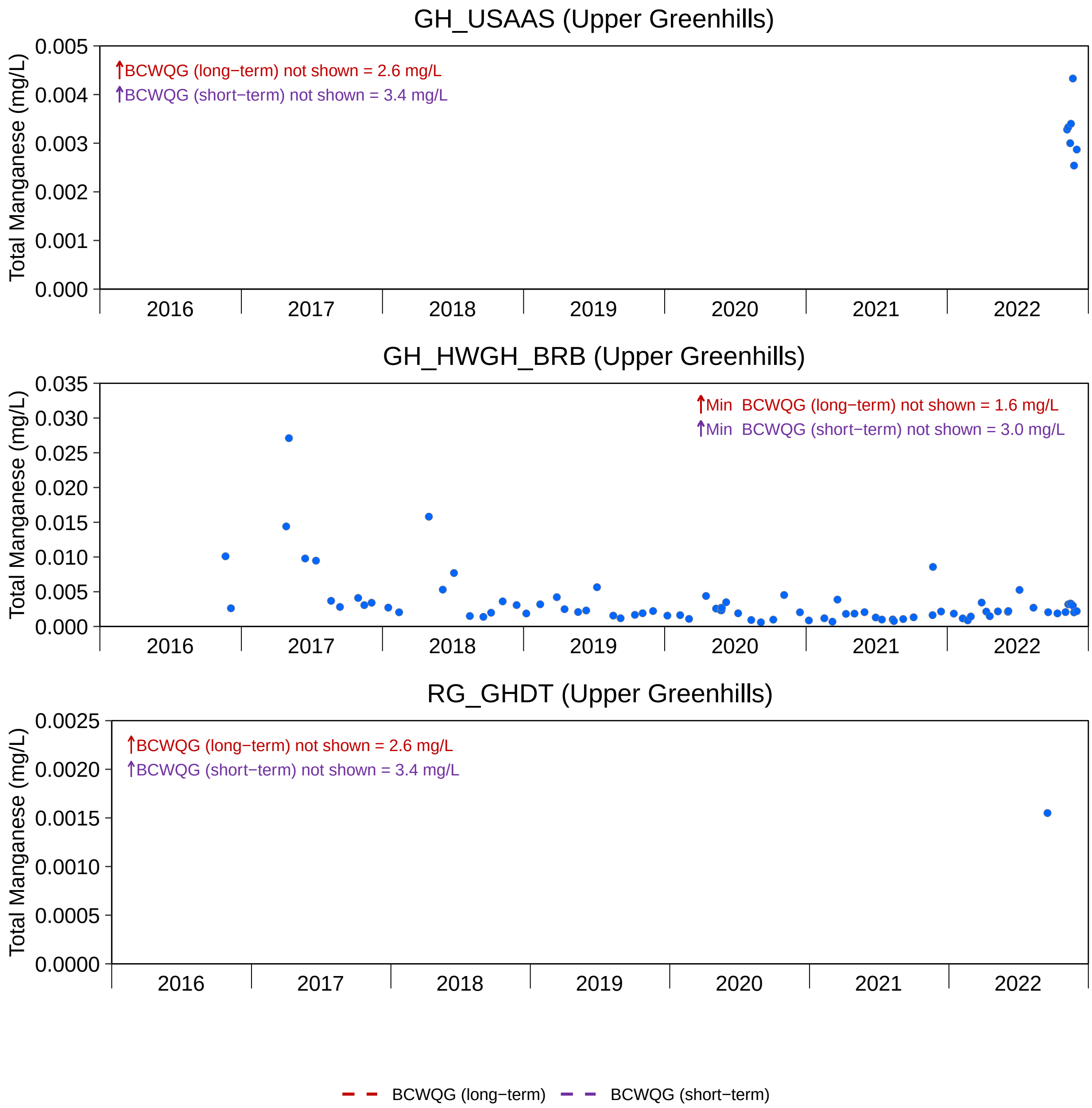

Figure E.9: Total Manganese Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

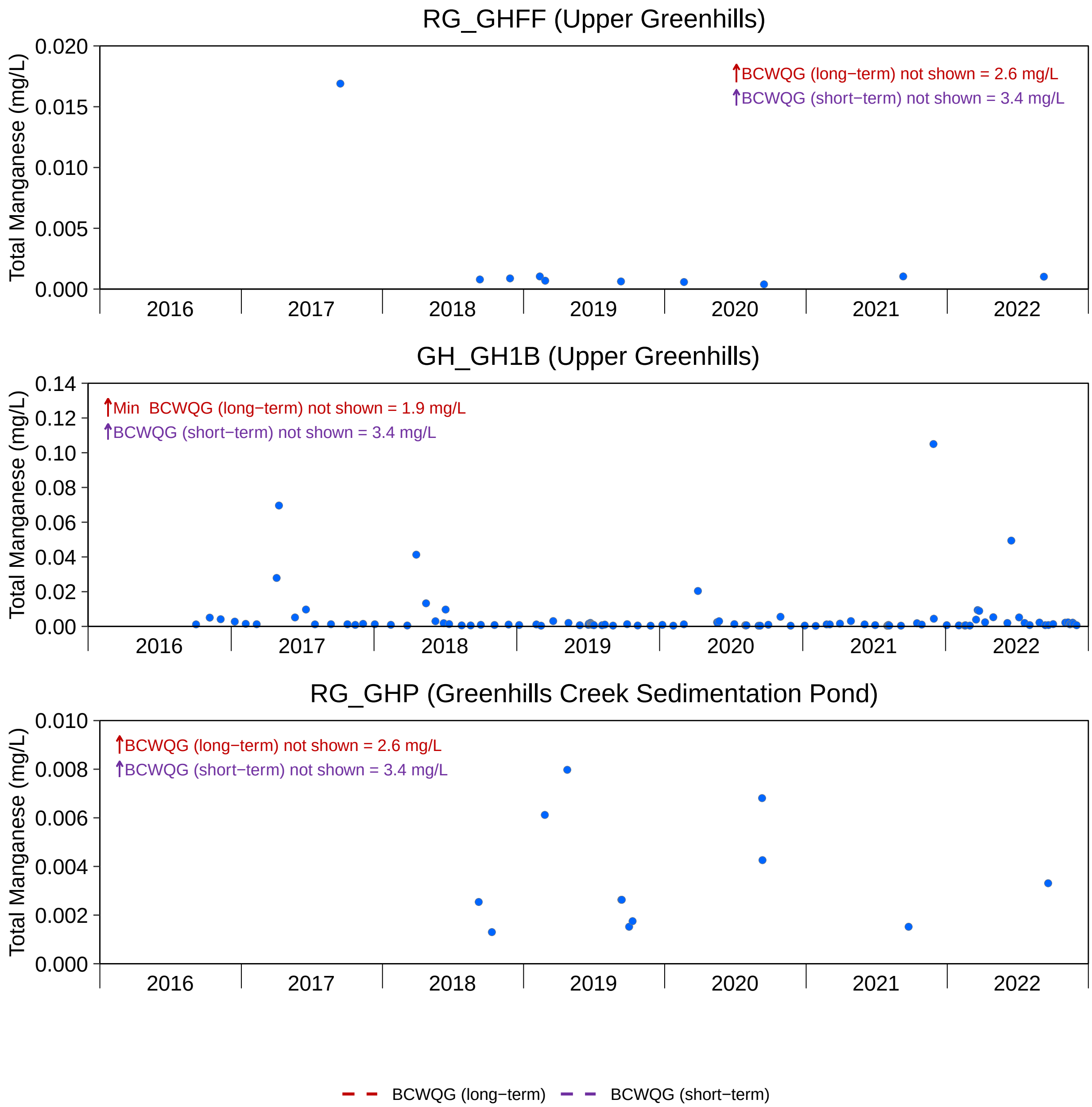

Figure E.9: Total Manganese Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

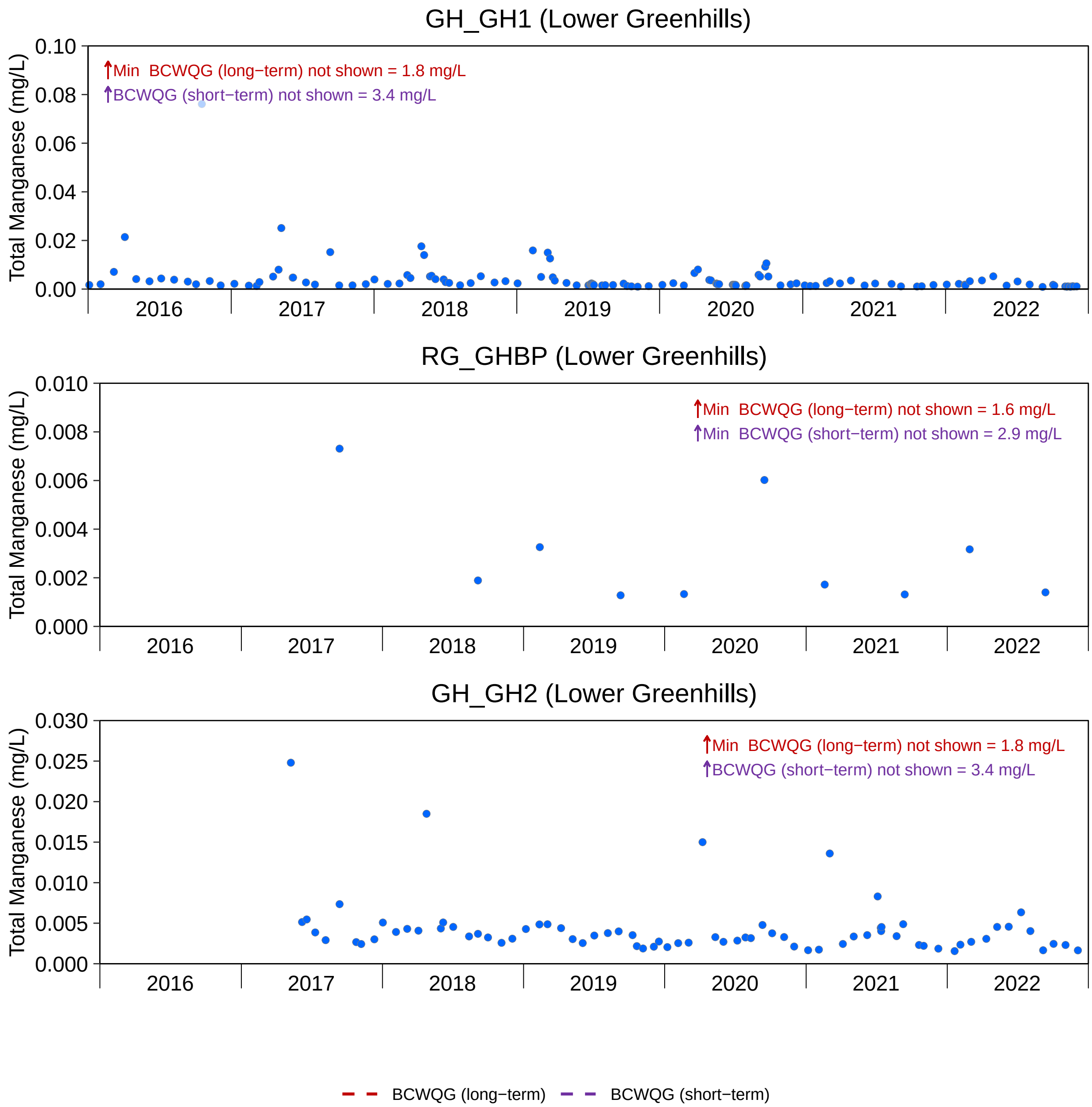

Figure E.9: Total Manganese Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

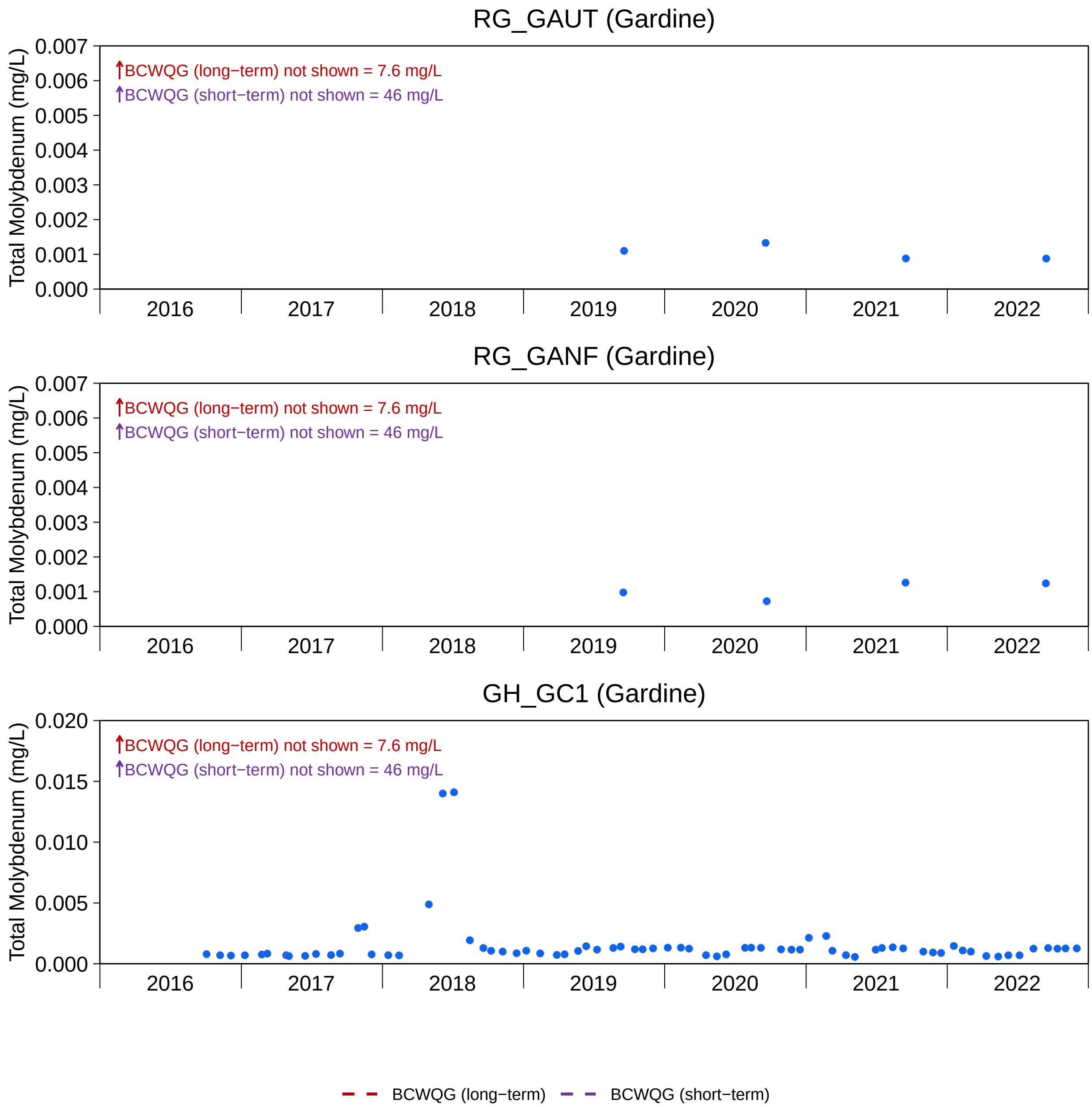

Figure E.10: Total Molybdenum Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

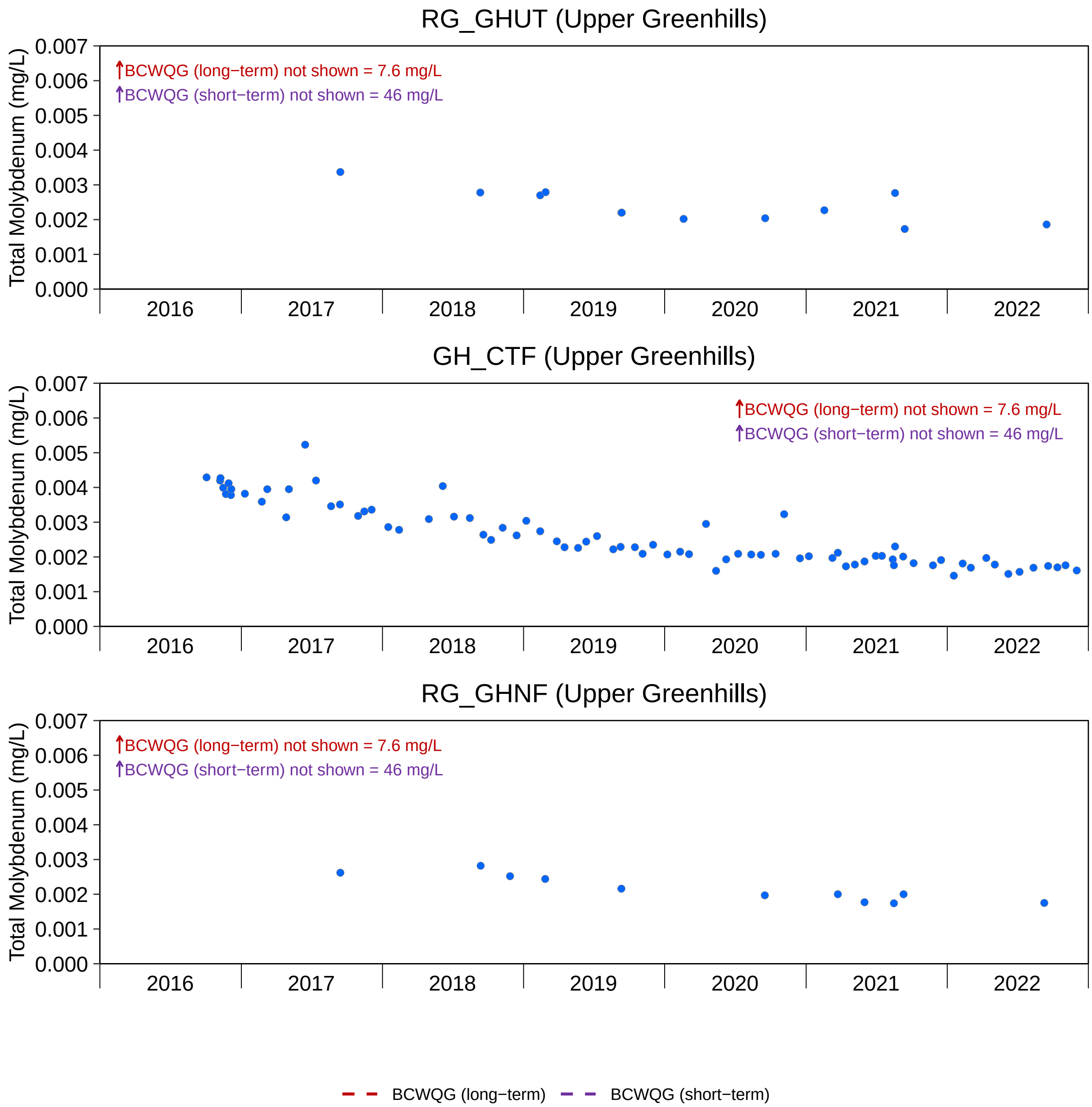

Figure E.10: Total Molybdenum Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

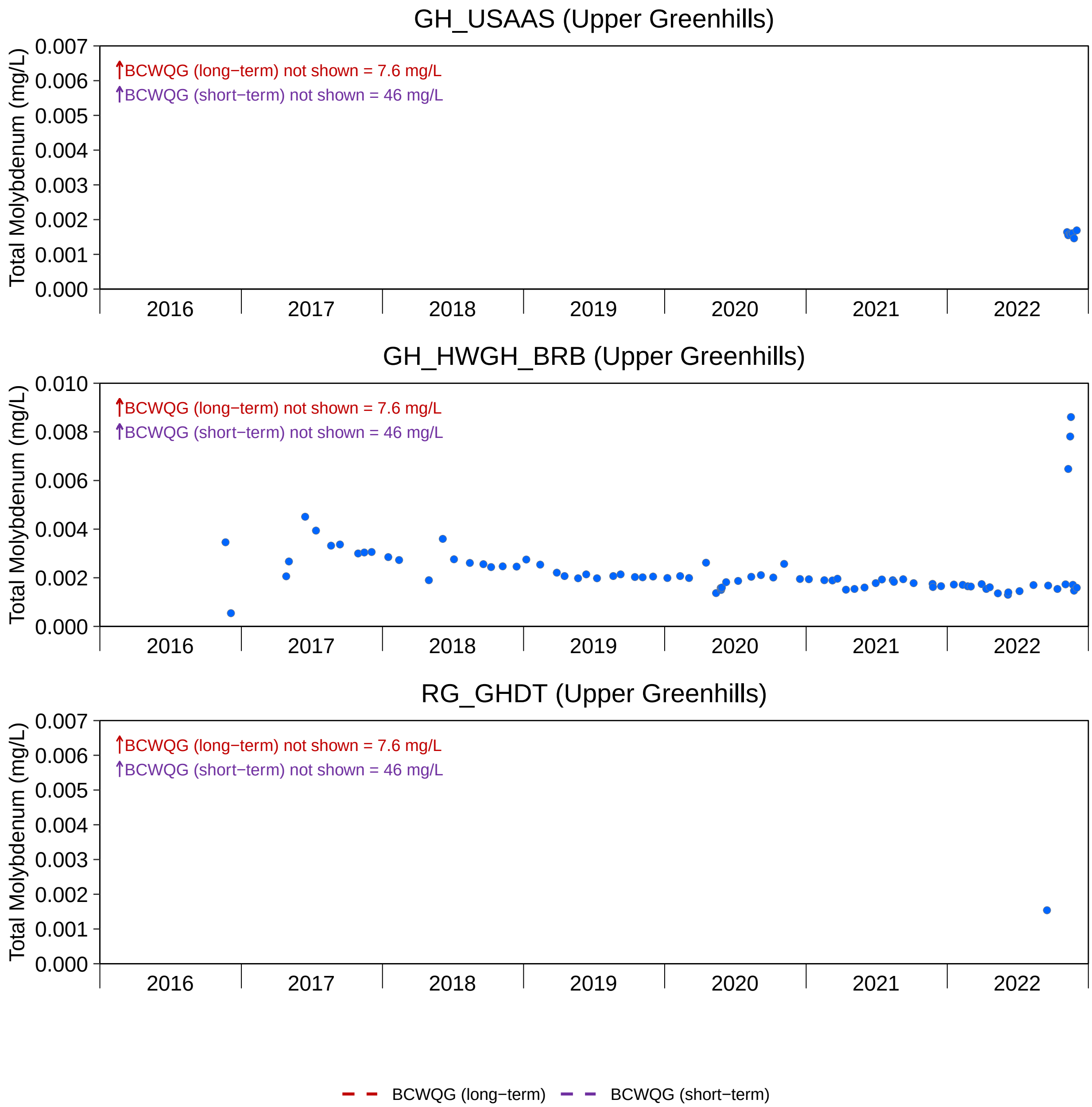

Figure E.10: Total Molybdenum Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

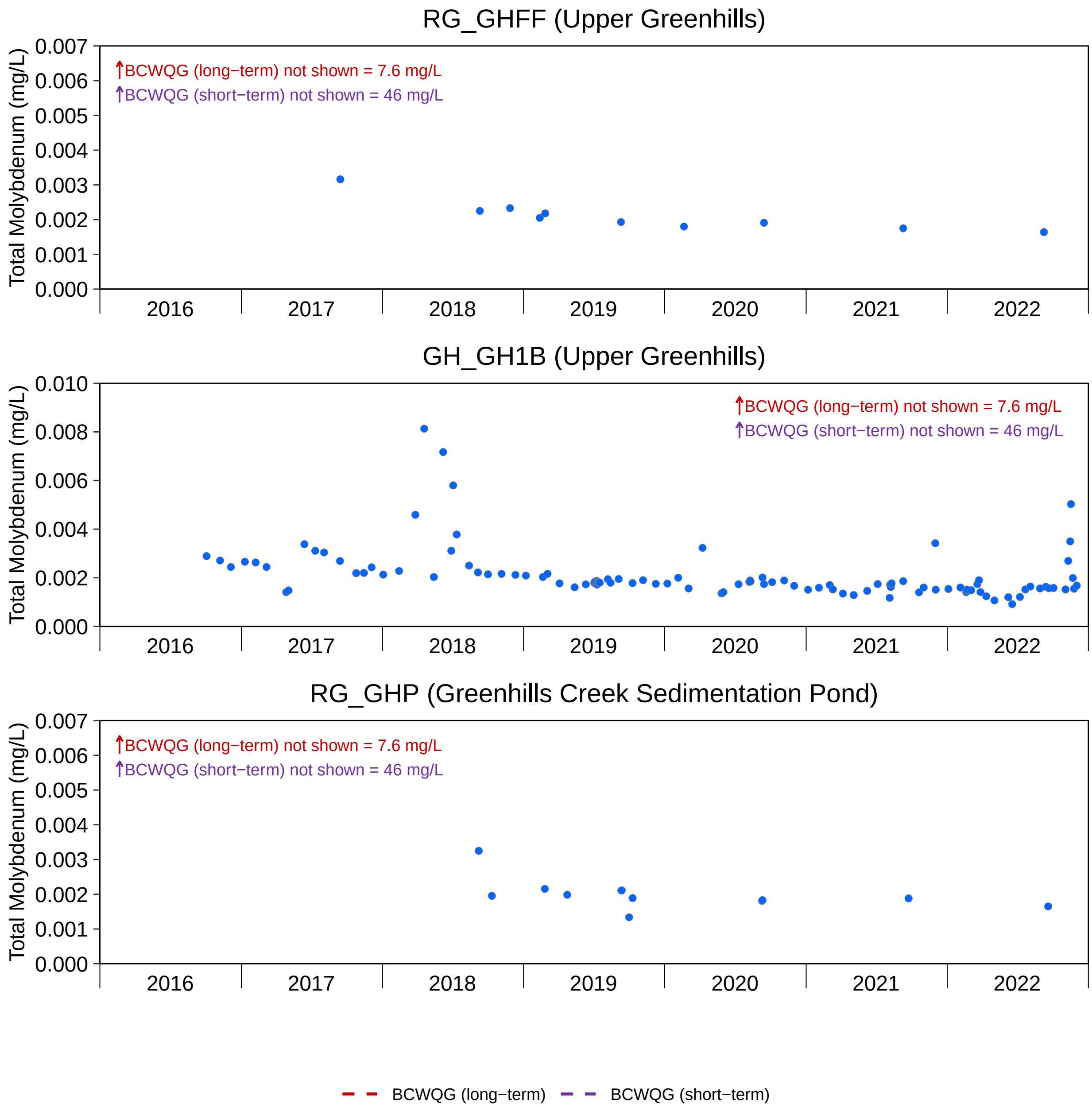

Figure E.10: Total Molybdenum Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

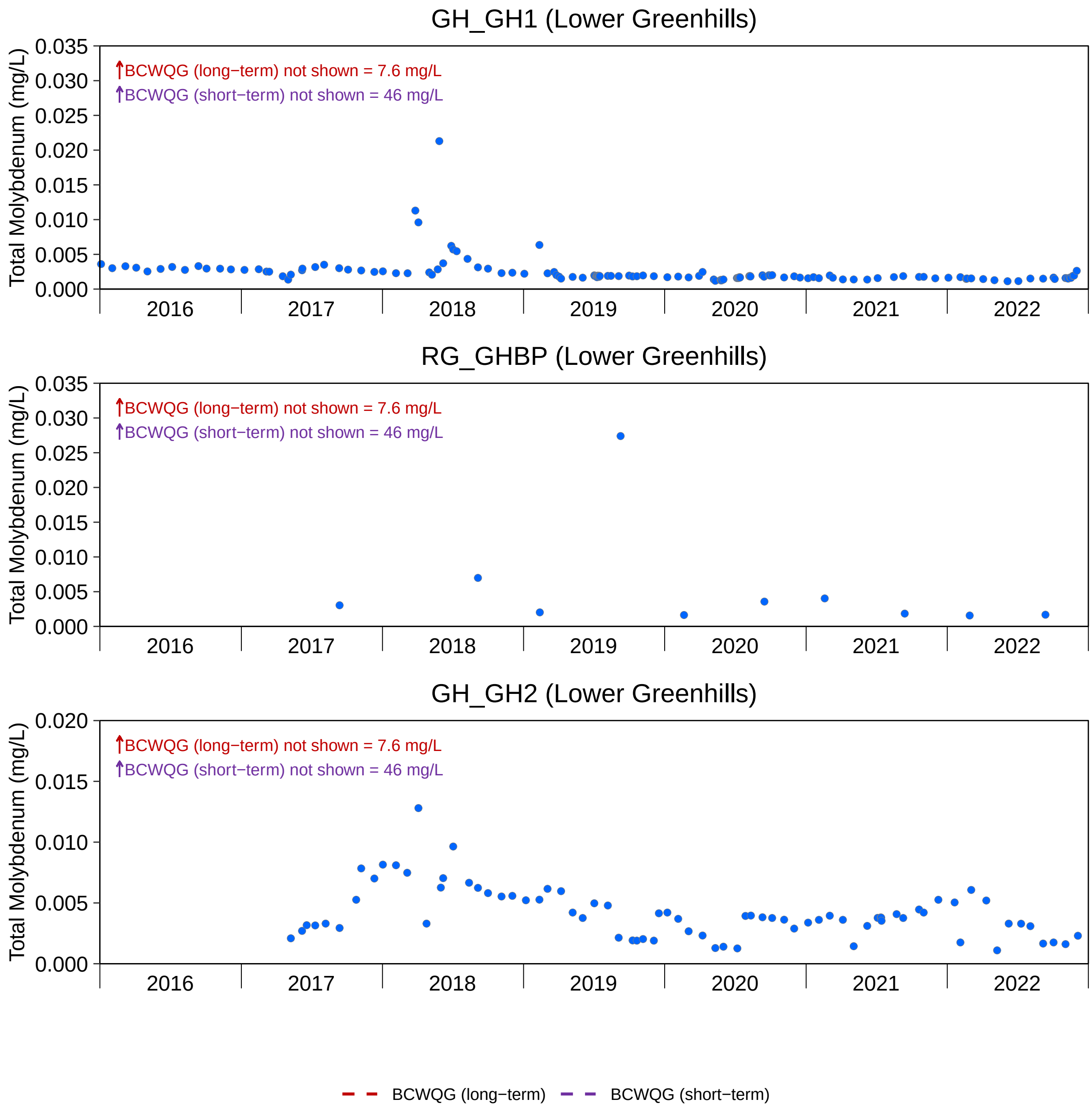

Figure E.10: Total Molybdenum Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

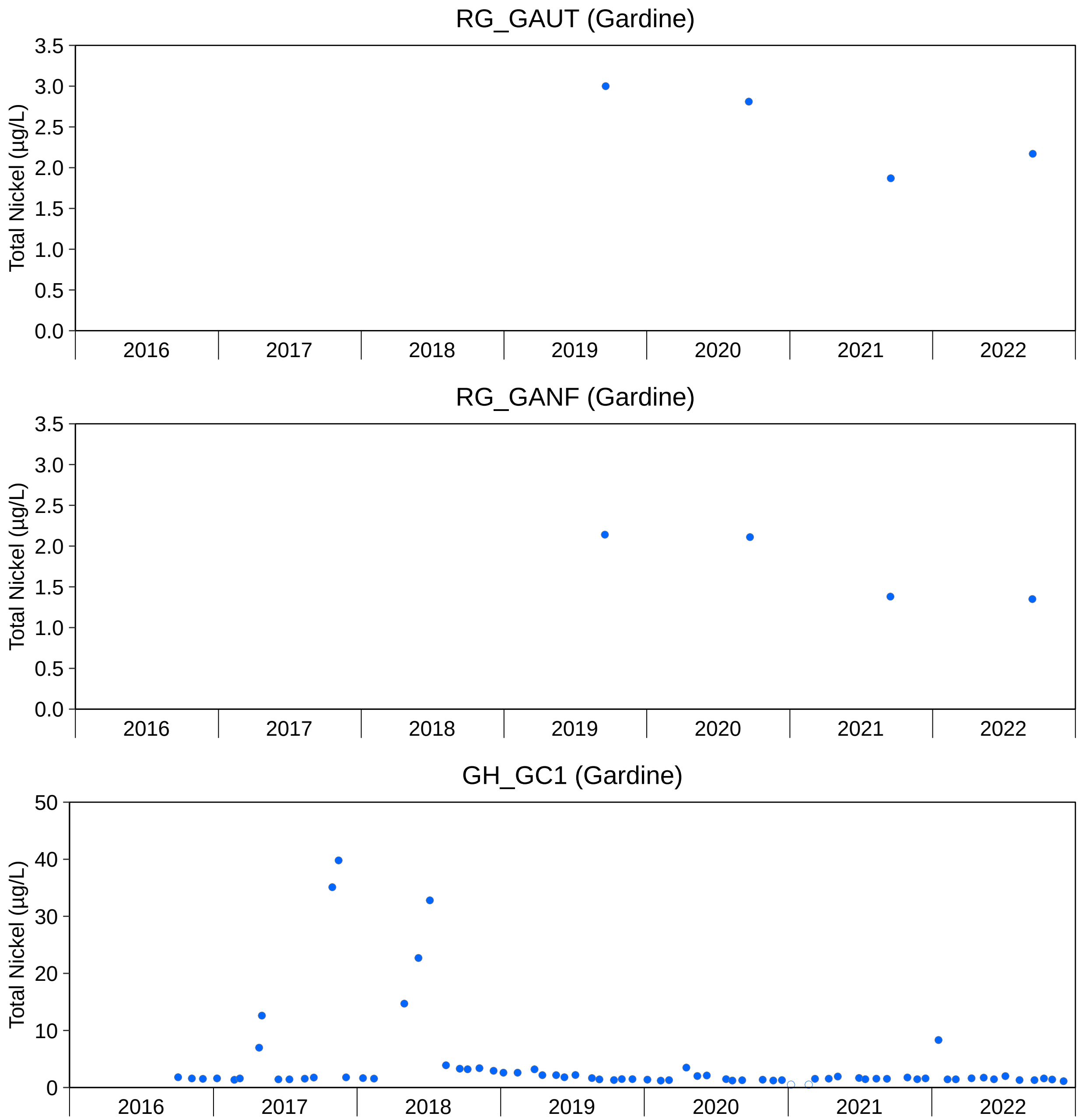

Figure E.11: Total Nickel Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

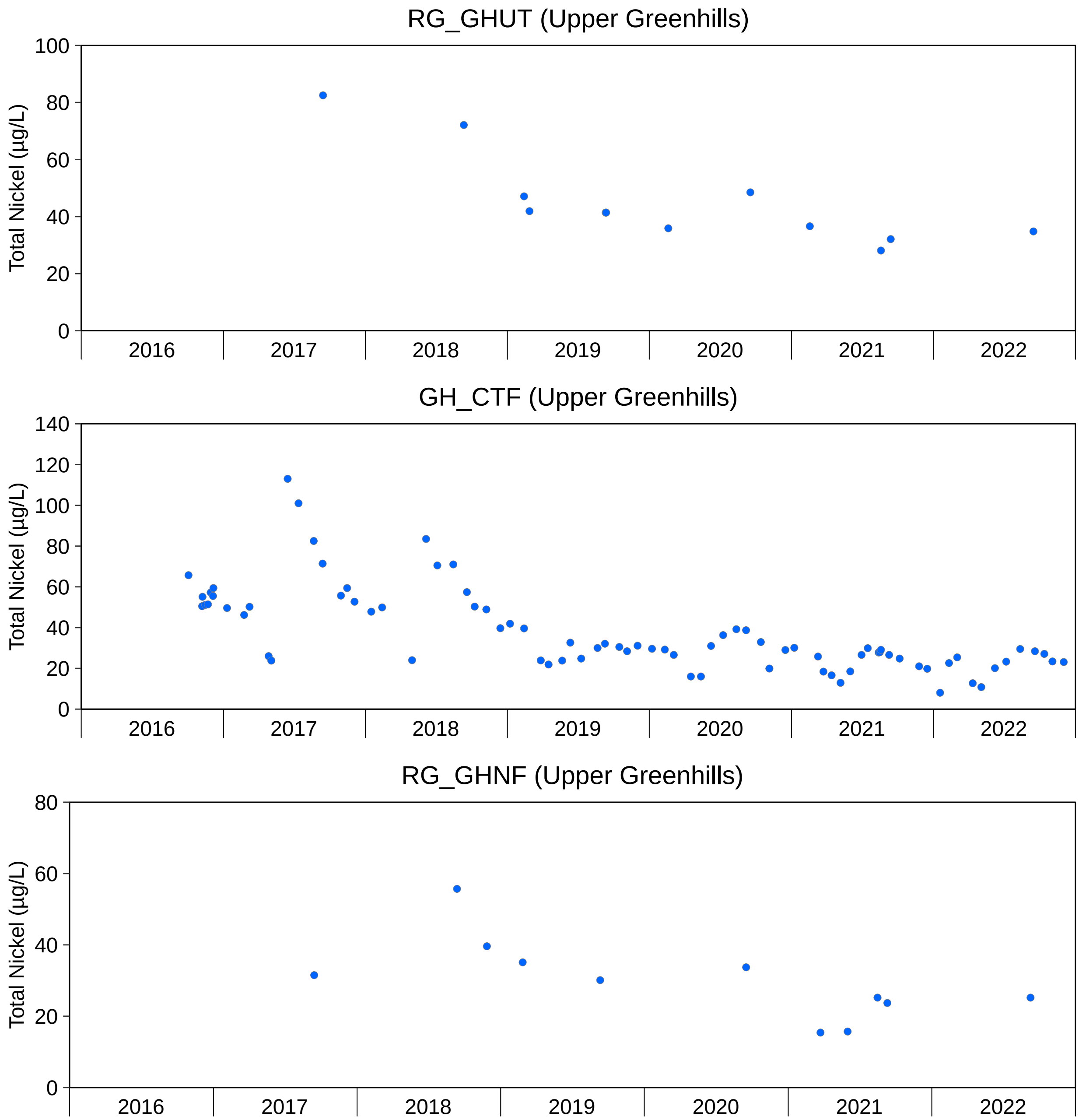

Figure E.11: Total Nickel Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

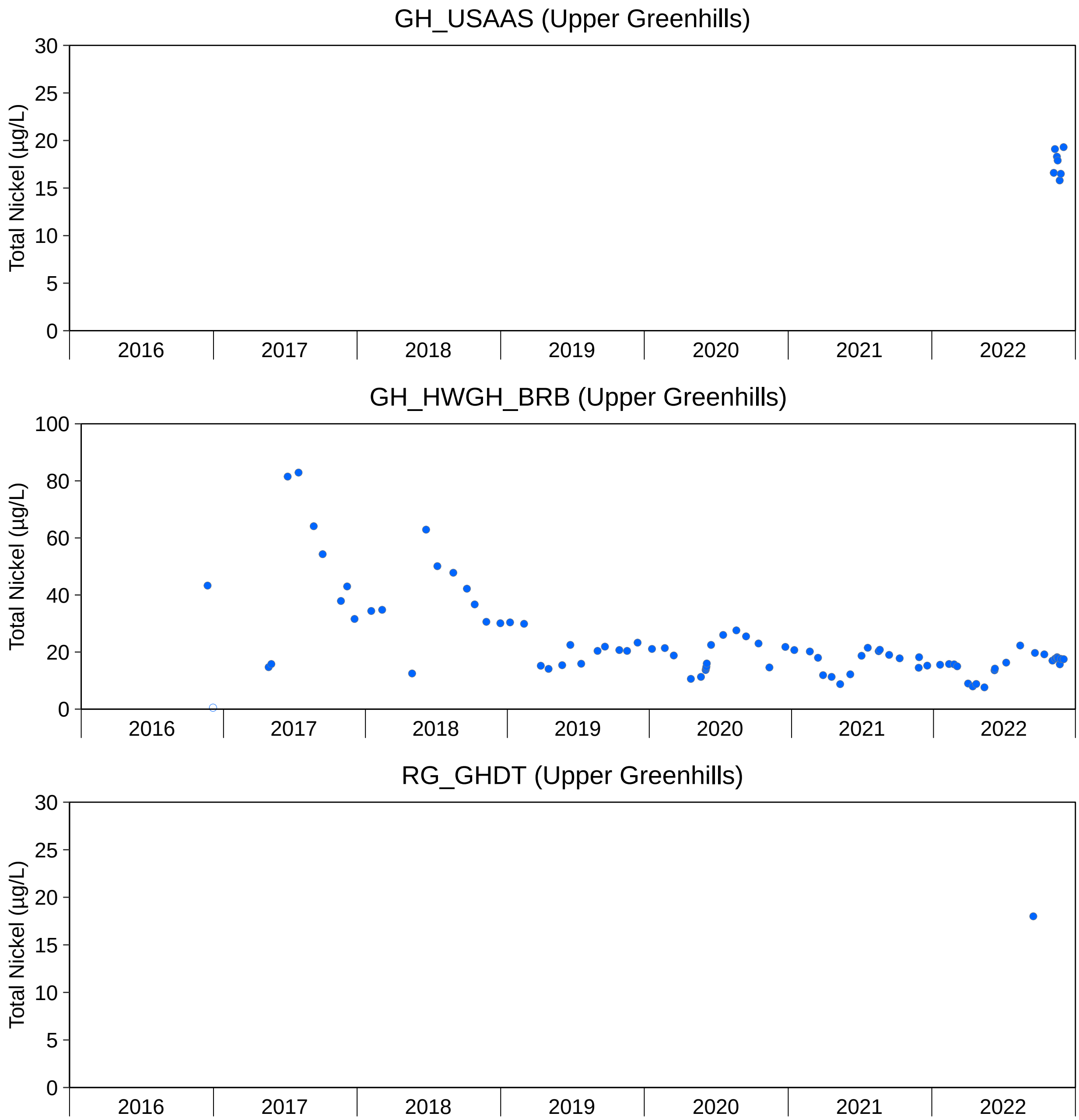

Figure E.11: Total Nickel Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

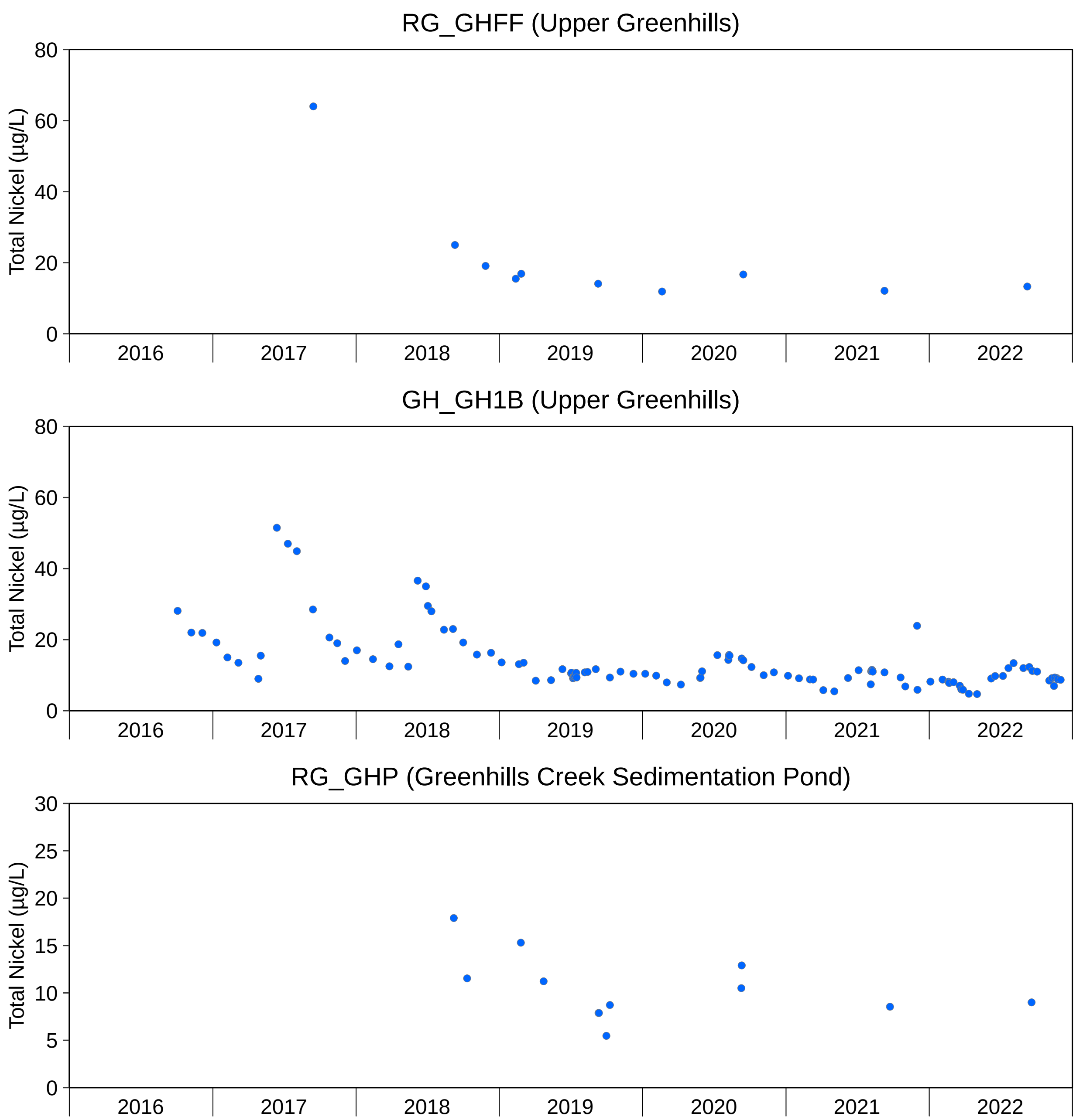

Figure E.11: Total Nickel Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

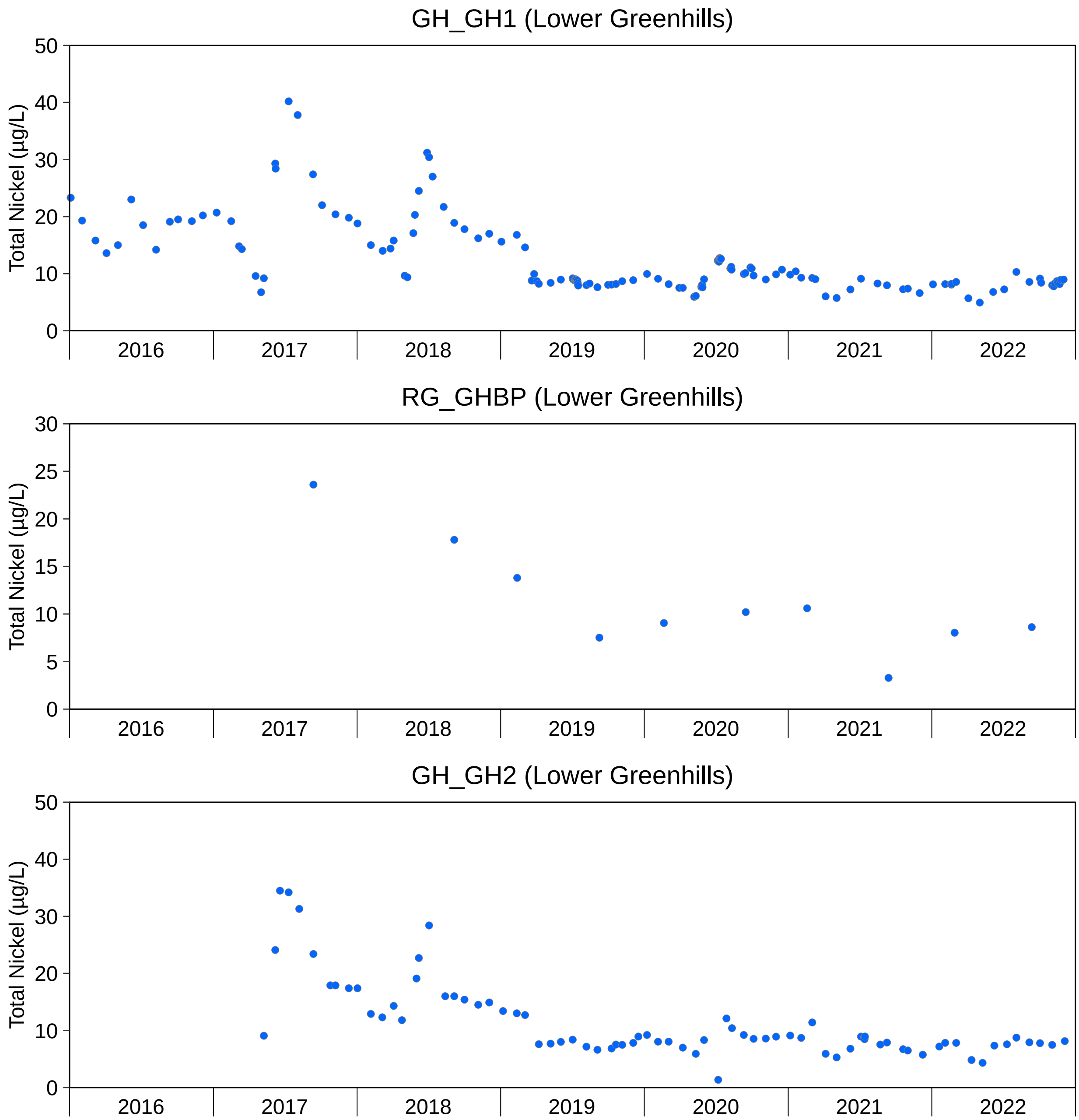

Figure E.11: Total Nickel Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

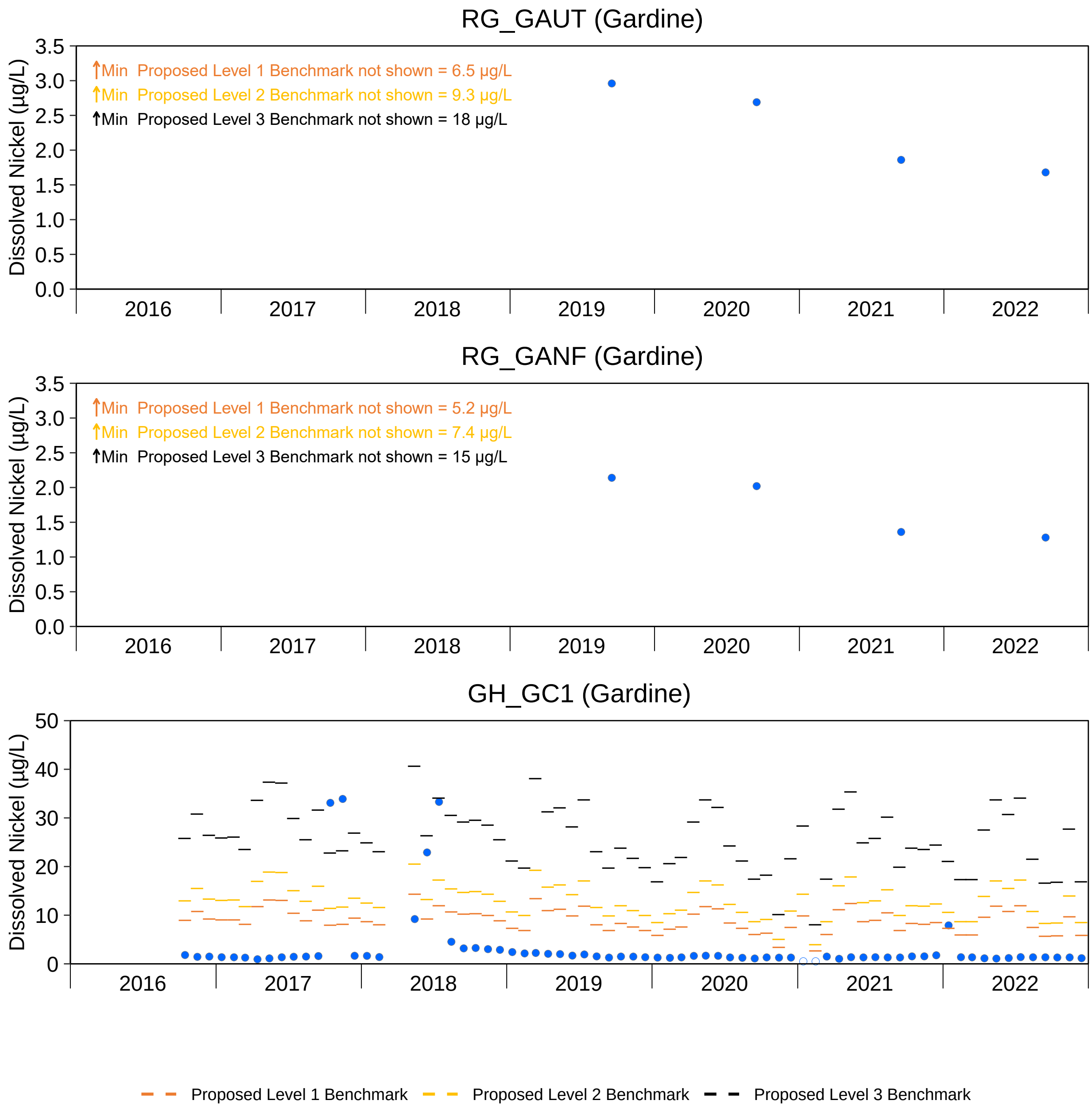

Figure E.12: Dissolved Nickel Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Proposed benchmarks are dependent on dissolved organic carbon, water hardness, and bicarbonate concentrations. Values and proposed benchmarks were averaged by month according to screening guidance.

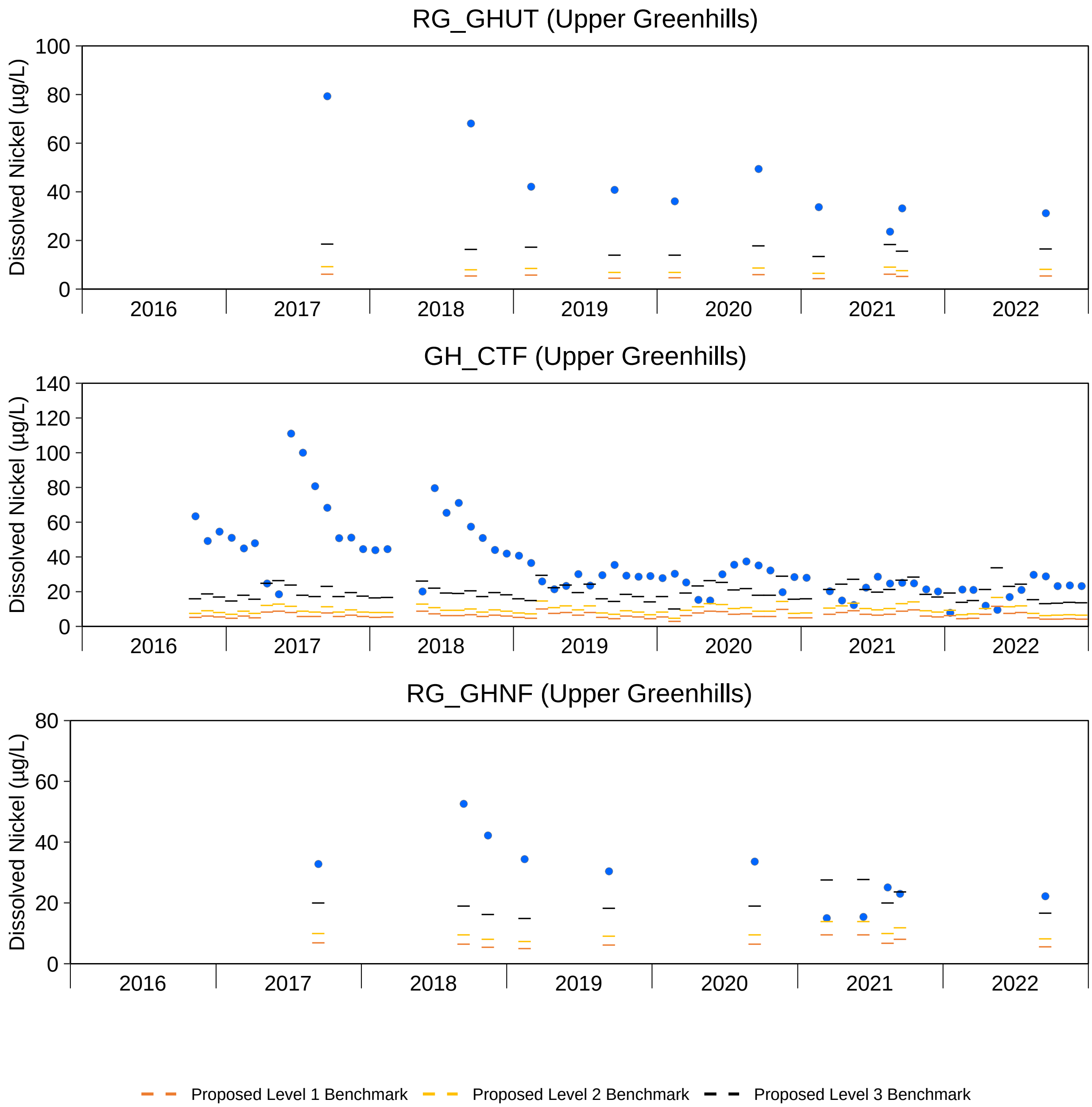

Figure E.12: Dissolved Nickel Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Proposed benchmarks are dependent on dissolved organic carbon, water hardness, and bicarbonate concentrations. Values and proposed benchmarks were averaged by month according to screening guidance.

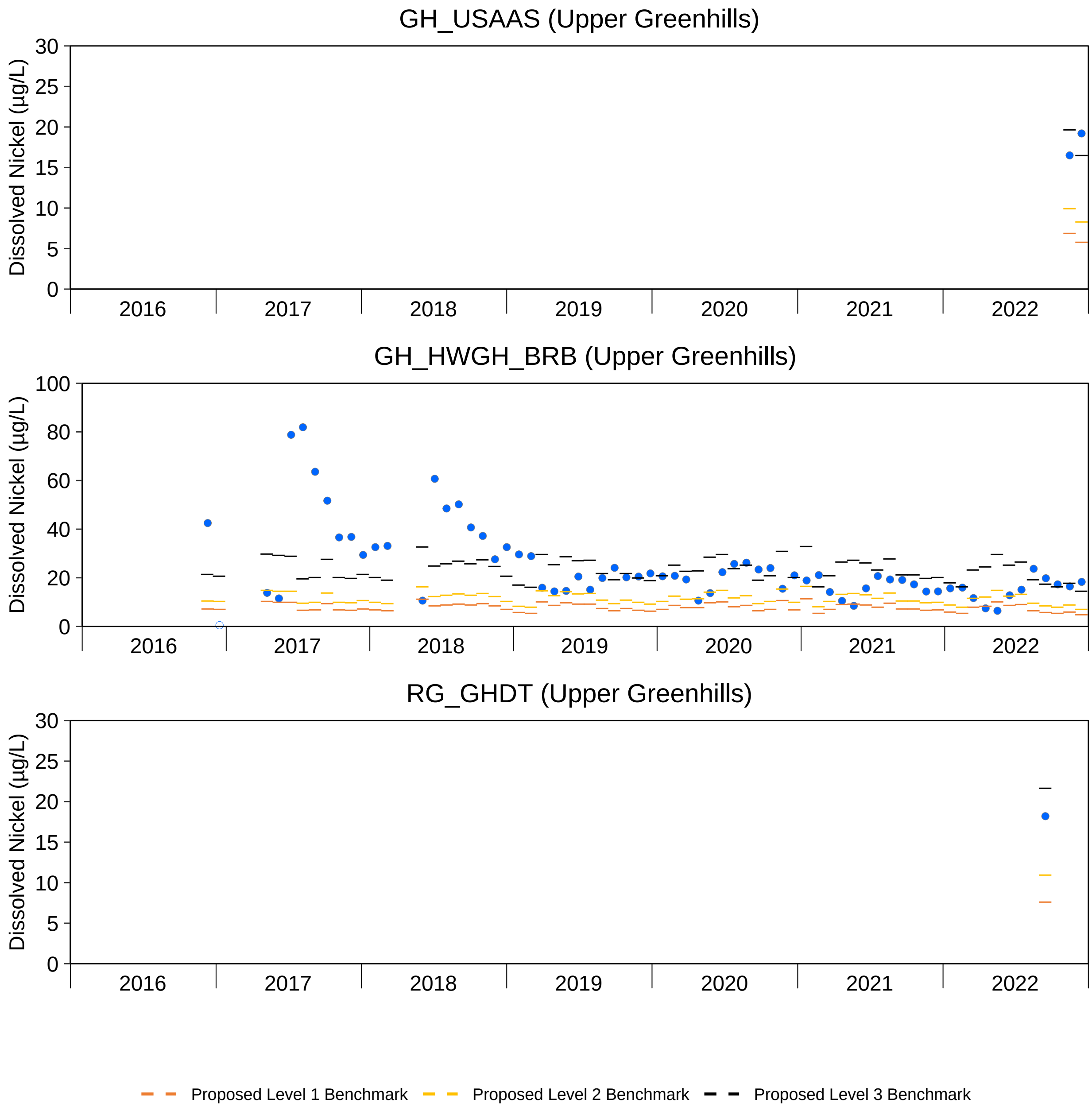

Figure E.12: Dissolved Nickel Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Proposed benchmarks are dependent on dissolved organic carbon, water hardness, and bicarbonate concentrations. Values and proposed benchmarks were averaged by month according to screening guidance.

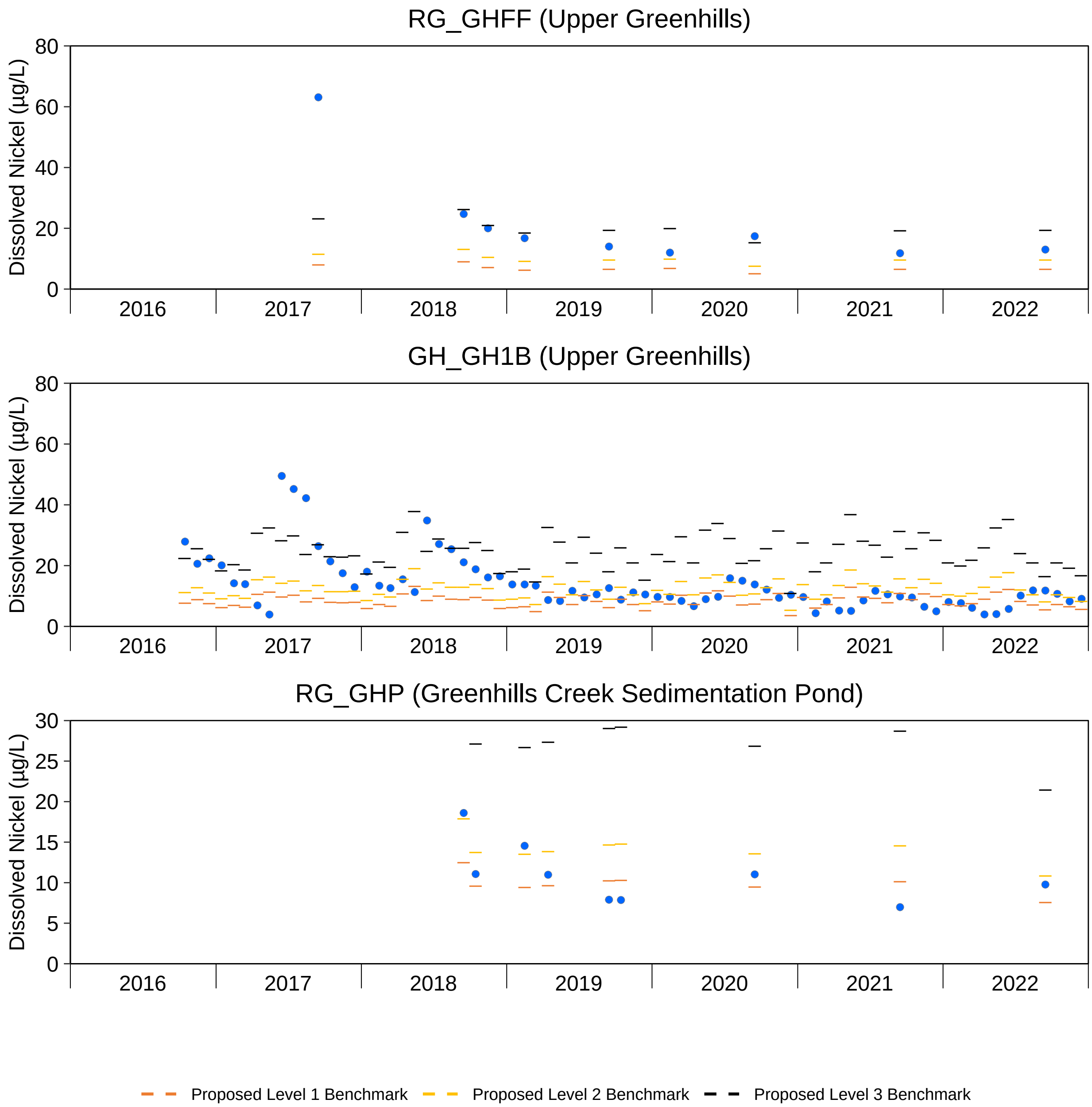

Figure E.12: Dissolved Nickel Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.
Proposed benchmarks are dependent on dissolved organic carbon, water hardness, and bicarbonate concentrations.
Values and proposed benchmarks were averaged by month according to screening guidance.

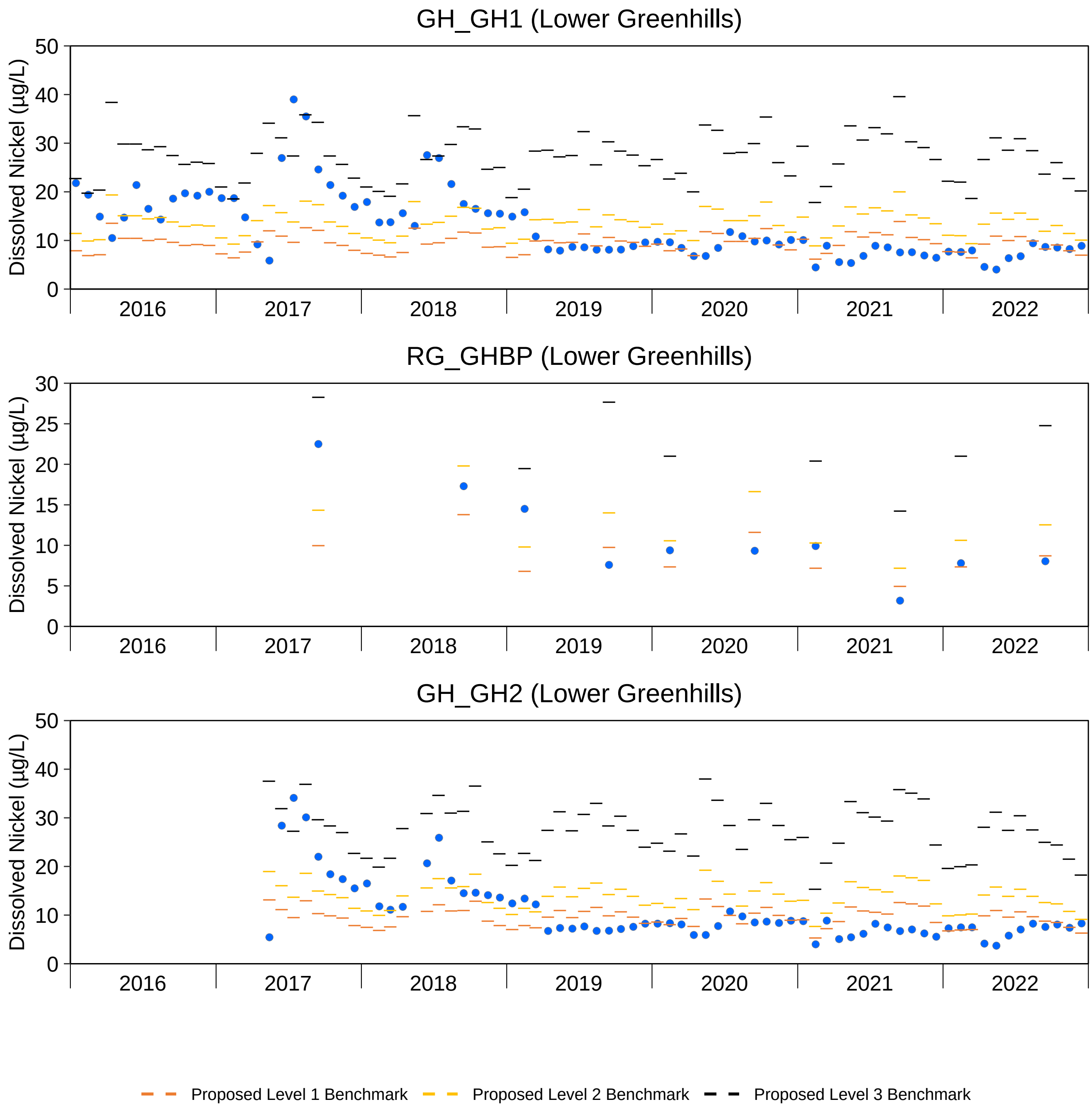

Figure E.12: Dissolved Nickel Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Proposed benchmarks are dependent on dissolved organic carbon, water hardness, and bicarbonate concentrations. Values and proposed benchmarks were averaged by month according to screening guidance.

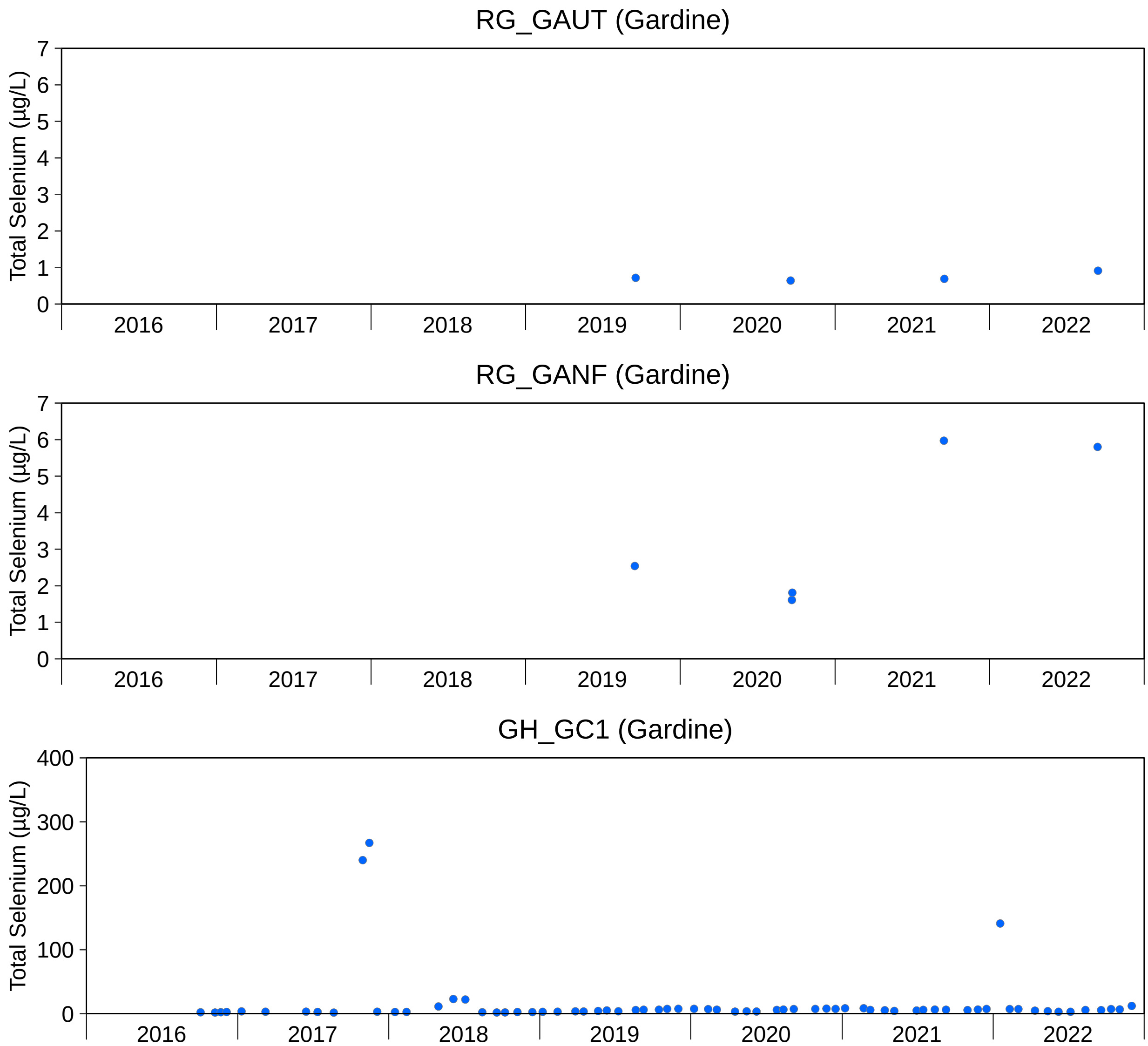

Figure E.13: Total Selenium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

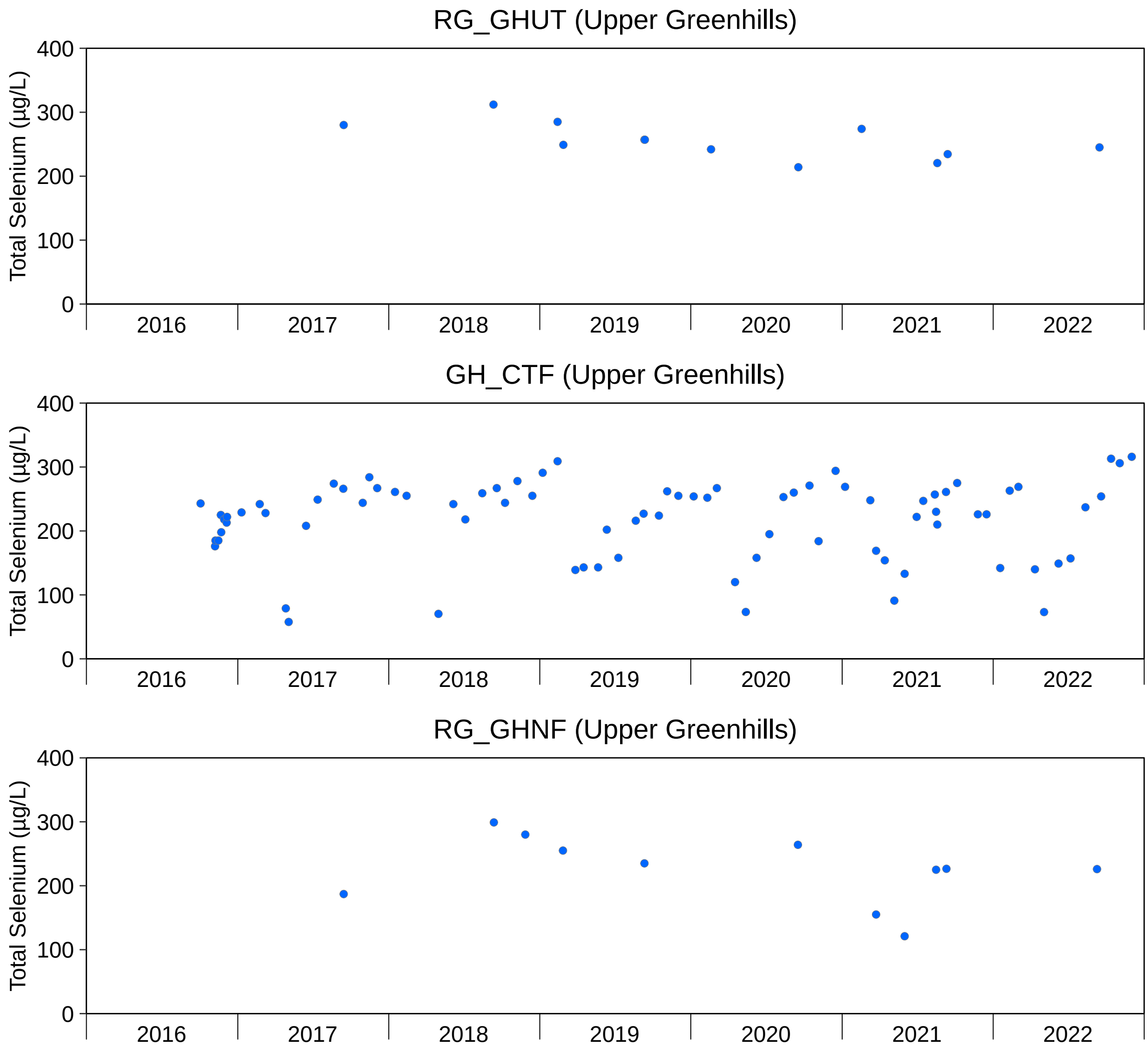

Figure E.13: Total Selenium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

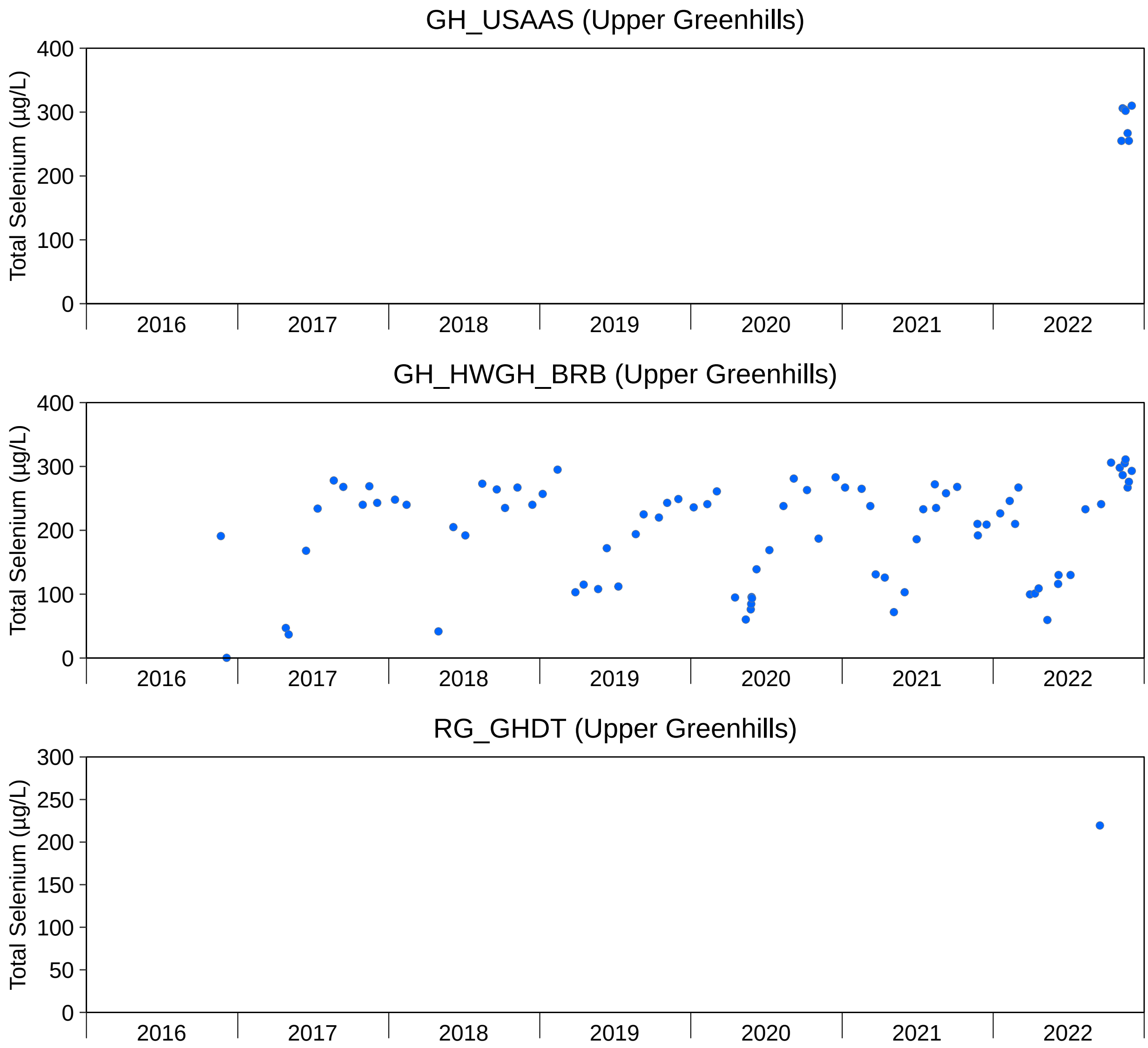

Figure E.13: Total Selenium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

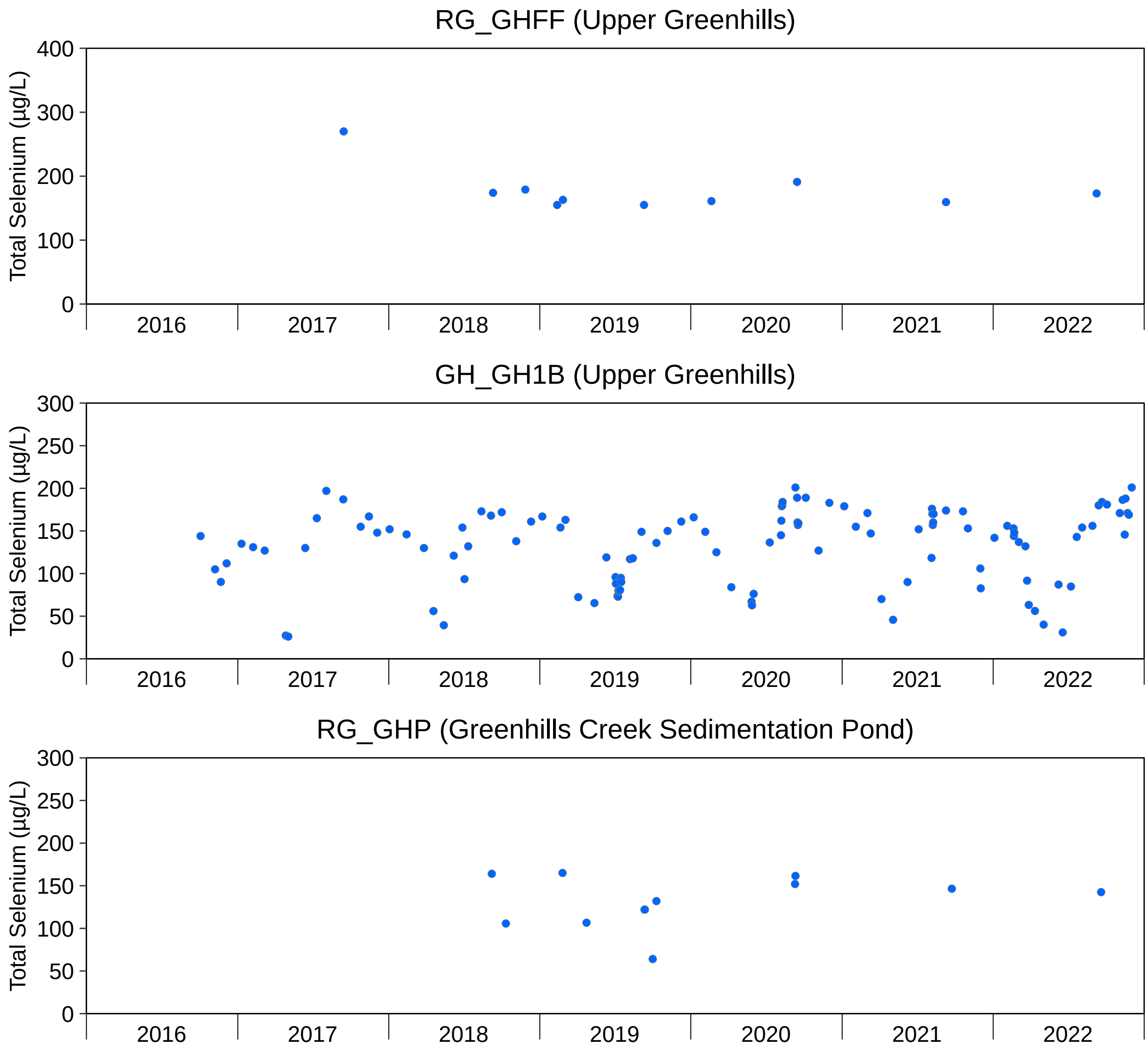

Figure E.13: Total Selenium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

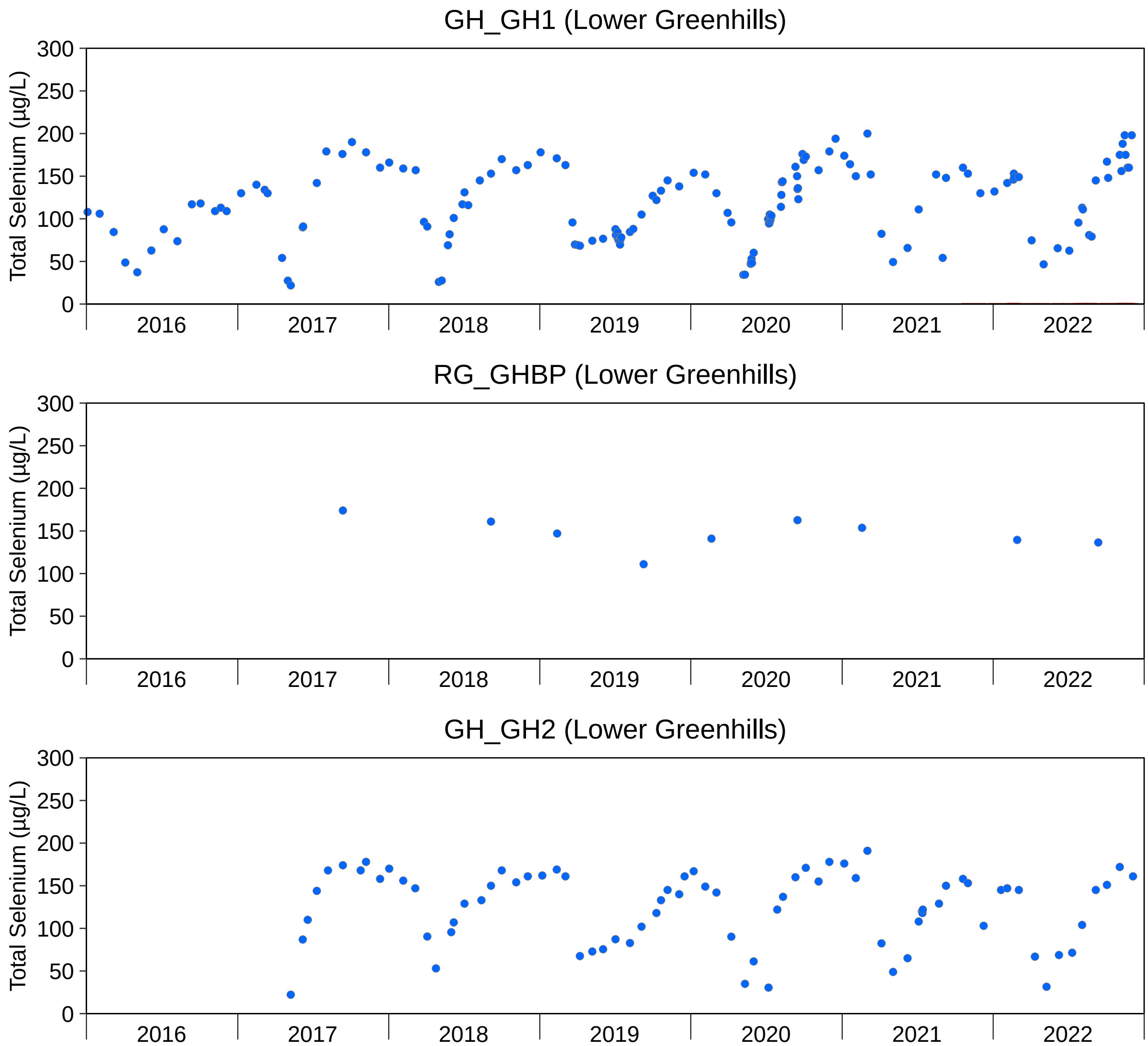

Figure E.13: Total Selenium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

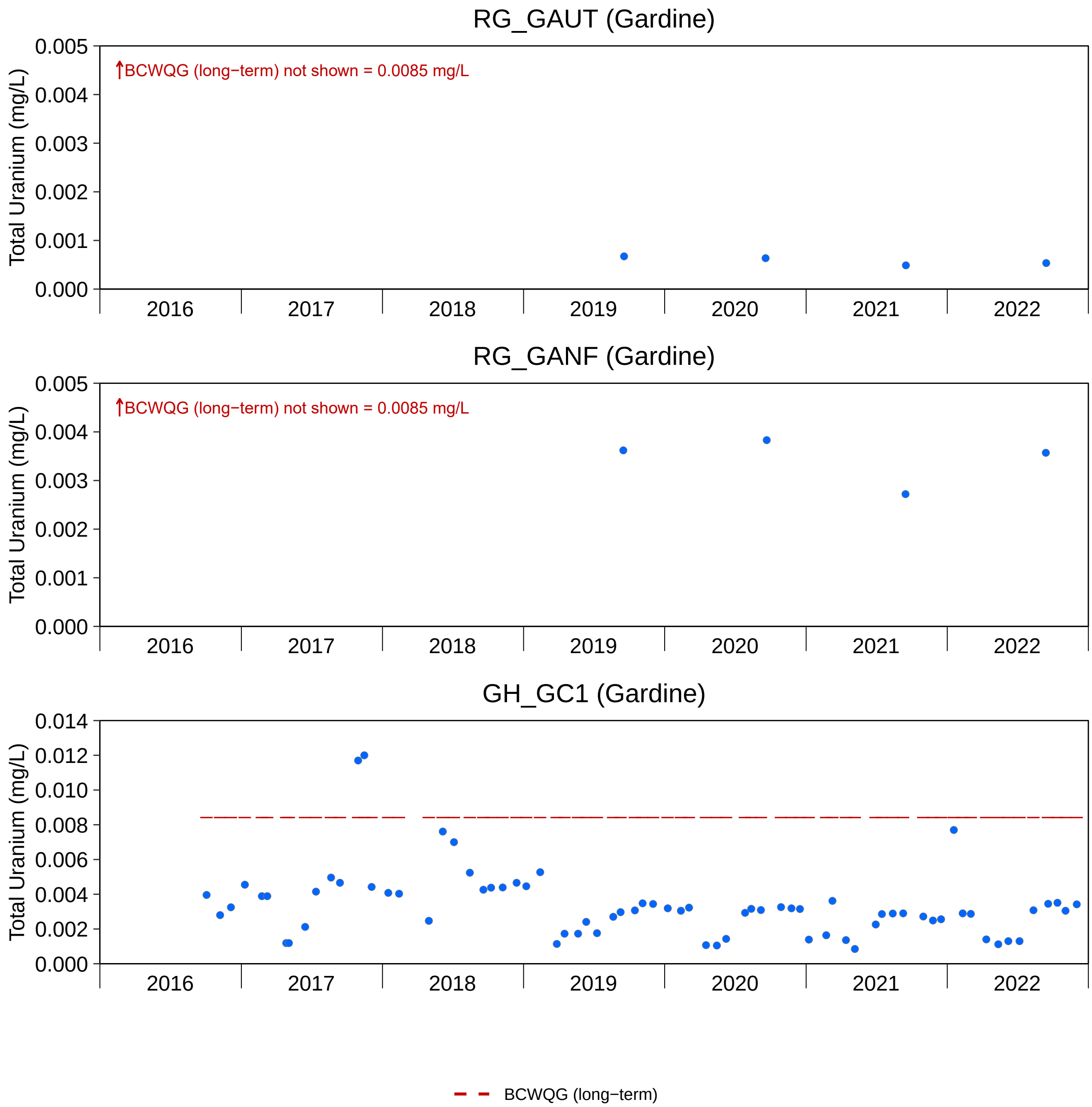

Figure E.14: Total Uranium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.
Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

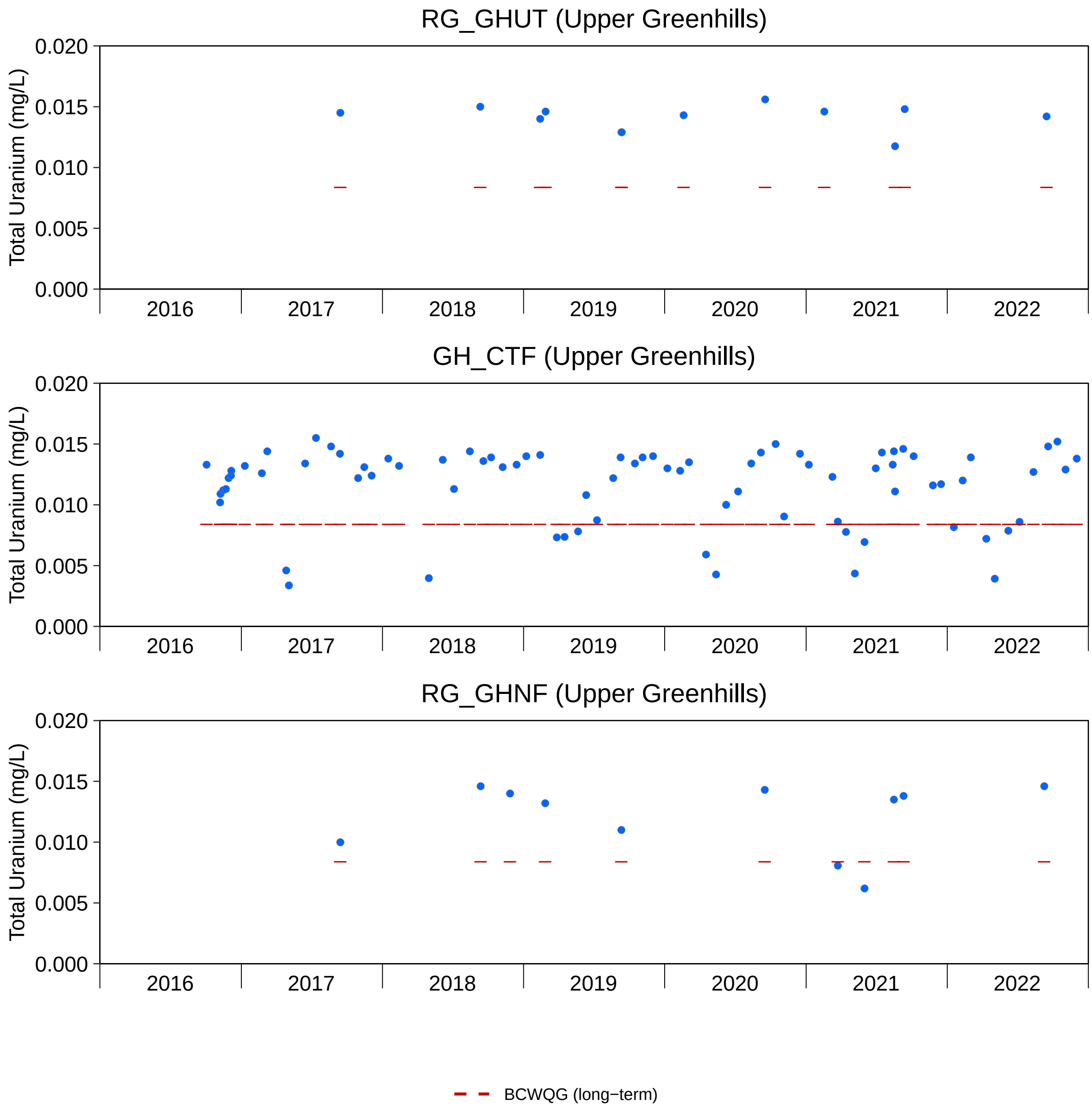

Figure E.14: Total Uranium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

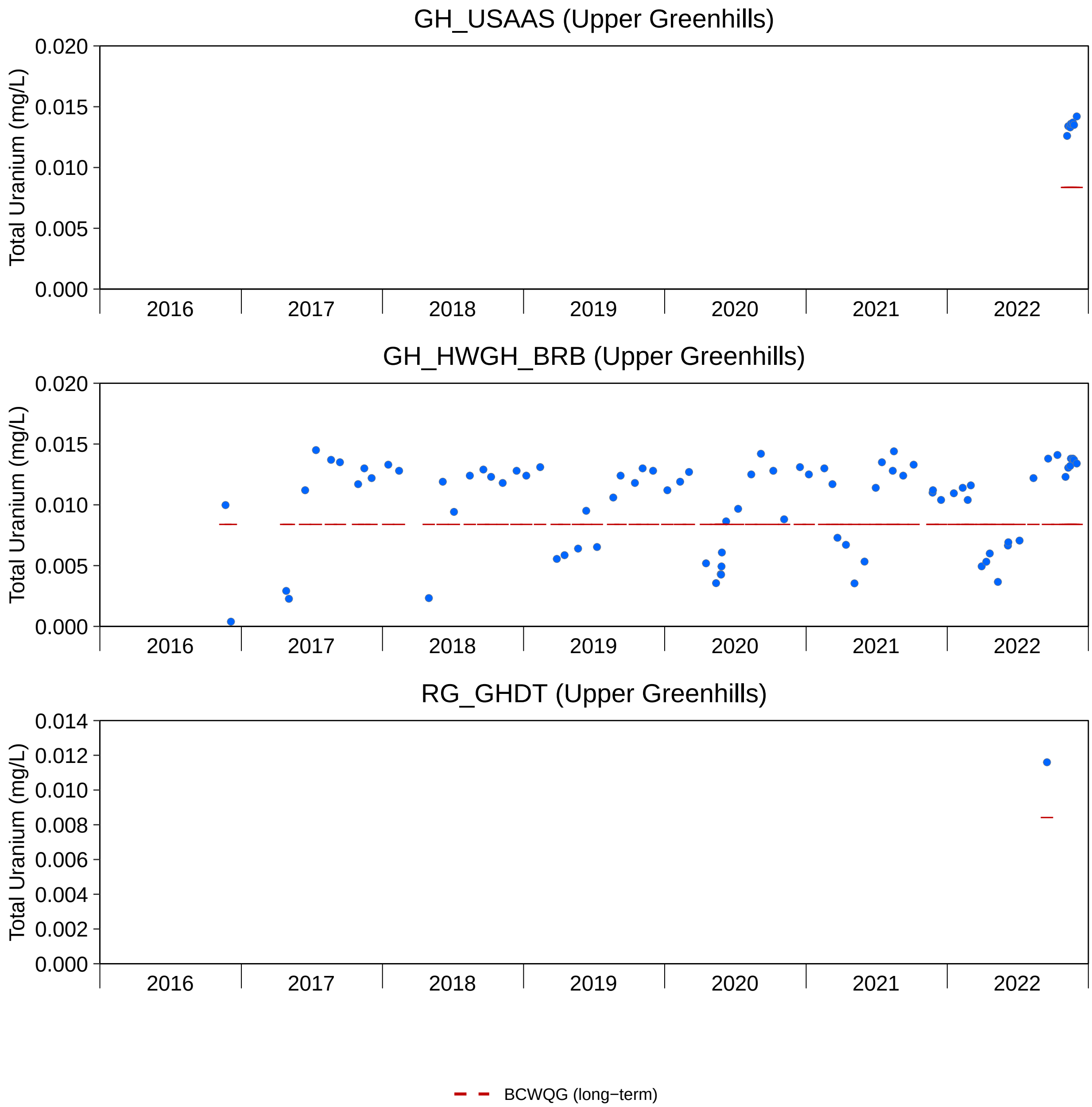

Figure E.14: Total Uranium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

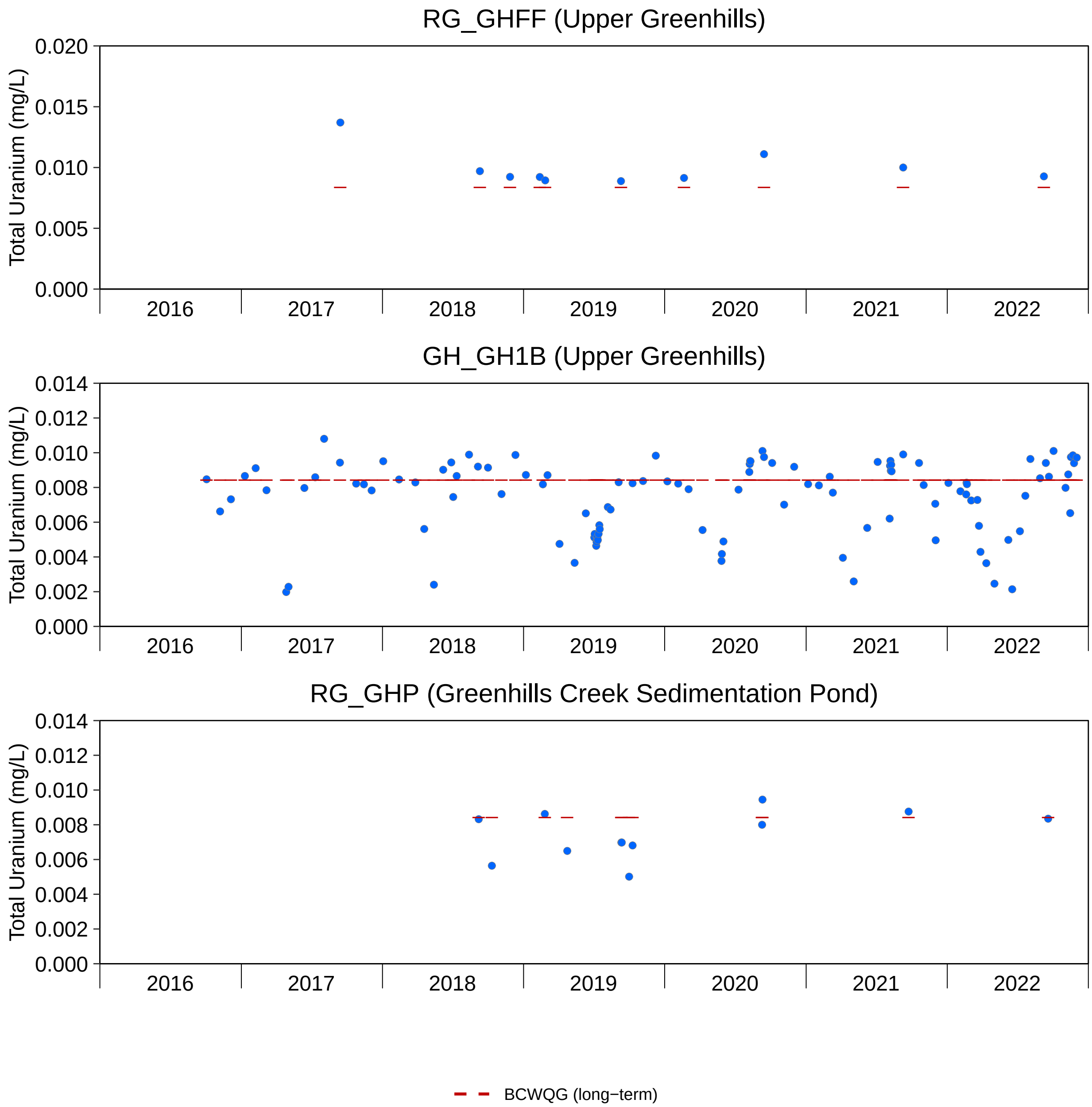

Figure E.14: Total Uranium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

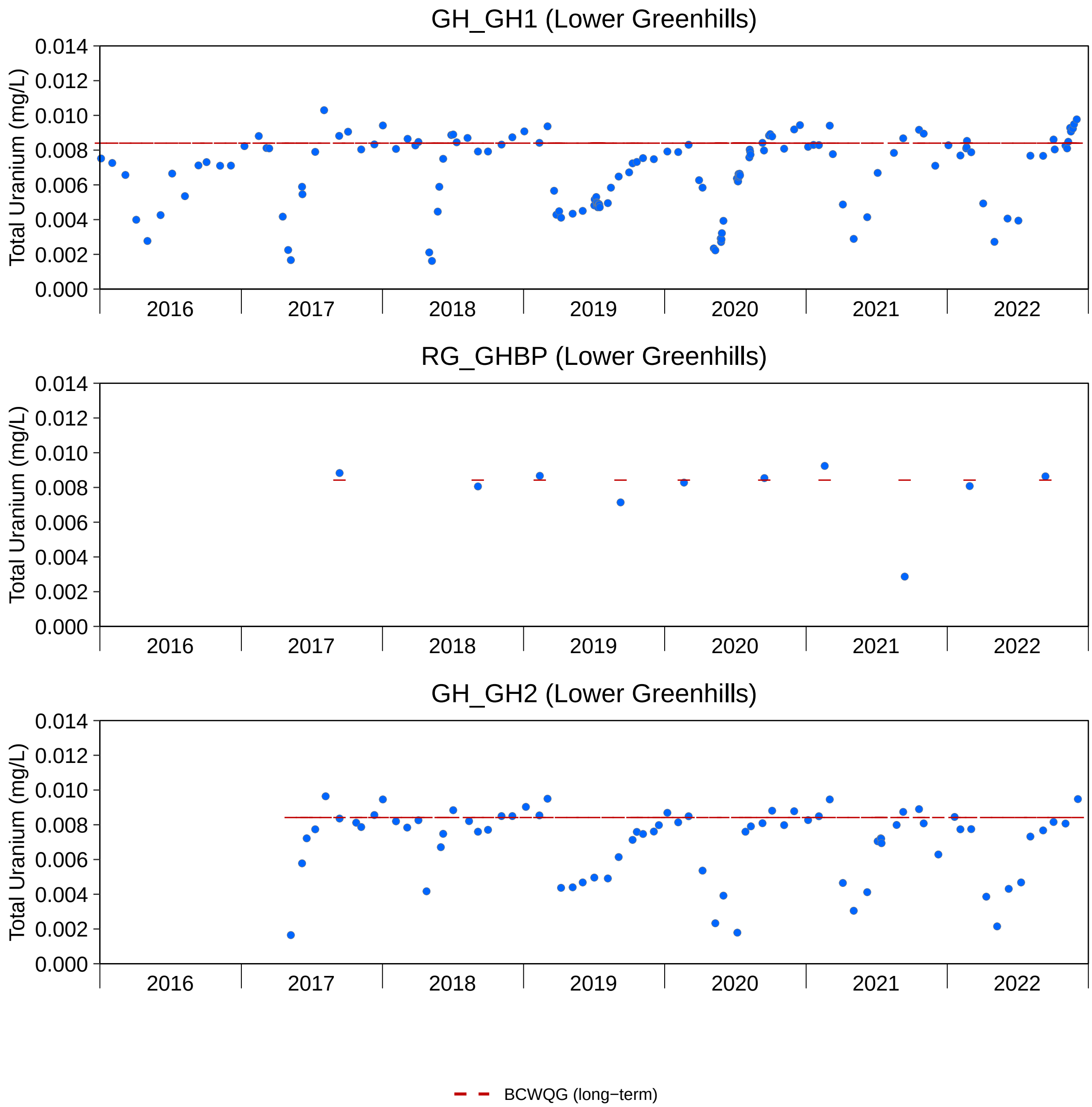

Figure E.14: Total Uranium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

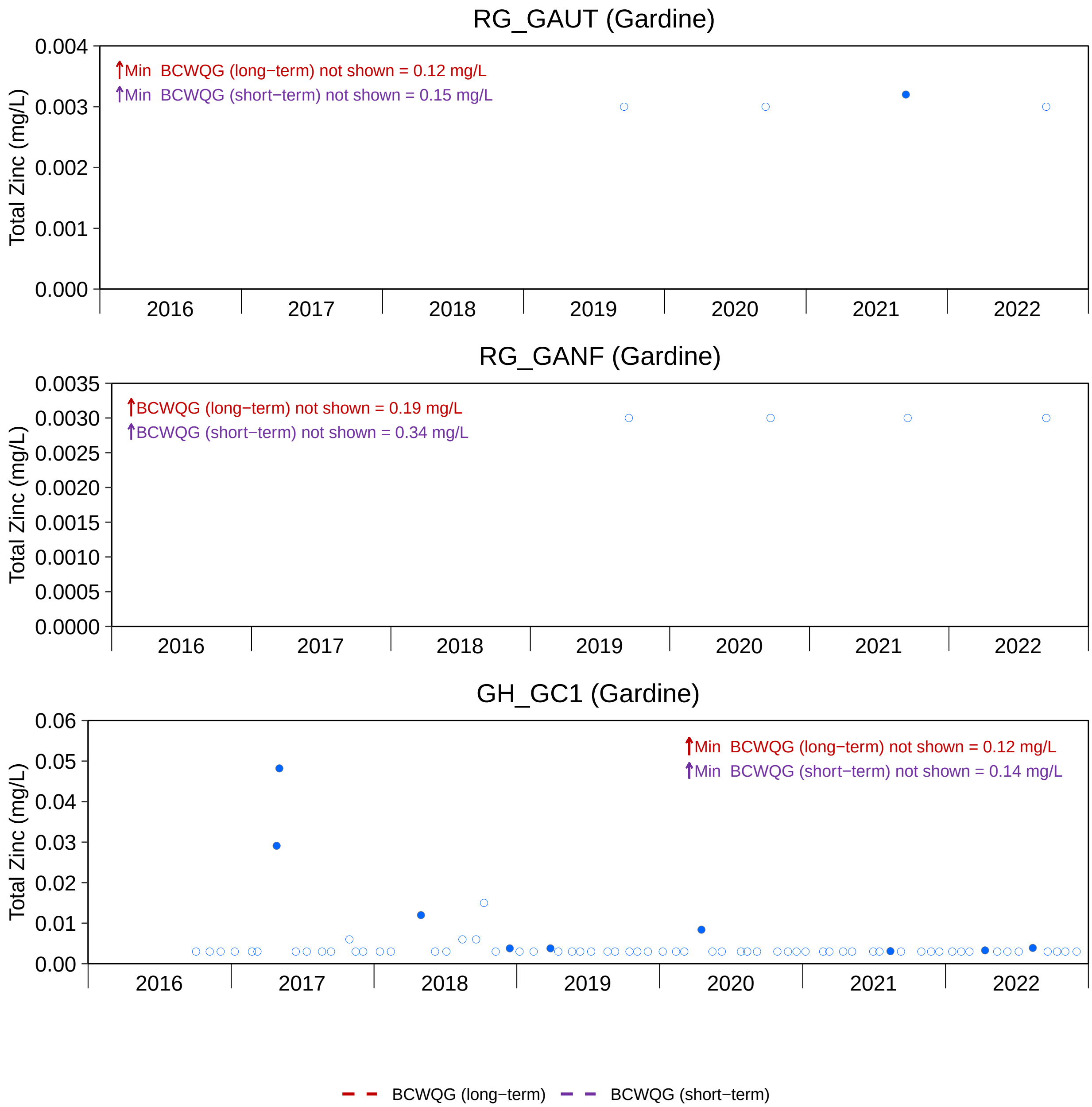

Figure E.15: Total Zinc Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

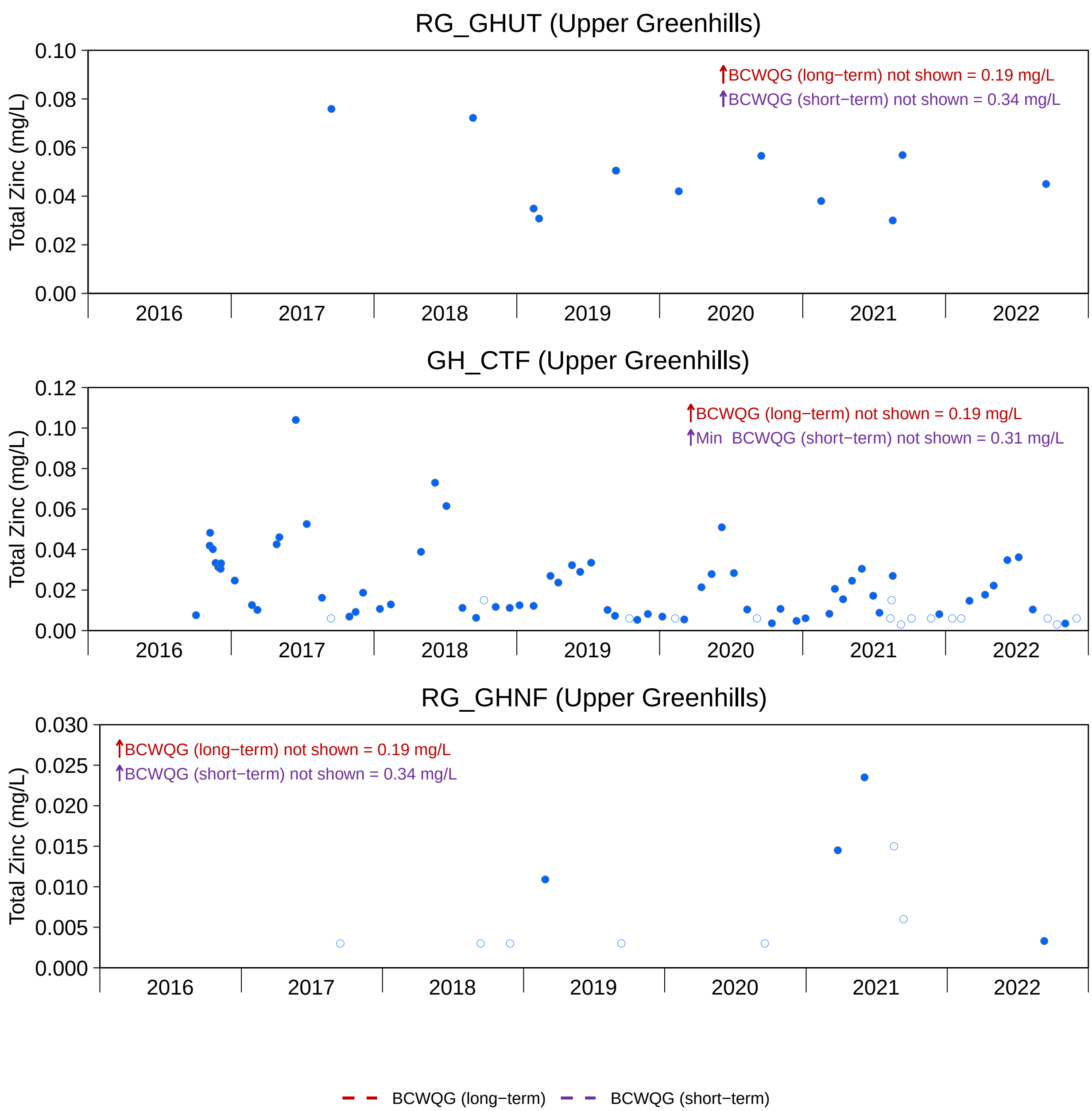

Figure E.15: Total Zinc Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

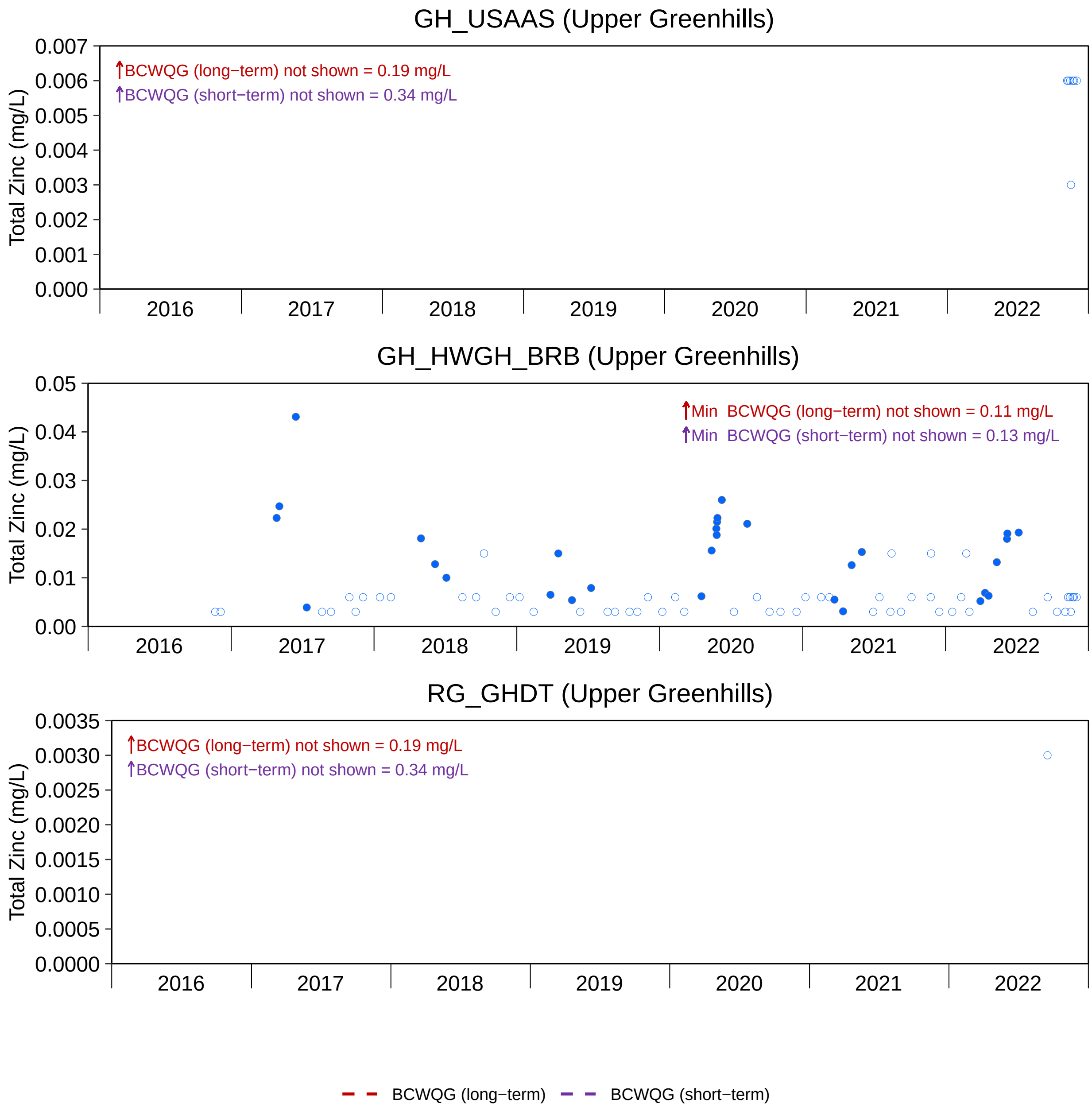

Figure E.15: Total Zinc Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

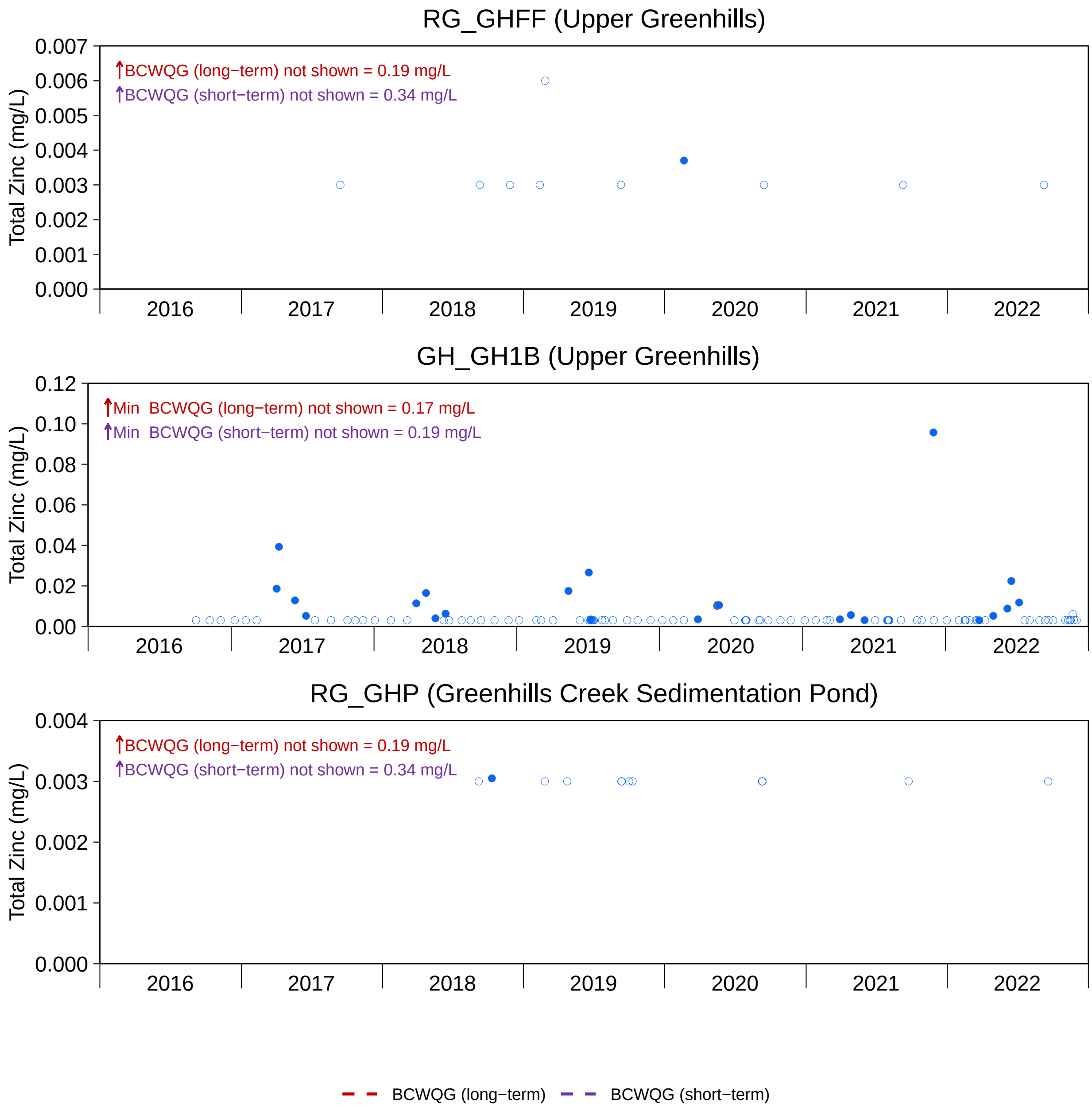

Figure E.15: Total Zinc Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

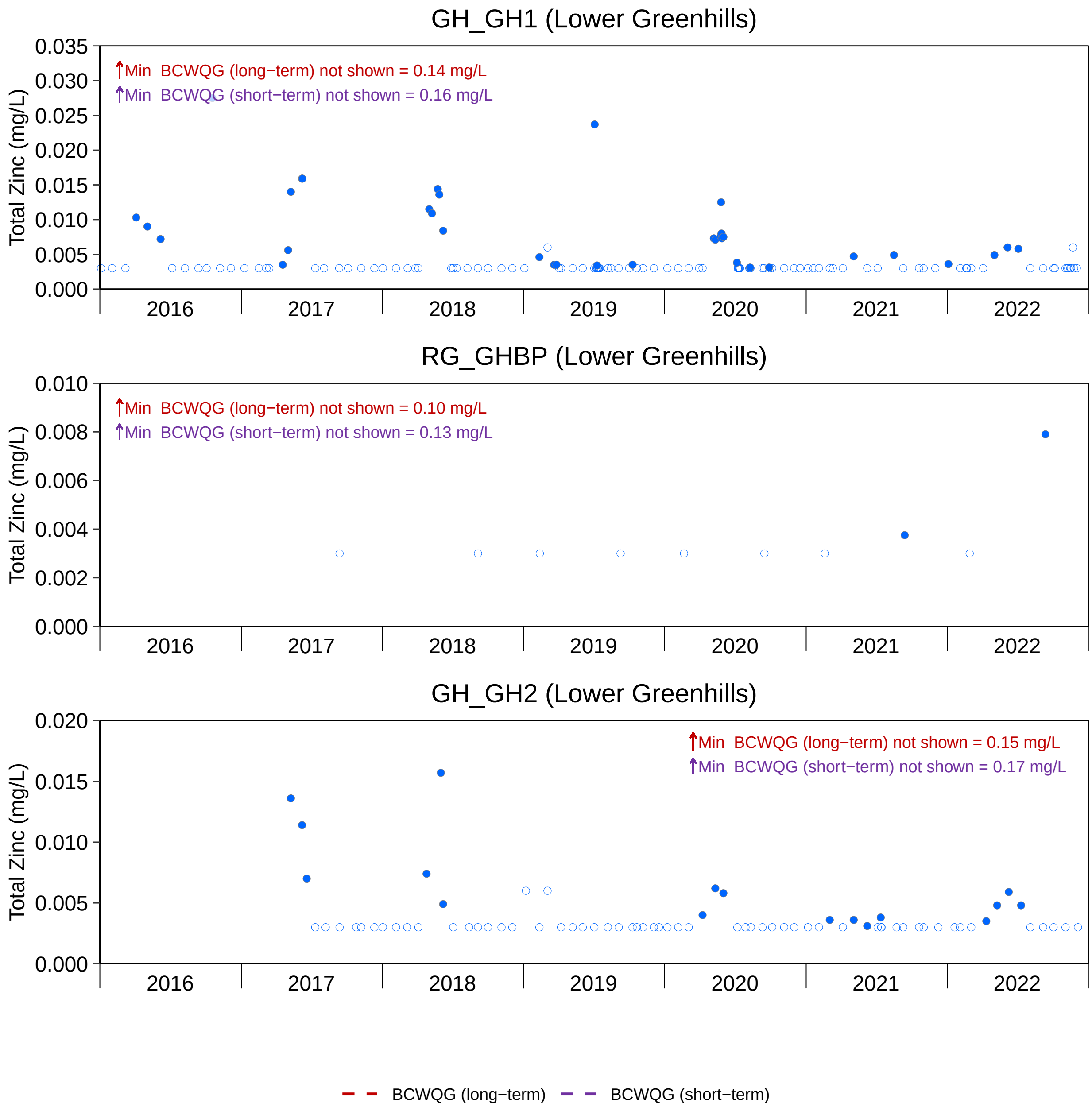

Figure E.15: Total Zinc Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

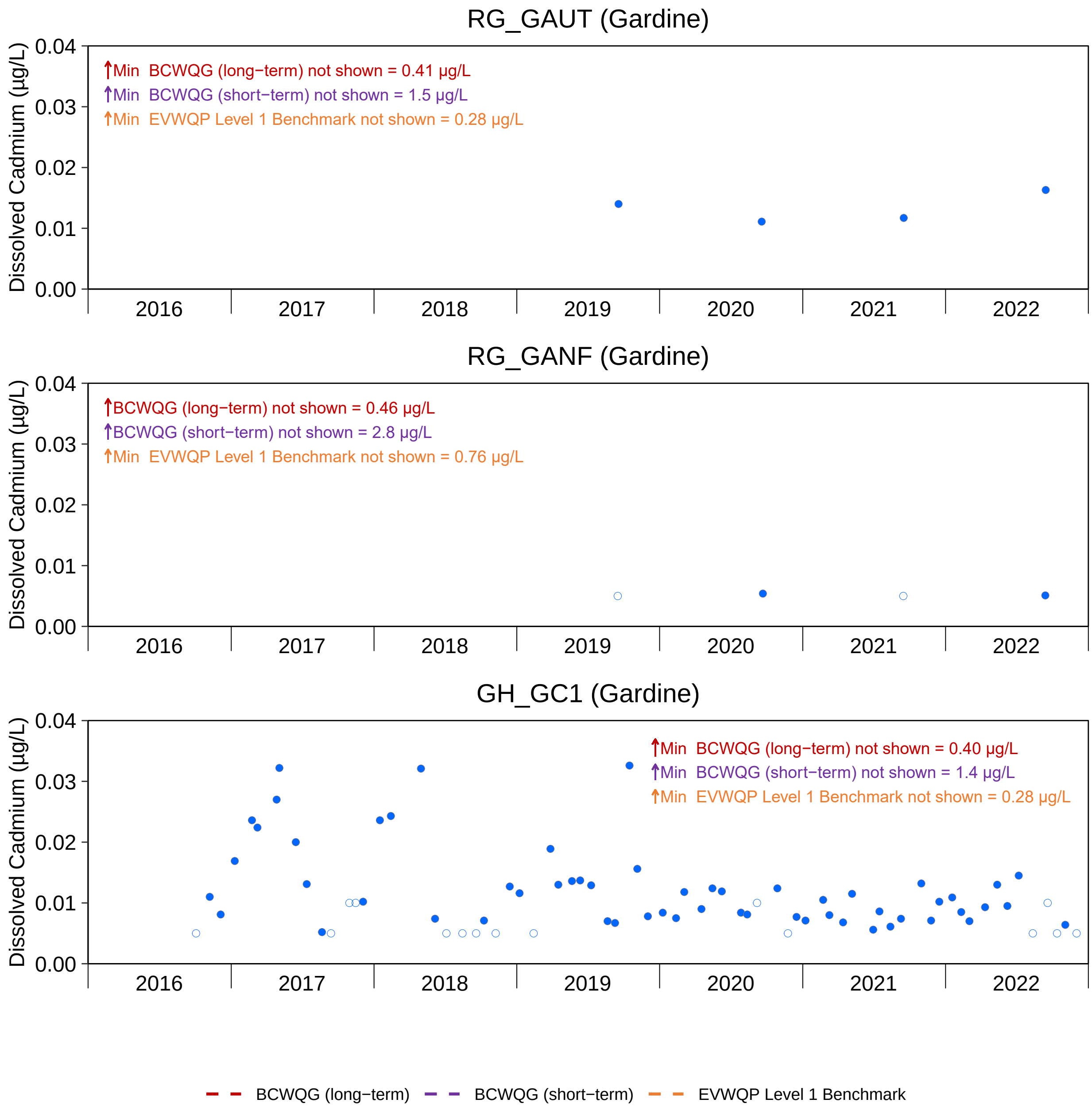

Figure E.16: Dissolved Cadmium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines and benchmarks are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

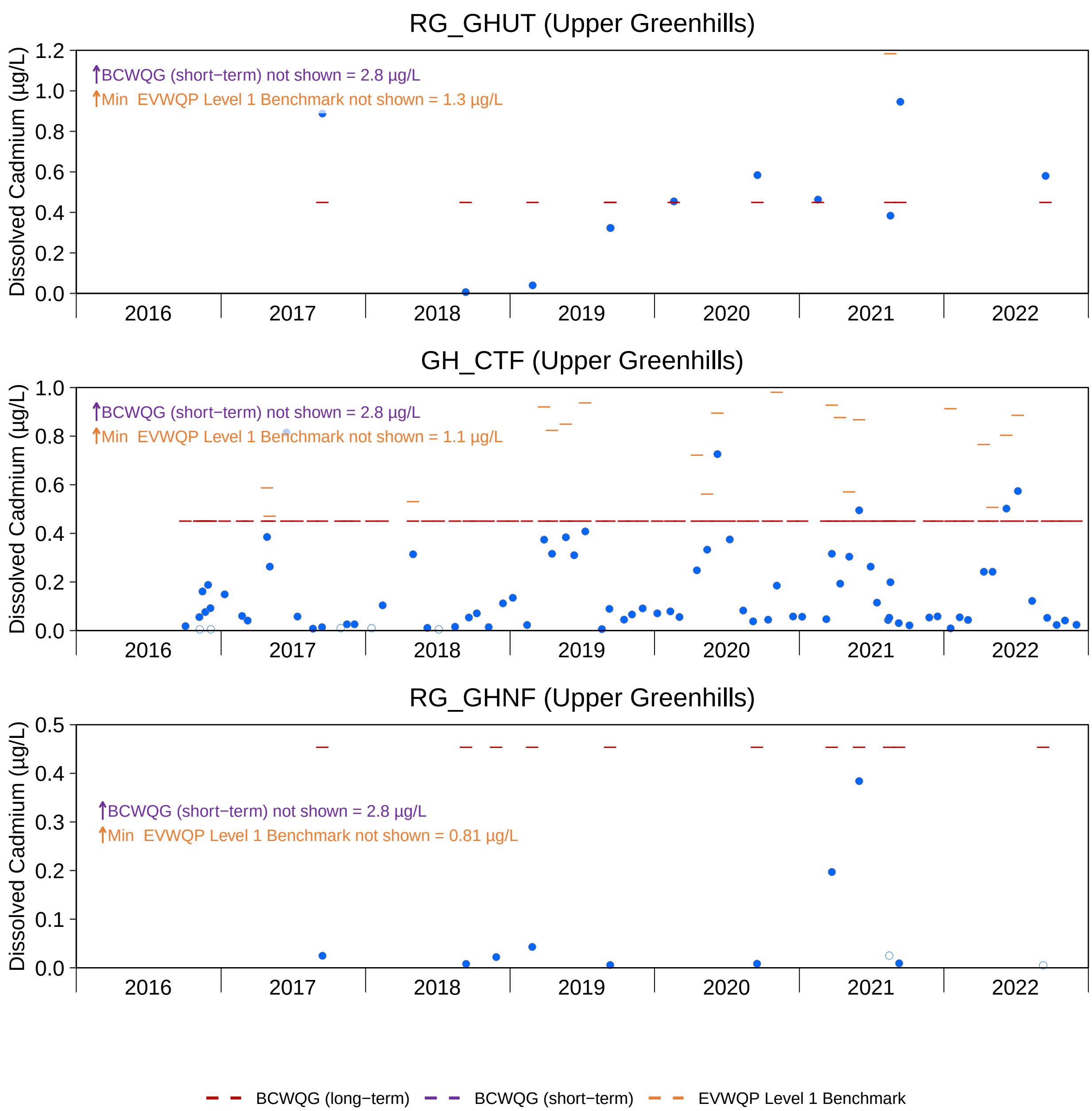

Figure E.16: Dissolved Cadmium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines and benchmarks are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

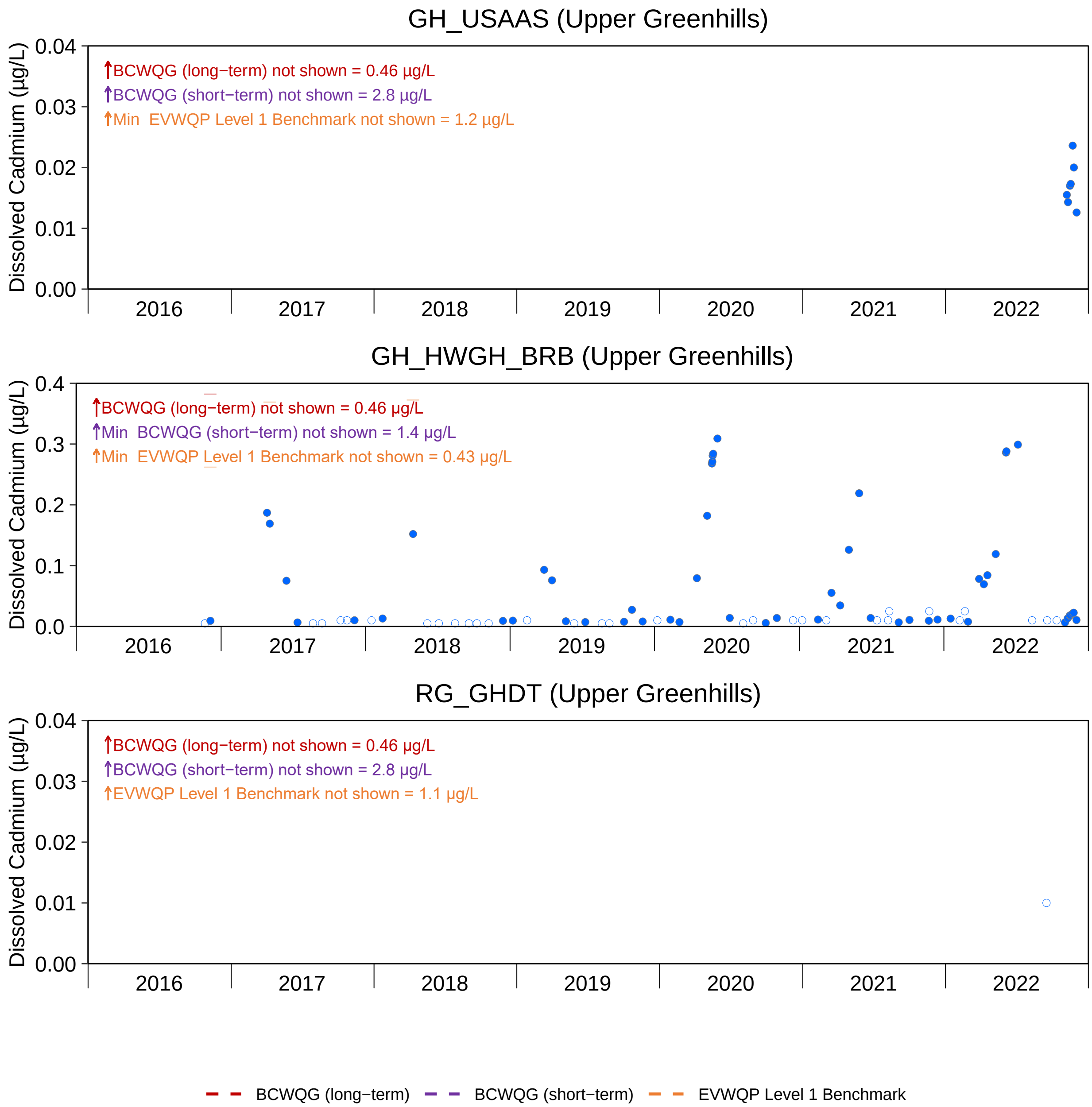

Figure E.16: Dissolved Cadmium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines and benchmarks are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

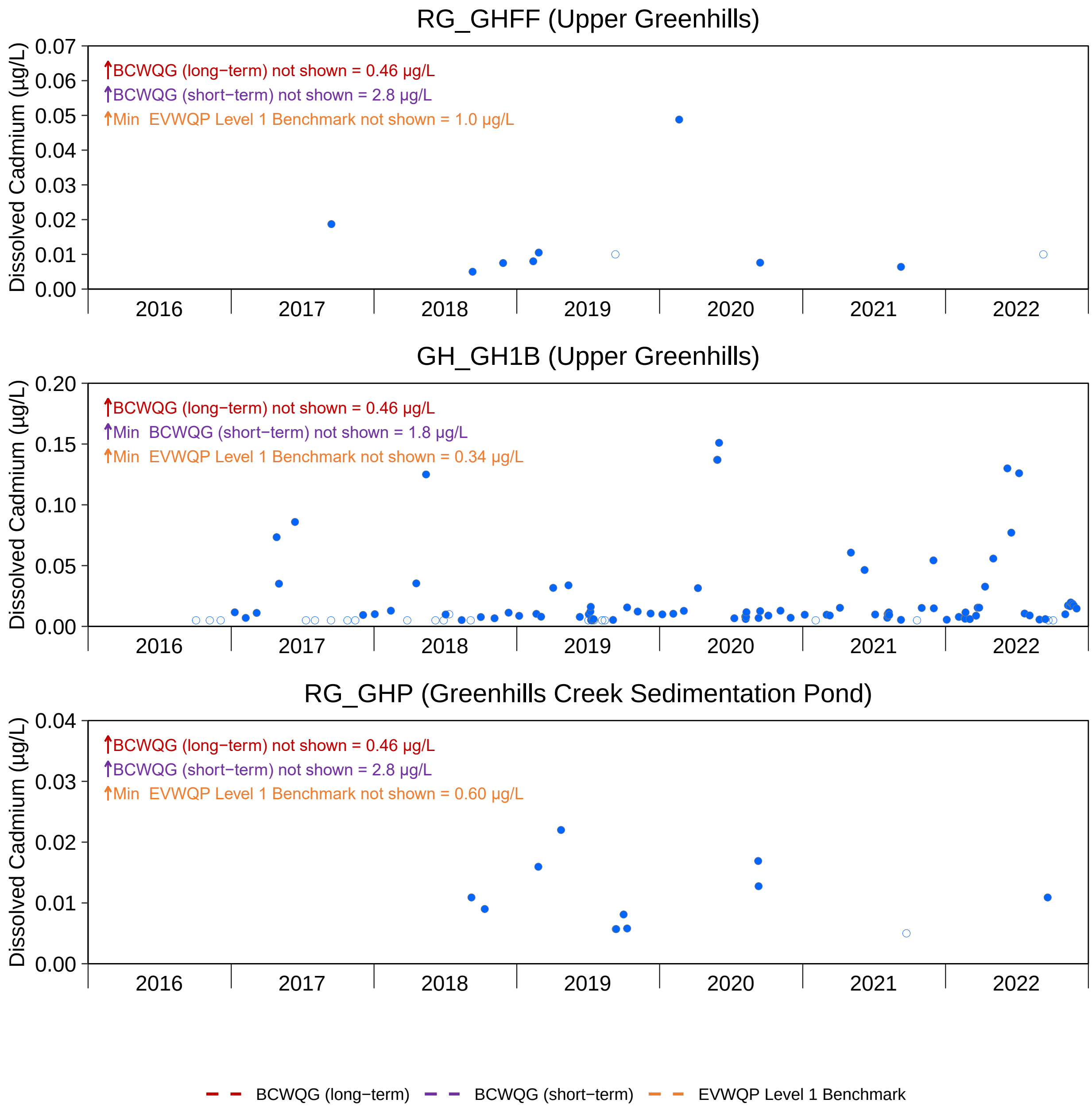

Figure E.16: Dissolved Cadmium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines and benchmarks are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

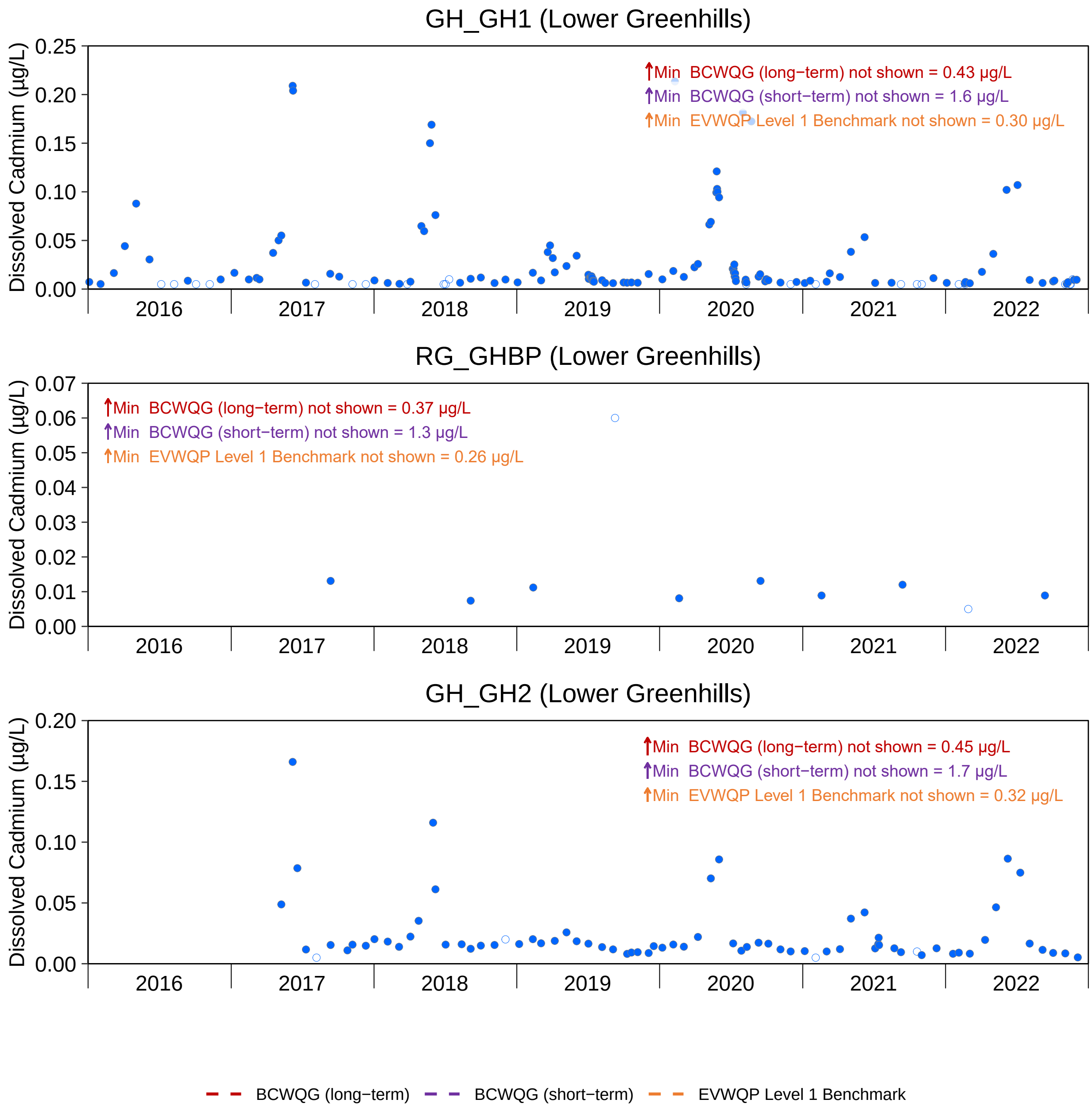

Figure E.16: Dissolved Cadmium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines and benchmarks are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

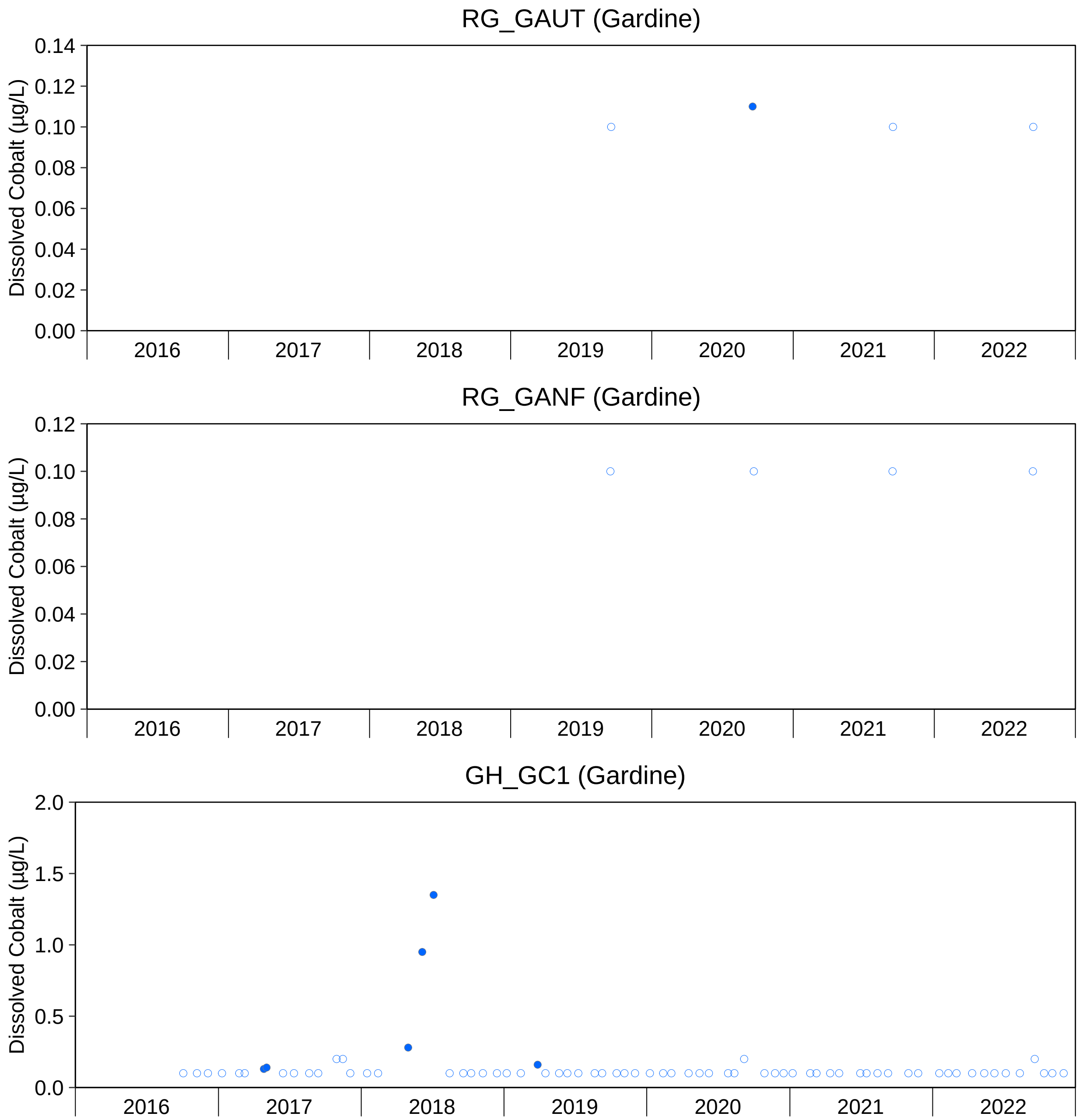

Figure E.17: Dissolved Cobalt Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

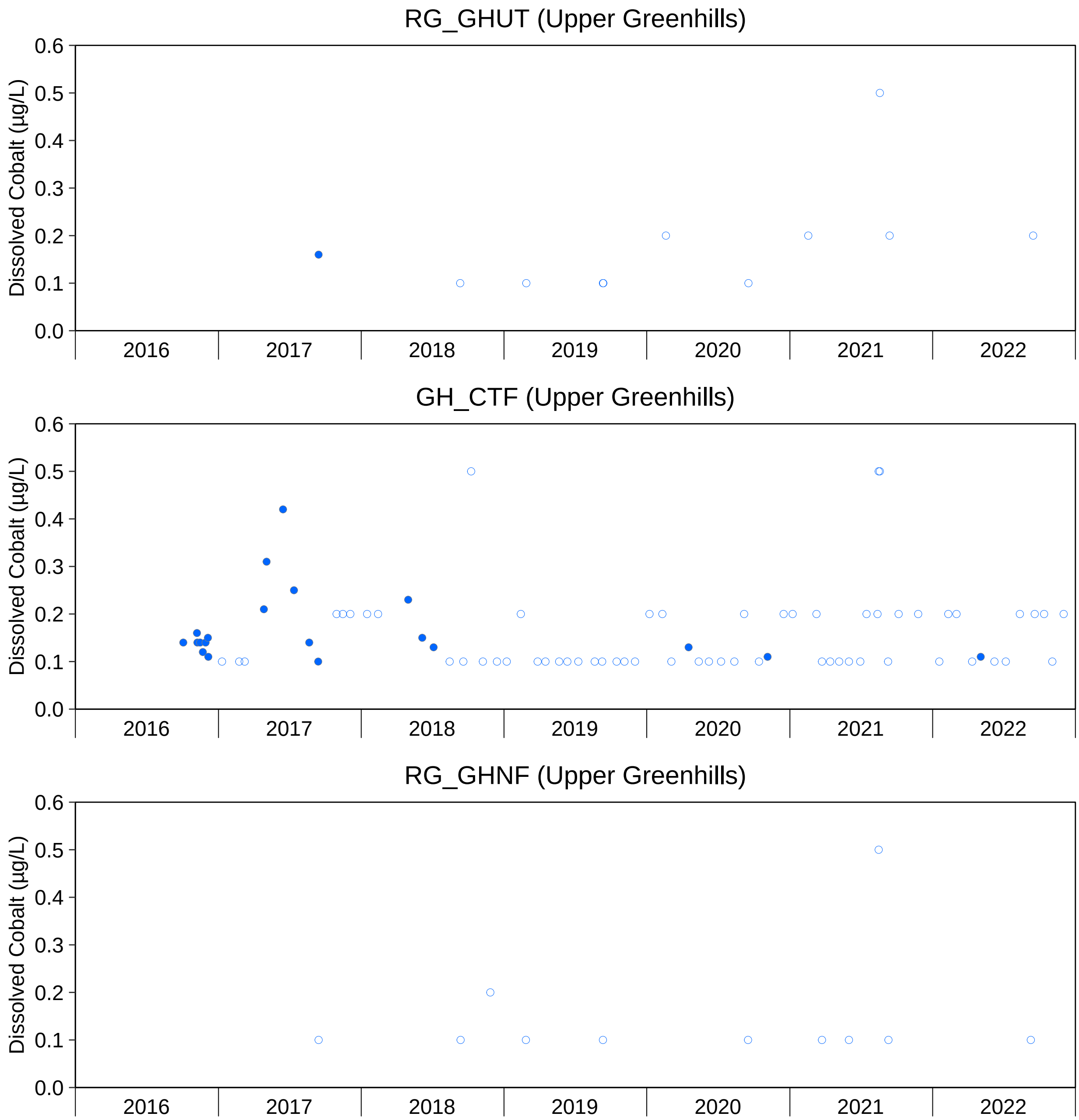

Figure E.17: Dissolved Cobalt Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

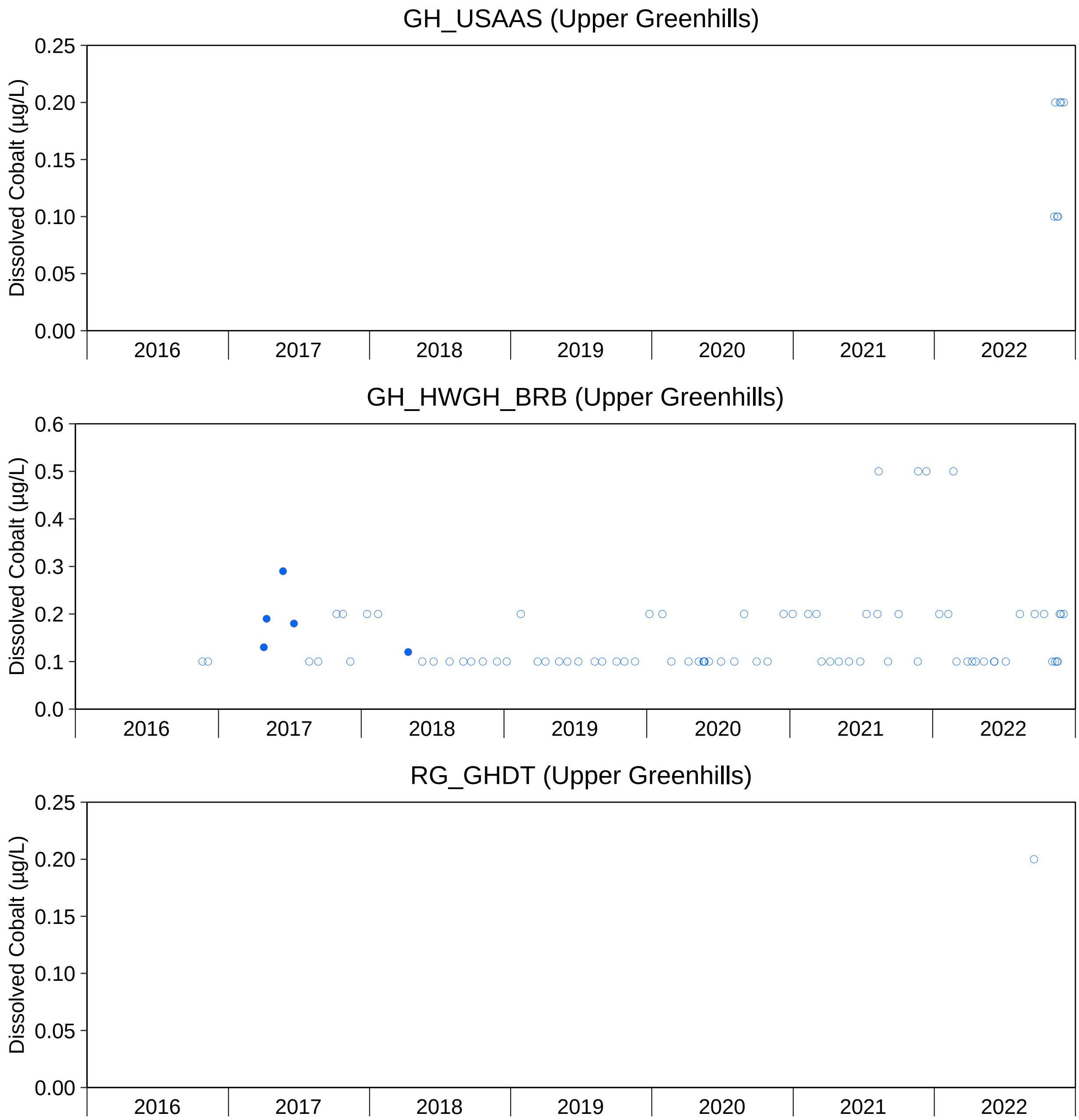

Figure E.17: Dissolved Cobalt Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018).

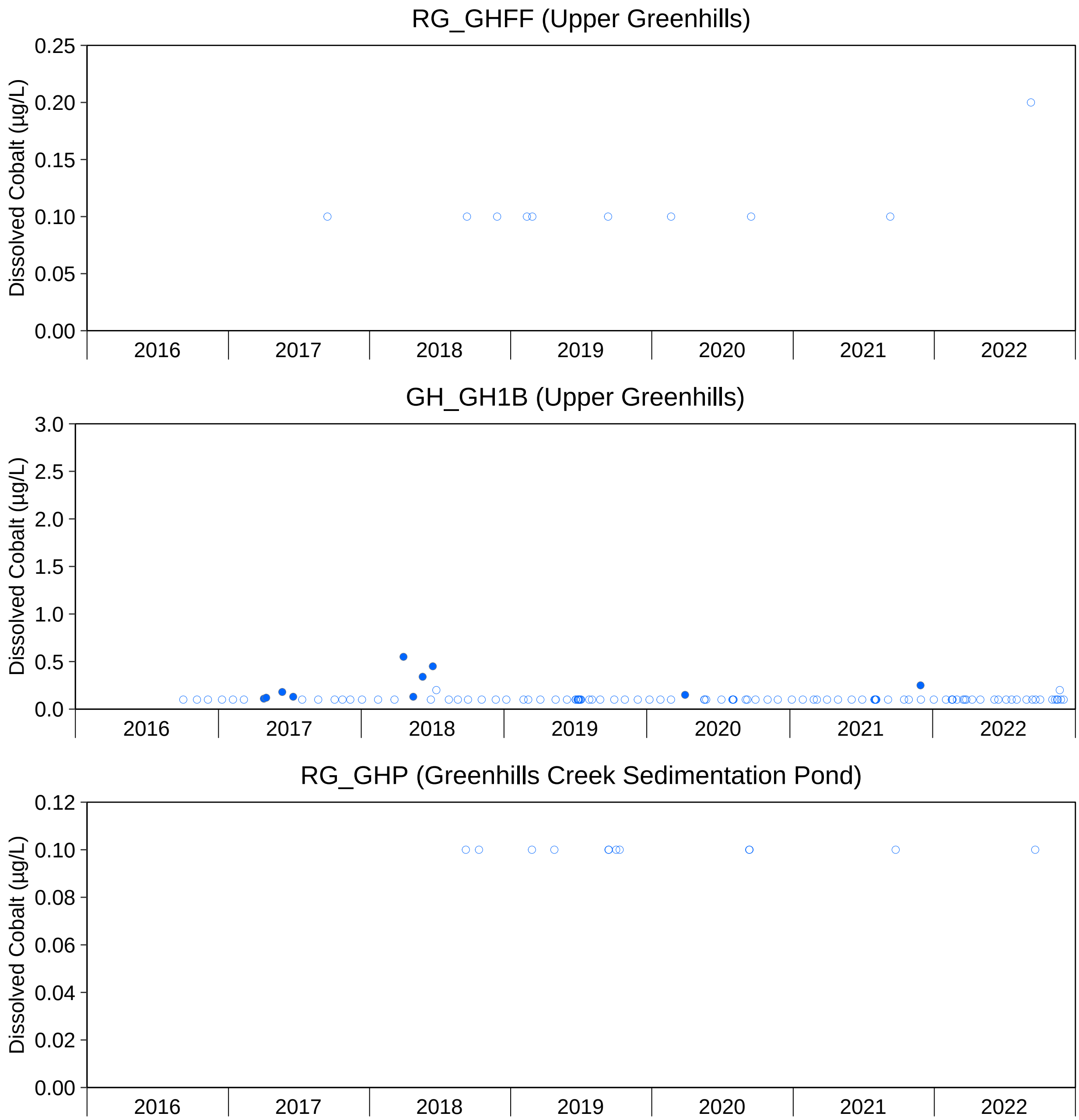

Figure E.17: Dissolved Cobalt Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

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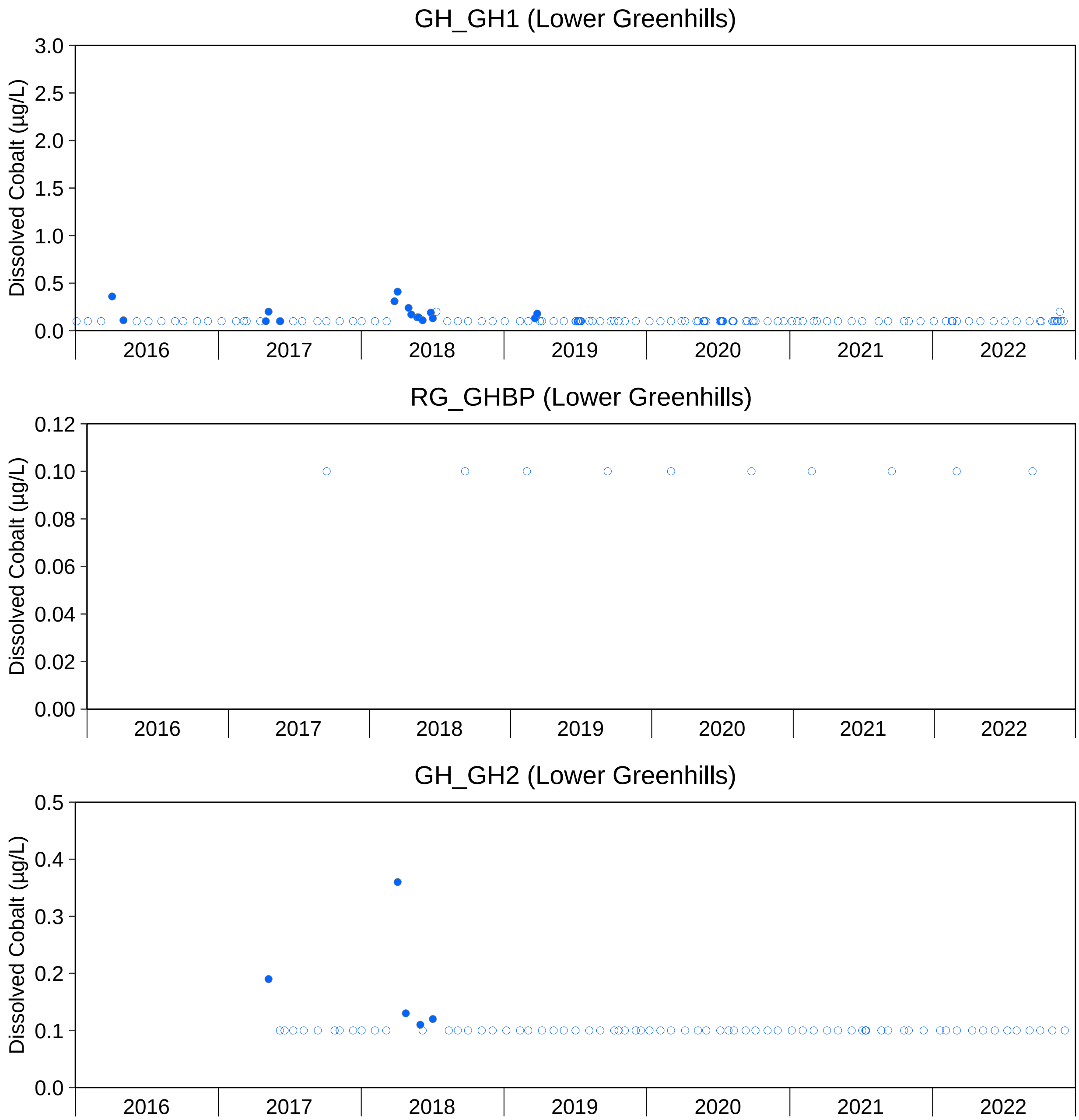

Figure E.17: Dissolved Cobalt Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2022

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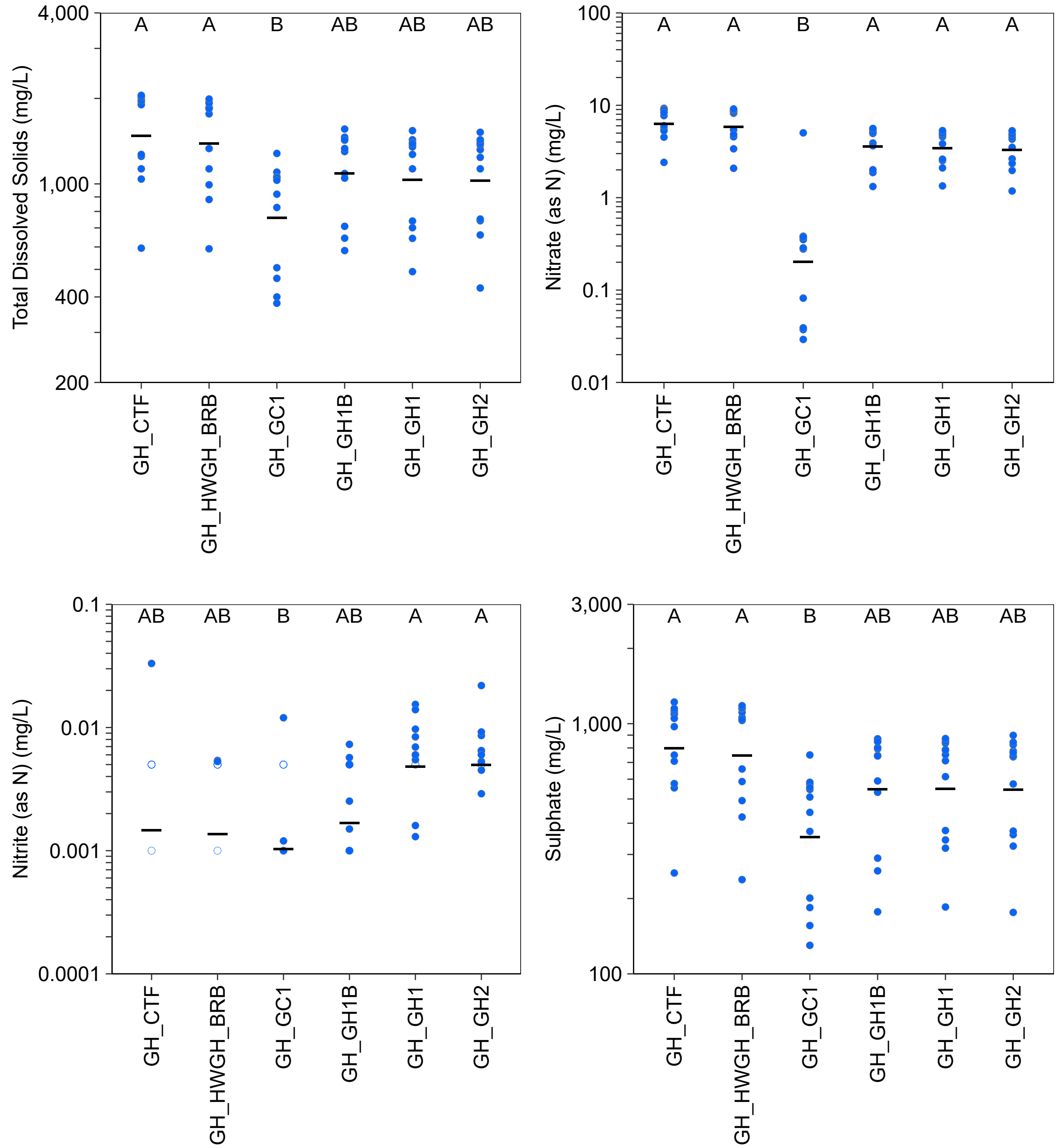

Figure E.18: Comparisons of Monthly Mean Concentrations for Water Quality Constituents in Samples from Routine Monitoring Stations on Greenhills and Gardine Creeks, 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Black dashes represent estimated marginal mean values from a censored regression Analysis of Variance (ANOVA) fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Stations that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value <0.05) for the ANOVA or in a Tukey's Honestly Significant Differences *post hoc* test. Statistics were not conducted for dissolved cobalt because most data were at the LRL.

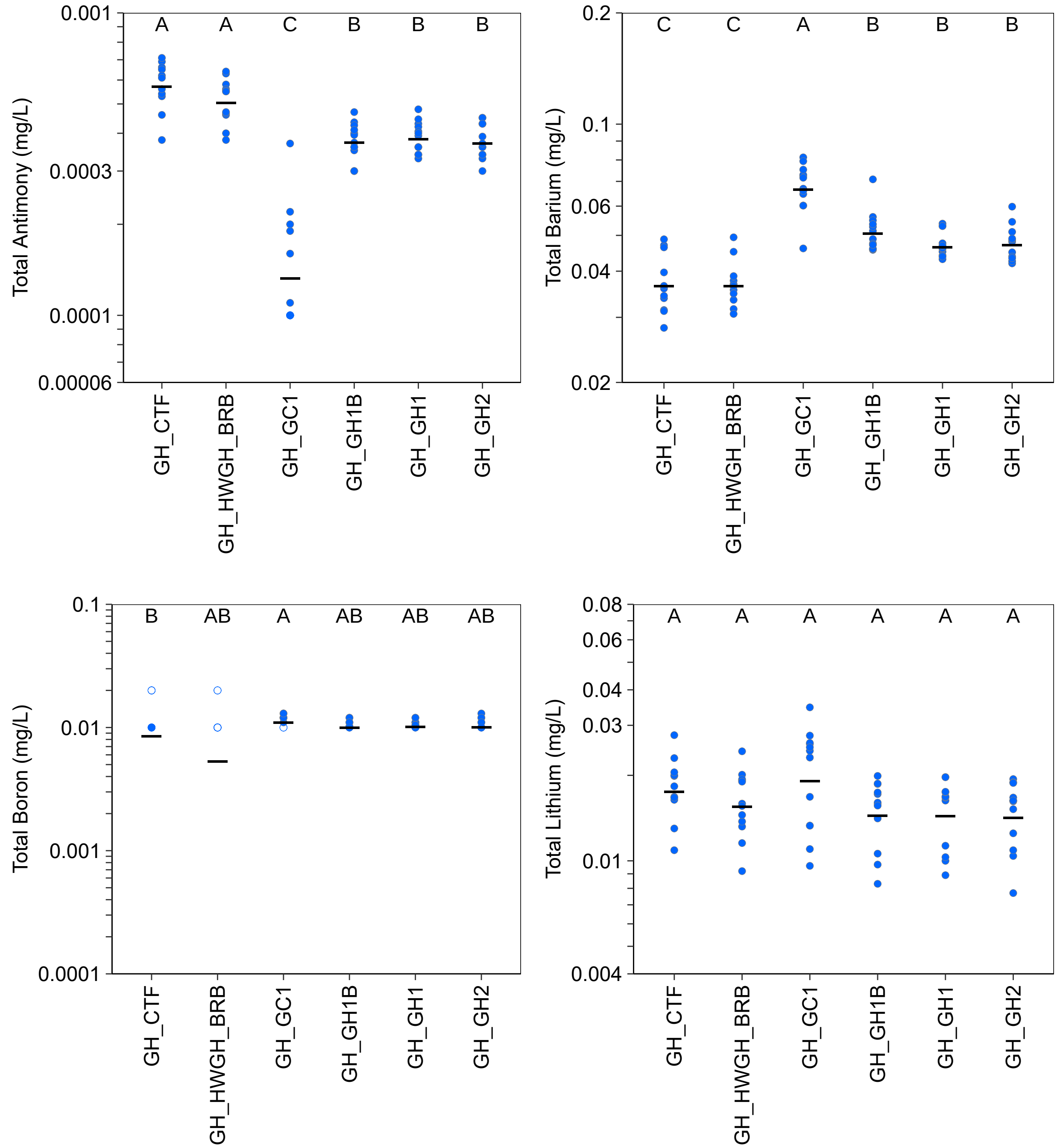

Figure E.18: Comparisons of Monthly Mean Concentrations for Water Quality Constituents in Samples from Routine Monitoring Stations on Greenhills and Gardine Creeks, 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Black dashes represent estimated marginal mean values from a censored regression Analysis of Variance (ANOVA) fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Stations that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value <0.05) for the ANOVA or in a Tukey's Honestly Significant Differences *post hoc* test. Statistics were not conducted for dissolved cobalt because most data were at the LRL.

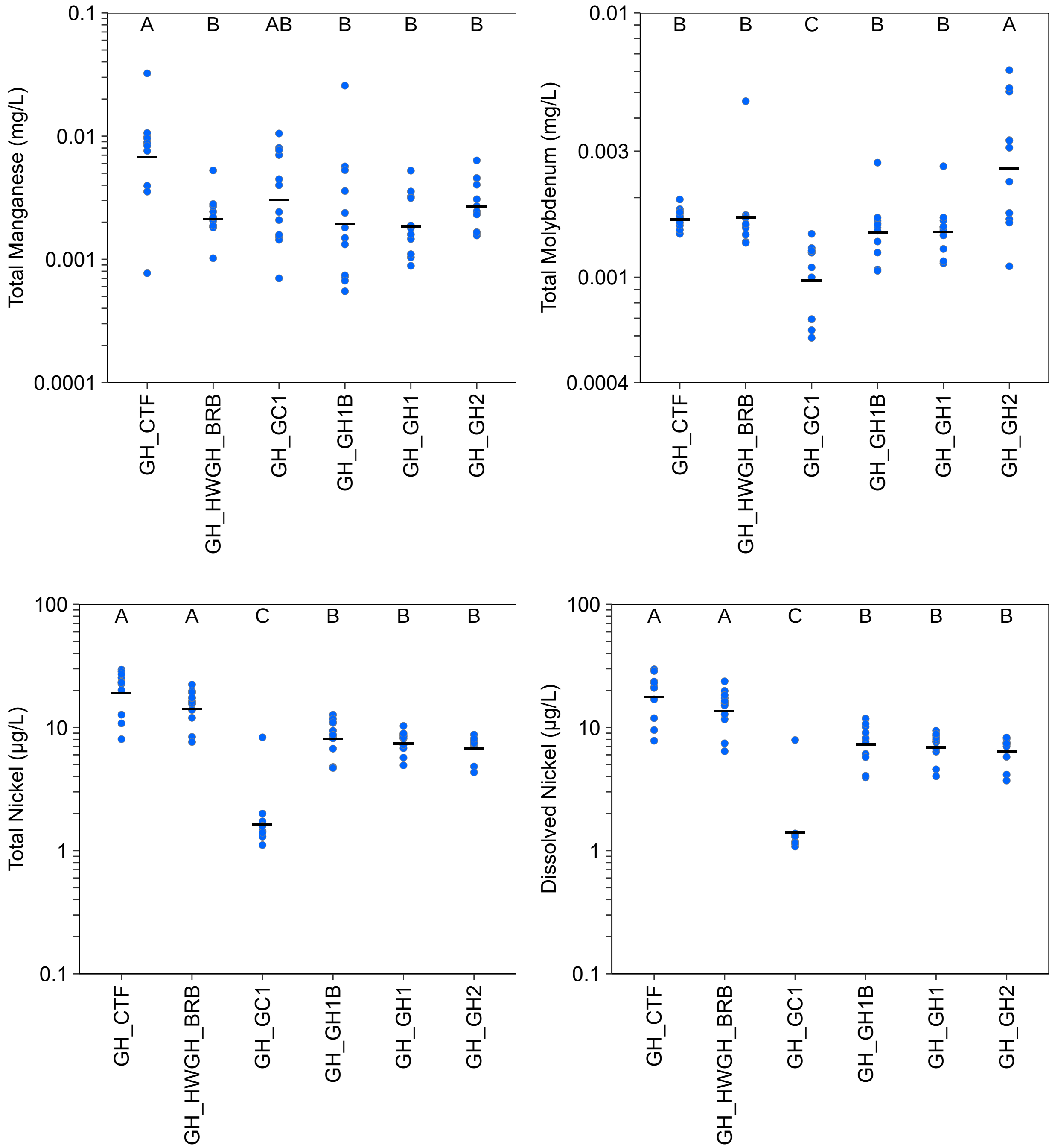

Figure E.18: Comparisons of Monthly Mean Concentrations for Water Quality Constituents in Samples from Routine Monitoring Stations on Greenhills and Gardine Creeks, 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Black dashes represent estimated marginal mean values from a censored regression Analysis of Variance (ANOVA) fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Stations that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value <0.05) for the ANOVA or in a Tukey's Honestly Significant Differences *post hoc* test. Statistics were not conducted for dissolved cobalt because most data were at the LRL.

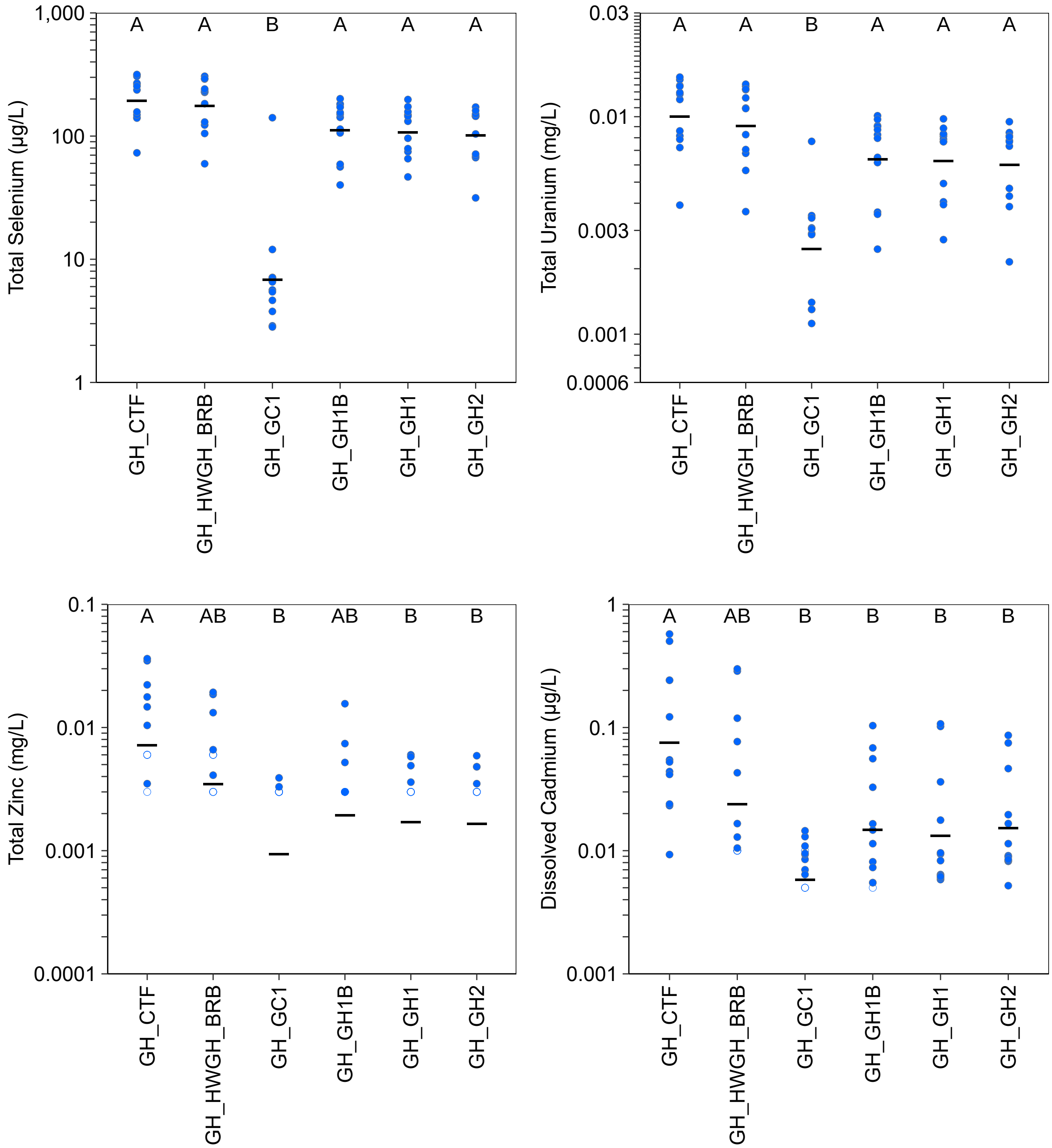

Figure E.18: Comparisons of Monthly Mean Concentrations for Water Quality Constituents in Samples from Routine Monitoring Stations on Greenhills and Gardine Creeks, 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Black dashes represent estimated marginal mean values from a censored regression Analysis of Variance (ANOVA) fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Stations that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value <0.05) for the ANOVA or in a Tukey's Honestly Significant Differences *post hoc* test. Statistics were not conducted for dissolved cobalt because most data were at the LRL.

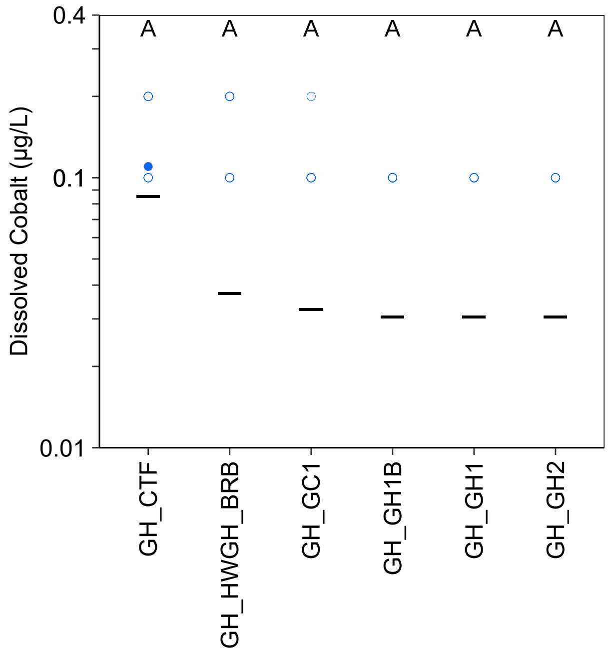

Figure E.18: Comparisons of Monthly Mean Concentrations for Water Quality Constituents in Samples from Routine Monitoring Stations on Greenhills and Gardine Creeks, 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Black dashes represent estimated marginal mean values from a censored regression Analysis of Variance (ANOVA) fit using Maximum Likelihood Estimation with an assumed log−normal distribution. Stations that share a letter (e.g., A,B,C) have concentrations that do not differ significantly (p−value <0.05) for the ANOVA or in a Tukey's Honestly Significant Differences *post hoc* test. Statistics were not conducted for dissolved cobalt because most data were at the LRL.

Table E.1: Water Quality at Biological Monitoring Areas on Greenhills and Gardine Creeks and the Greenhills Creek Sedimentation Pond, 2022

Constituent	Units	BC WQG/ CCME WQG [a,b]		Teck Screening Value/ Benchmark/ Updated EC [c]			Gardine Creek		Upper Greenhills Creek				Greenhills Creek Sedimentation Pond	Lower Greenhills Creek	
		Long-term Average	Short-term Maximum	Level 1	Level 2	Level 3	RG_GAUT 14-Sep-22	RG_GANF 13-Sep-22	RG_GHUT 15-Sep-22	RG_GHNF 9-Sep-22	RG_GHDT 16-Sep-22	RG_GHFF 8-Sep-22	RG_GHP 19-Sep-22	RG_GHBP 28-Feb-22	RG_GHBP 12-Sep-22
Physical Tests															
Specific Conductance	μS/cm	-	-	-	-	-	485	1,339	2,203	1,936	2,034	1,592	1,568	1,881	1,482
Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	243	826	1,500	1,450	1,320	1,230	1,190	1,070	994
pH	pH	6.5 - 9.0	-	-	-	-	7.8	7.9	7.9	7.5	8.2	7.5	8.0	8.1	7.9
Total Suspended Solids	mg/L	-	-	-	-	-	65	1.2	44	15	2.0	5.1	3.4	<1	2.2
Total Dissolved Solids	mg/L	-	-	1,000	-	-	292	1,070	1,920	1,910	1,710	1,450	1,320	1,400	1,400
Turbidity	NTU	-	-	-	-	-	18	0.30	33	1.3	0.14	0.50	1.2	0.48	1.6
Anions and Nutrients															
Alkalinity, Total (as $CaCO_3$)	mg/L	>20	-	-	-	-	222	302	443	400	328	274	253	299	246
Ammonia, Total (as N) [d]	mg/L	0.75 to 1.9	3.9 to 12	-	-	-	<0.005	<0.005	0.013	<0.005	<0.005	<0.005	0.0088	0.022	0.0084
Bromide	mg/L	-	-	-	-	-	<0.05	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Chloride	mg/L	150	600	-	-	-	2.5	2.3	1.6	3.2	1.6	2.2	1.5	2.1	1.8
Fluoride [e]	mg/L	-	1.7 to 1.9	-	-	-	0.13	0.39	<0.1	<0.1	<0.1	0.20	0.15	0.14	0.15
Nitrate (as N)	mg/L	3.0	33	10 to 36	14 to 48	23 to 82	0.036	0.21	8.9	8.6	8.1	6.2	4.6	4.8	4.3
Nitrite (as N) [f]	mg/L	0.020 to 0.040	0.060 to 0.12	-	-	-	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	0.011	0.011	0.010
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	-	0.097	<0.5	0.68	0.52	<0.5	0.39	<0.5	0.49	1.7
Orthophosphate-Dissolved (as P)	mg/L	-	-	-	-	-	0.014	<0.001	0.0026	<0.001	0.0015	<0.001	0.0018	0.0026	<0.001
Total Phosphorus	mg/L	-	-	-	-	-	0.025	0.0046	0.032	0.029	0.014	0.0052	0.0063	0.0036	0.0034
Sulphate (SO_4) [e]	mg/L	429	-	617	764	1,099	65	576	1,110	1,100	1,080	932	846	776	780
Organic/Inorganic Carbon															
Total Organic Carbon	mg/L	-	-	-	-	-	2.9	1.2	4.6	2.4	1.8	1.4	1.5	1.8	1.7
Dissolved Organic Carbon	mg/L	-	-	-	-	-	2.8	0.97	1.6	1.5	1.9	1.3	1.4	1.6	1.9

Indicates value greater than the long-term average BC WQG (BCMOE 2021a,b; BCMWLRS 2023) or the long-term CCME WQG for total mercury (CCME 2003).

Indicates value greater than the short-term maximum BC WQG (BCMOE 2021a,b).

Indicates value greater than the Level 1 Elk Valley Water Quality Plan Benchmark (dissolved cadmium), Screening Value (TDS), Updated Effects Concentration (sulphate and nitrate) or Proposed Benchmark (dissolved nickel) (Golder 2022a,b; Teck 2014, 2018).

Indicates value greater than the Level 2 Elk Valley Water Quality Plan Benchmark (dissolved cadmium), Screening Value (TDS), Updated Effects Concentration (sulphate and nitrate) or Proposed Benchmark (dissolved nickel) (Golder 2022a,b; Teck 2014, 2018).

Indicates value greater than the Level 3 Elk Valley Water Quality Plan Benchmark (dissolved cadmium), Screening Value (TDS), Updated Effects Concentration (sulphate and nitrate) or Proposed Benchmark (dissolved nickel) (Golder 2022a,b; Teck 2014, 2018).

Notes: BC = British Columbia; WQG = Water Quality Guideline; CCME = Canadian Council of Ministers of the Environment; Teck = Teck Coal Limited; EC = Effect Concentration; μS/cm = microSiemens per centimetre; - = no data/not applicable; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; NTU = Nephelometric Turbidity Units; > = greater than; TDS = total dissolved solids; DOC = dissolved organic carbon.

[a] Approved (BCMOECCS 2021a), working (BCMOECCS 2021b), and updated aluminum (BCMWLRS 2023) BC WQG for the protection of freshwater aquatic life or the long-term CCME mercury WQG (CCME 2003) for the protection of freshwater aquatic life. The BC WQG for total selenium were excluded because tissue-based benchmarks are considered more appropriate for screening selenium data.

[b] Working BC WQG were applied for alkalinity, antimony, barium, beryllium, chromium, thallium, and uranium (BCMOECCS 2021b).

[c] Where more than one screening value, benchmark, or updated EC was applicable, the most conservative (lowest) value was used.

[d] Ammonia guidelines were calculated based on the temperature and pH of individual water samples.

[e] Hardness-based guidelines, benchmarks, and/or updated EC were calculated based on the hardness of individual water samples.

[f] Nitrite guidelines were calculated based on chloride concentrations in individual water samples.

[g] Total aluminum guidelines were calculated based on the pH, DOC, and hardness of individual water samples (BCMWLRS 2023).

[h] Guideline for chromium VI (0.001 mg/L) was selected because this is the principal species found in surface waters.

[i] Dissolved copper guidelines were calculated based on the Biotic Ligand Model (BCMOECCS 2021a).

Table E.1: Water Quality at Biological Monitoring Areas on Greenhills and Gardine Creeks and the Greenhills Creek Sedimentation Pond, 2022

Constituent	Units	BC WQG/ CCME WQG [a,b]		Teck Screening Value/ Benchmark/ Updated EC [c]			Gardine Creek		Upper Greenhills Creek				Greenhills Creek Sedimentation Pond	Lower Greenhills Creek	
		Long-term Average	Short-term Maximum	Level 1	Level 2	Level 3	RG_GAUT	RG_GANF	RG_GHUT	RG_GHNF	RG_GHDT	RG_GHFF	RG_GHP	RG_GHBP	
							14-Sep-22	13-Sep-22	15-Sep-22	9-Sep-22	16-Sep-22	8-Sep-22	19-Sep-22	28-Feb-22	12-Sep-22
Total Metals															
Aluminum (Al) [g]	mg/L	0.12 to 0.23	-	-	-	-	0.10	0.0070	0.24	0.050	0.0044	0.0070	0.014	0.0045	0.0091
Antimony (Sb)	mg/L	0.0090	-	-	-	-	0.00021	0.00013	0.00078	0.00060	0.00058	0.00046	0.00048	0.00039	0.00047
Arsenic (As)	mg/L	-	0.0050	-	-	-	0.00031	0.00025	0.00036	0.00024	0.00019	0.00025	0.00029	0.00023	0.00028
Barium (Ba)	mg/L	1.0	-	-	-	-	0.13	0.070	0.043	0.036	0.035	0.048	0.046	0.042	0.042
Beryllium (Be)	mg/L	0.00013	-	-	-	-	<0.00002	<0.00002	<0.00004	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Bismuth (Bi)	mg/L	-	-	-	-	-	<0.00005	<0.00005	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Boron (B)	mg/L	1.2	-	-	-	-	0.014	0.016	<0.02	<0.01	<0.01	<0.01	0.012	0.010	0.013
Cadmium (Cd)	mg/L	-	-	-	-	-	0.000028	0.0000075	0.00079	0.000035	0.0000073	0.0000056	0.000012	0.0000083	0.000014
Calcium (Ca)	mg/L	-	-	-	-	-	72	143	303	252	213	209	166	175	157
Chromium (Cr) [h]	mg/L	0.0010	-	-	-	-	0.00018	0.00014	0.00047	0.00016	<0.0001	0.00014	0.00011	0.00014	0.00016
Cobalt (Co)	mg/L	0.0040	0.11	-	-	-	0.00017	<0.0001	0.00052	0.00015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper (Cu)	mg/L	-	-	-	-	-	0.00051	<0.0005	0.0020	0.00052	<0.0005	<0.0005	0.00051	<0.0005	<0.0005
Iron (Fe)	mg/L	-	1.0	-	-	-	0.11	<0.01	0.28	0.10	<0.01	<0.01	0.010	<0.01	<0.01
Lead (Pb) [e]	mg/L	0.013 to 0.020	0.25 to 0.42	-	-	-	0.00011	<0.00005	0.00060	0.00013	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium (Li)	mg/L	-	-	-	-	-	0.0087	0.034	0.021	0.022	0.017	0.021	0.020	0.016	0.020
Magnesium (Mg)	mg/L	-	-	-	-	-	25	112	230	220	208	174	168	147	151
Manganese (Mn)	mg/L	1.7 to 2.6	3.2 to 3.4	-	-	-	0.0072	0.00094	0.022	0.016	0.0016	0.0010	0.0033	0.0032	0.0014
Mercury (Hg)	mg/L	0.000026	-	-	-	-	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.0000005	<0.000005
Molybdenum (Mo)	mg/L	7.6	46	-	-	-	0.00088	0.0012	0.0019	0.0018	0.0015	0.0016	0.0016	0.0016	0.0017
Nickel (Ni)	mg/L	-	-	-	-	-	0.0022	0.0014	0.035	0.025	0.018	0.013	0.0090	0.0080	0.0086
Potassium (K)	mg/L	-	-	-	-	-	1.4	2.8	3.3	2.8	2.8	2.6	2.6	2.4	2.4
Selenium (Se)	mg/L	-	-	-	-	-	0.00086	0.0073	0.26	0.27	0.24	0.20	0.16	0.14	0.15
Silicon (Si)	mg/L	-	-	-	-	-	4.2	3.1	3.7	3.3	3.4	4.0	3.6	3.9	3.5
Silver (Ag) [e]	mg/L	0.0015	0.0030	-	-	-	<0.00001	<0.00001	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium (Na)	mg/L	-	-	-	-	-	3.6	4.6	1.9	2.0	2.0	2.6	2.7	3.2	2.7
Strontium (Sr)	mg/L	-	-	-	-	-	0.24	0.26	0.17	0.17	0.16	0.21	0.20	0.21	0.19
Thallium (Tl)	mg/L	0.00080	-	-	-	-	<0.00001	<0.00001	0.000044	0.000019	<0.00001	<0.00001	<0.00001	<0.00001	0.000024
Tin (Sn)	mg/L	-	-	-	-	-	<0.0001	<0.0001	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium (Ti)	mg/L	-	-	-	-	-	0.0023	<0.0003	0.0067	0.00079	<0.0003	<0.0003	0.00047	<0.0003	0.00036
Uranium (U)	mg/L	0.0085	-	-	-	-	0.00054	0.0036	0.014	0.015	0.012	0.0093	0.0084	0.0081	0.0086
Vanadium (V)	mg/L	-	-	-	-	-	0.00075	<0.0025	0.0012	<0.0005	<0.0005	0.00056	<0.0005	<0.0005	0.00051
Zinc (Zn) [e]	mg/L	0.12 to 0.19	0.15 to 0.34	-	-	-	<0.003	<0.003	0.045	0.0033	<0.003	<0.003	<0.003	<0.003	0.0079

Indicates value greater than the long-term average BC WQG (BCMOE 2021a,b; BCMWLRS 2023) or the long-term CCME WQG for total mercury (CCME 2003).

Indicates value greater than the short-term maximum BC WQG (BCMOE 2021a,b).

Indicates value greater than the Level 1 Elk Valley Water Quality Plan Benchmark (dissolved cadmium), Screening Value (TDS), Updated Effects Concentration (sulphate and nitrate) or Proposed Benchmark (dissolved nickel) (Golder 2022a,b; Teck 2014, 2018).

Indicates value greater than the Level 2 Elk Valley Water Quality Plan Benchmark (dissolved cadmium), Screening Value (TDS), Updated Effects Concentration (sulphate and nitrate) or Proposed Benchmark (dissolved nickel) (Golder 2022a,b; Teck 2014, 2018).

Indicates value greater than the Level 3 Elk Valley Water Quality Plan Benchmark (dissolved cadmium), Screening Value (TDS), Updated Effects Concentration (sulphate and nitrate) or Proposed Benchmark (dissolved nickel) (Golder 2022a,b; Teck 2014, 2018).

Notes: BC = British Columbia; WQG = Water Quality Guideline; CCME = Canadian Council of Ministers of the Environment; Teck = Teck Coal Limited; EC = Effect Concentration; µS/cm = microSiemens per centimetre; - = no data/not applicable; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; NTU = Nephelometric Turbidity Units; > = greater than; TDS = total dissolved solids; DOC = dissolved organic carbon.

[a] Approved (BCMOECCS 2021a), working (BCMOECCS 2021b), and updated aluminum (BCMWLRS 2023) BC WQG for the protection of freshwater aquatic life or the long-term CCME mercury WQG (CCME 2003) for the protection of freshwater aquatic life. The BC WQG for total selenium were excluded because tissue-based benchmarks are considered more appropriate for screening selenium data.

[b] Working BC WQG were applied for alkalinity, antimony, barium, beryllium, chromium, thallium, and uranium (BCMOECCS 2021b).

[c] Where more than one screening value, benchmark, or updated EC was applicable, the most conservative (lowest) value was used.

[d] Ammonia guidelines were calculated based on the temperature and pH of individual water samples.

[e] Hardness-based guidelines, benchmarks, and/or updated EC were calculated based on the hardness of individual water samples.

[f] Nitrite guidelines were calculated based on chloride concentrations in individual water samples.

[g] Total aluminum guidelines were calculated based on the pH, DOC, and hardness of individual water samples (BCMWLRS 2023).

[h] Guideline for chromium VI (0.001 mg/L) was selected because this is the principal species found in surface waters.

[i] Dissolved copper guidelines were calculated based on the Biotic Ligand Model (BCMOECCS 2021a).

Table E.1: Water Quality at Biological Monitoring Areas on Greenhills and Gardine Creeks and the Greenhills Creek Sedimentation Pond, 2022

Constituent	Units	BC WQG/ CCME WQG [a,b]		Teck Screening Value/ Benchmark/ Updated EC [c]			Gardine Creek		Upper Greenhills Creek				Greenhills Creek Sedimentation Pond	Lower Greenhills Creek	
		Long-term Average	Short-term Maximum	Level 1	Level 2	Level 3	RG_GAUT	RG_GANF	RG_GHUT	RG_GHNF	RG_GHDT	RG_GHFF	RG_GHP	RG_GHBP	
							14-Sep-22	13-Sep-22	15-Sep-22	9-Sep-22	16-Sep-22	8-Sep-22	19-Sep-22	28-Feb-22	12-Sep-22
Dissolved Metals															
Aluminum (Al)	mg/L	-	-	-	-	-	0.0036	<0.001	0.0021	<0.001	0.0033	0.0029	<0.001	<0.001	<0.001
Antimony (Sb)	mg/L	-	-	-	-	-	0.00015	<0.0001	0.00064	0.00077	0.00057	0.00045	0.00052	0.00034	0.00042
Arsenic (As)	mg/L	-	-	-	-	-	0.00024	0.00015	0.00022	0.00020	<0.0002	<0.0002	0.00025	0.00016	0.00023
Barium (Ba)	mg/L	-	-	-	-	-	0.11	0.074	0.037	0.036	0.038	0.048	0.048	0.041	0.043
Beryllium (Be)	mg/L	-	-	-	-	-	<0.00002	<0.00002	<0.00004	<0.00002	<0.00004	<0.00004	<0.00002	<0.00002	<0.00002
Bismuth (Bi)	mg/L	-	-	-	-	-	<0.00005	<0.00005	<0.0001	<0.00005	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005
Boron (B)	mg/L	-	-	-	-	-	0.010	0.013	<0.02	<0.01	<0.02	<0.02	0.011	<0.01	<0.01
Cadmium (Cd) [e]	mg/L	0.00041 to 0.00046	0.0015 to 0.0028	0.00028 to 0.0013	-	-	0.000016	0.0000051	0.00058	<0.000005	<0.00001	<0.00001	0.000011	<0.000005	0.0000089
Calcium (Ca)	mg/L	-	-	-	-	-	62	146	269	249	213	202	178	188	141
Chromium (Cr)	mg/L	-	-	-	-	-	<0.0001	0.00012	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	0.00013	<0.0001
Cobalt (Co)	mg/L	-	-	-	-	-	<0.0001	<0.0001	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001
Copper (Cu) [i]	mg/L	0.00070 to 0.0016	0.0041 to 0.0099	-	-	-	0.00035	<0.0002	0.00052	0.00027	<0.0004	<0.0004	0.00038	<0.0002	0.00042
Iron (Fe)	mg/L	-	0.35	-	-	-	<0.01	<0.01	<0.02	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
Lead (Pb)	mg/L	-	-	-	-	-	<0.00005	<0.00005	<0.0001	<0.00005	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005
Lithium (Li)	mg/L	-	-	-	-	-	0.0085	0.031	0.021	0.017	0.019	0.021	0.019	0.015	0.017
Magnesium (Mg)	mg/L	-	-	-	-	-	21	112	200	201	192	176	181	147	156
Manganese (Mn)	mg/L	-	-	-	-	-	0.0039	0.0011	0.0090	0.0079	0.0015	0.00088	0.0011	0.0019	0.00090
Mercury (Hg)	mg/L	-	-	-	-	-	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Molybdenum (Mo)	mg/L	-	-	-	-	-	0.00073	0.0013	0.0017	0.0019	0.0016	0.0016	0.0016	0.0015	0.0015
Nickel (Ni)	mg/L	-	-	0.0052 to 0.0089	0.0074 to 0.013	0.015 to 0.025	0.0017	0.0013	0.031	0.022	0.018	0.013	0.0098	0.0078	0.0080
Potassium (K)	mg/L	-	-	-	-	-	1.2	2.9	2.9	3.0	2.7	2.5	2.7	2.3	2.4
Selenium (Se)	mg/L	-	-	-	-	-	0.00074	0.0075	0.29	0.27	0.27	0.19	0.16	0.14	0.16
Silicon (Si)	mg/L	-	-	-	-	-	3.6	4.0	2.9	3.3	3.1	3.7	4.4	3.7	3.3
Silver (Ag)	mg/L	-	-	-	-	-	<0.00001	<0.00001	<0.00002	<0.00001	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001
Sodium (Na)	mg/L	-	-	-	-	-	3.2	4.7	1.8	1.9	1.9	2.3	2.7	3.0	2.6
Strontium (Sr)	mg/L	-	-	-	-	-	0.22	0.27	0.16	0.18	0.17	0.20	0.20	0.21	0.17
Thallium (Tl)	mg/L	-	-	-	-	-	<0.00001	<0.00001	0.000021	<0.00001	<0.00002	<0.00002	0.000010	<0.00001	<0.00001
Tin (Sn)	mg/L	-	-	-	-	-	<0.0001	<0.0001	<0.0002	<0.0001	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001
Titanium (Ti)	mg/L	-	-	-	-	-	<0.0003	<0.0003	<0.0006	<0.0003	<0.0006	<0.0006	<0.0003	<0.0003	<0.0003
Uranium (U)	mg/L	-	-	-	-	-	0.00048	0.0036	0.012	0.014	0.011	0.0093	0.0084	0.0074	0.0073
Vanadium (V)	mg/L	-	-	-	-	-	<0.0005	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.0005	<0.0005
Zinc (Zn)	mg/L	-	-	-	-	-	0.0012	<0.001	0.033	<0.001	<0.002	<0.002	<0.001	<0.001	0.0010

Indicates value greater than the long-term average BC WQG (BCMOE 2021a,b; BCMWLRS 2023) or the long-term CCME WQG for total mercury (CCME 2003).

Indicates value greater than the short-term maximum BC WQG (BCMOE 2021a,b).

Indicates value greater than the Level 1 Elk Valley Water Quality Plan Benchmark (dissolved cadmium), Screening Value (TDS), Updated Effects Concentration (sulphate and nitrate) or Proposed Benchmark (dissolved nickel) (Golder 2022a,b; Teck 2014, 2018).

Indicates value greater than the Level 2 Elk Valley Water Quality Plan Benchmark (dissolved cadmium), Screening Value (TDS), Updated Effects Concentration (sulphate and nitrate) or Proposed Benchmark (dissolved nickel) (Golder 2022a,b; Teck 2014, 2018).

Indicates value greater than the Level 3 Elk Valley Water Quality Plan Benchmark (dissolved cadmium), Screening Value (TDS), Updated Effects Concentration (sulphate and nitrate) or Proposed Benchmark (dissolved nickel) (Golder 2022a,b; Teck 2014, 2018).

Notes: BC = British Columbia; WQG = Water Quality Guideline; CCME = Canadian Council of Ministers of the Environment; Teck = Teck Coal Limited; EC = Effect Concentration; µS/cm = microSiemens per centimetre; - = no data/not applicable; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; NTU = Nephelometric Turbidity Units; > = greater than; TDS = total dissolved solids; DOC = dissolved organic carbon.

[a] Approved (BCMOECCS 2021a), working (BCMOECCS 2021b), and updated aluminum (BCMWLRS 2023) BC WQG for the protection of freshwater aquatic life or the long-term CCME mercury WQG (CCME 2003) for the protection of freshwater aquatic life. The BC WQG for total selenium were excluded because tissue-based benchmarks are considered more appropriate for screening selenium data.

[b] Working BC WQG were applied for alkalinity, antimony, barium, beryllium, chromium, thallium, and uranium (BCMOECCS 2021b).

[c] Where more than one screening value, benchmark, or updated EC was applicable, the most conservative (lowest) value was used.

[d] Ammonia guidelines were calculated based on the temperature and pH of individual water samples.

[e] Hardness-based guidelines, benchmarks, and/or updated EC were calculated based on the hardness of individual water samples.

[f] Nitrite guidelines were calculated based on chloride concentrations in individual water samples.

[g] Total aluminum guidelines were calculated based on the pH, DOC, and hardness of individual water samples (BCMWLRS 2023).

[h] Guideline for chromium VI (0.001 mg/L) was selected because this is the principal species found in surface waters.

[i] Dissolved copper guidelines were calculated based on the Biotic Ligand Model (BCMOECCS 2021a).

Table E.2: Summary of Water Chemistry Data for Key Constituents Measured at Routine Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2022

Watercourse	Station	Summary Statistic	Total Dissolved Solids (mg/L) [a]	Lab pH	Field pH	Dissolved Oxygen (mg/L)	Alkalinity (mg/L)	Nitrate-N (mg/L)	Nitrite-N (mg/L)	Ammonia (mg/L)	Sulphate (mg/L)	Total Chloride (mg/L)	Total Fluoride (mg/L)	Total Aluminum (mg/L)	Total Antimony (mg/L)
		n	12	12	12	12	12	12	12	12	12	12	12	12	12
		Annual Minimum	380	8.2	8.0	9.3	176	0.029	<0.0010	<0.0050	130	1.4	0.11	0.0044	0.00010
		Annual Maximum	1,280	8.7	8.7	12	309	5.0	0.012	0.011	750	4.1	0.53	0.26	0.00037
		Annual Mean	840	8.3	8.3	11	268	0.64	0.0020	0.0063	417	2.4	0.29	0.061	0.00015
		Annual Median	975	8.3	8.3	12	290	0.32	0.0010	0.0050	476	2.4	0.27	0.017	0.00010
Gardine Creek	GH_GC1	% <LRL	0%	0%	0%	0%	0%	0%	75%	67%	0%	0%	0%	0%	33%
		% >BC or CCME WQG [b]	-	-	0%	0%	0%	8.3%	0%	0%	58%	0%	-	0%	0%
		% >BCWQG [c]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	-
		% >Level 1 Benchmark/updated EC	50%	-	-	-	-	0%	-	-	8.3%	-	-	-	-
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	0%	-	-	0%	-	-	-	-
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	0%	-	-	0%	-	-	-	-
		n	12	12	12	12	12	12	12	12	12	12	12	12	12
		Annual Minimum	594	8.1	7.9	7.7	226	2.4	<0.0010	<0.0050	253	0.46	0.078	0.0039	0.00038
		Annual Maximum	2,050	8.6	8.7	12	443	9.3	0.033	0.016	1,220	2.0	0.12	0.22	0.00071
		Annual Mean	1,602	8.2	8.2	11	373	7.1	0.0037	0.0065	880	1.5	0.084	0.045	0.00059
		Annual Median	1,920	8.2	8.1	11	409	8.0	0.0050	0.0050	1,012	1.5	0.078	0.014	0.00062
	GH_CTF	% <LRL	0%	0%	0%	0%	0%	0%	92%	75%	0%	0%	75%	8.3%	0%
		% >BC or CCME WQG [b]	-	-	0%	8.3%	0%	92%	8.3%	0%	92%	0%	-	8.3%	0%
		% >BCWQG [c]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	-
		% >Level 1 Benchmark/updated EC	92%	-	-	-	-	0%	-	-	75%	-	-	-	-
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	0%	-	-	58%	-	-	-	-
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	0%	-	-	33%	-	-	-	-
		n	21	21	29	28	30	21	21	21	21	21	21	21	21
		Annual Minimum	591	8.2	8.0	9.8	207	2.1	<0.0010	<0.0050	238	0.43	0.071	<0.003	0.00036
		Annual Maximum	2,090	8.7	8.8	12	460	9.1	0.0054	0.013	1,200	4.1	0.13	0.05	0.00064
		Annual Mean	1,560	8.3	8.2	11	338	7.0	0.0014	0.0061	882	1.5	0.074	0.013	0.00052
		Annual Median	1,810	8.3	8.2	11	346	8.6	0.0050	0.0050	1,050	1.6	0.071	0.0078	0.00055
Upper Greenhills Creek	GH_HWGH_BRB	% <LRL	0%	0%	0%	0%	0%	0%	90%	67%	0%	0%	90%	38%	0%
		% >BC or CCME WQG [b]	-	-	0%	0%	0%	95%	0%	0%	86%	0%	-	0%	0%
		% >BCWQG [c]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	-
		% >Level 1 Benchmark/updated EC	71%	-	-	-	-	0%	-	-	67%	-	-	-	-
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	0%	-	-	67%	-	-	-	-
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	0%	-	-	43%	-	-	-	-
		n	27	27	36	36	35	27	27	27	27	27	27	27	27
		Annual Minimum	392	7.1	8.2	9.6	171	1.2	<0.0010	<0.0050	141	0.60	0.088	<0.003	0.00030
		Annual Maximum	1,600	8.5	8.8	15	352	5.7	0.0096	0.026	870	3.4	0.22	0.79	0.00049
		Annual Mean	1,219	8.3	8.4	12	290	4.4	0.0020	0.0063	665	1.8	0.16	0.056	0.00038
		Annual Median	1,340	8.4	8.4	12	295	5.0	0.0050	0.0050	748	1.8	0.15	0.011	0.00037
	GH_GH1B	% <LRL	0%	0%	0%	0%	0%	0%	78%	74%	0%	0%	0%	7%	0%
		% >BC or CCME WQG [b]	-	-	0%	0%	0%	78%	0%	0%	81%	0%	-	3.7%	0%
		% >BCWQG [c]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	-
		% >Level 1 Benchmark/updated EC	78%	-	-	-	-	0%	-	-	67%	-	-	-	-
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	0%	-	-	44%	-	-	-	-
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	0%	-	-	0%	-	-	-	-

>5% of samples exceed the guideline or benchmark.

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Notes: mg/L = milligrams per litre; < = less than; % = percent; LRL = laboratory reporting limit; > = greater than; BC = British Columbia; WQG = Water Quality Guidelines for the protection of freshwater aquatic life; CCME = Canadian Council of Ministers of the Environment; - = no data/not calculated/not applicable; EC = Effects Concentration. The updated EC apply to nitrate, sulphate, and dissolved nickel. The Level 1 Screening Value is shown for total dissolved solids; and the Elk Valley Water Quality Plan benchmark is shown for dissolved cadmium. The BC WQG, benchmarks, updated EC, and screening values that are dependent on other constituents (e.g., hardness or chloride) were calculated based on concurrent measurements. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the BC WQG, benchmark, updated EC, or screening value.

[a] Screening values are applied to total dissolved solids concentrations, rather than Benchmarks/updated EC.

[b] Long-term average BC WQG or CCME mercury WQG for the protection of freshwater aquatic life. The BC WQG for total selenium were excluded because tissue-based benchmarks are considered more appropriate for screening selenium data. Working BC WQG were applied for alkalinity, antimony, barium, beryllium, chromium, thallium, and uranium.

[c] Short-term maximum BC WQG for the protection of freshwater aquatic life.

Table E.2: Summary of Water Chemistry Data for Key Constituents Measured at Routine Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2022

Watercourse	Station	Summary Statistic	Total Arsenic (mg/L)	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Boron (mg/L)	Total Chromium (mg/L)	Total Cobalt (mg/L)	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Manganese (mg/L)	Total Mercury (mg/L)	Total Molybdenum (mg/L)
Gardine Creek	GH_GC1	n	12	12	12	12	12	12	12	12	12	12	12	12
		Annual Minimum	0.00016	0.046	<0.000020	<0.010	<0.00010	<0.00010	<0.010	<0.000050	0.0096	0.00070	<0.00000050	0.00059
		Annual Maximum	0.00052	0.081	0.000023	0.013	0.00035	0.00025	0.31	0.00028	0.035	0.010	0.0000015	0.0015
		Annual Mean	0.00026	0.068	0.000020	0.012	0.00019	0.00012	0.085	0.000087	0.021	0.0043	0.00000077	0.0010
		Annual Median	0.00022	0.069	0.000020	0.012	0.00016	0.00010	0.030	0.000050	0.024	0.0032	0.00000056	0.0012
		% <LRL	0%	0%	92%	25%	17%	75%	33%	58%	0%	0%	83%	0%
		% >BC or CCME WQG [b]	-	0%	0%	0%	0%	0%	-	0%	-	0%	0%	0%
		% >BCWQG [c]	0%	-	-	-	-	0%	0%	0%	-	0%	-	0%
		% >Level 1 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
Upper Greenhills Creek	GH_CTF	n	12	12	12	12	12	12	12	12	12	12	12	12
		Annual Minimum	0.00017	0.028	<0.000020	<0.010	0.00011	<0.00010	<0.010	<0.000050	0.011	0.00077	<0.00000050	0.0015
		Annual Maximum	0.00031	0.049	<0.000020	0.010	0.00046	0.00025	0.26	0.00022	0.028	0.032	0.0000025	0.0020
		Annual Mean	0.00024	0.037	<0.000020	0.010	0.00019	0.00014	0.056	0.000086	0.018	0.0094	0.0000012	0.0017
		Annual Median	0.00023	0.036	<0.000020	0.010	0.00015	0.00020000	0.015	0.00010	0.018	0.0088	0.00000082	0.0017
		% <LRL	8.3%	0%	100%	92%	33%	75%	50%	67%	0%	0%	75%	0%
		% >BC or CCME WQG [b]	-	0%	0%	0%	0%	0%	-	0%	-	0%	0%	0%
		% >BCWQG [c]	0%	-	-	-	-	0%	0%	0%	-	0%	-	0%
		% >Level 1 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
	GH_HWGH_BRB	n	21	21	21	21	21	21	21	21	21	21	21	21
		Annual Minimum	0.00017	0.030	<0.000020	<0.010	0.00010	<0.00010	<0.010	<0.000050	0.0092	0.00088	<0.00000050	0.0013
		Annual Maximum	0.00027	0.049	<0.00010	<0.010	0.00035	0.00014	0.060	0.000097	0.024	0.0053	0.00000090	0.0086
		Annual Mean	0.00021	0.037	<0.000020	<0.010	0.00017	0.00010	0.018	0.000055	0.017	0.0024	0.00000060	0.0024
		Annual Median	0.00022	0.037	<0.000020	<0.010	0.00013	0.00010	0.020	0.000050	0.017	0.0021	0.0000050	0.0016
		% <LRL	24%	0%	100%	100%	38%	95%	67%	90%	0%	0%	95%	0%
		% >BC WQG [b]	-	0%	0%	0%	4.8%	0%	-	0%	-	0%	0%	0%
		% >BCWQG [c]	0%	-	-	-	-	0%	0%	0%	-	0%	-	0%
		% >Level 1 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
	GH_GH1B	n	27	27	27	27	27	27	27	27	27	27	27	27
		Annual Minimum	0.00014	0.040	<0.000020	<0.010	0.00010	<0.00010	<0.010	<0.000050	0.0082	0.00046	<0.00000050	0.00092
		Annual Maximum	0.00076	0.084	0.000095	0.012	0.0013	0.0012	1.1	0.0016	0.020	0.049	0.000010	0.0050
		Annual Mean	0.00023	0.052	0.000023	0.011	0.00024	0.00015	0.072	0.00012	0.016	0.0040	0.0000013	0.0017
		Annual Median	0.00022	0.051	0.000020	0.010	0.00015	0.00010	0.010	0.000050	0.016	0.0015	0.0000050	0.0016
		% <LRL	3.7%	0%	96%	41%	7.4%	85%	56%	70%	0%	0%	78%	0%
		% >BC or CCME WQG [b]	-	0%	0%	0%	7.4%	0%	-	0%	-	0%	0%	0%
		% >BCWQG [c]	0%	-	-	-	-	0%	3.7%	0%	-	0%	-	0%
		% >Level 1 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-

>5% of samples exceed the guideline or benchmark.

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Notes: mg/L = milligrams per litre; < = less than; % = percent; LRL = laboratory reporting limit; > = greater than; BC = British Columbia; WQG = Water Quality Guidelines for the protection of freshwater aquatic life; CCME = Canadian Council of Ministers of the Environment; - = no data/not calculated/not applicable; EC = Effects Concentration. The updated EC apply to nitrate, sulphate, and dissolved nickel. The Level 1 Screening Value is shown for total dissolved solids; and the Elk Valley Water Quality Plan benchmark is shown for dissolved cadmium. The BC WQG, benchmarks, updated EC, and screening values that are dependent on other constituents (e.g., hardness or chloride) were calculated based on concurrent measurements. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the BC WQG, benchmark, updated EC, or screening value.

[a] Screening values are applied to total dissolved solids concentrations, rather than Benchmarks/updated EC.

[b] Long-term average BC WQG or CCME mercury WQG for the protection of freshwater aquatic life. The BC WQG for total selenium were excluded because tissue-based benchmarks are considered more appropriate for screening selenium data. Working BC WQG were applied for alkalinity, antimony, barium, beryllium, chromium, thallium, and uranium.

[c] Short-term maximum BC WQG for the protection of freshwater aquatic life.

Table E.2: Summary of Water Chemistry Data for Key Constituents Measured at Routine Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2022

Watercourse	Station	Summary Statistic	Total Nickel (mg/L)	Total Selenium (mg/L)	Total Silver (mg/L)	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Cobalt (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Nickel (mg/L)
Gardine Creek	GH_GC1	n	12	12	12	12	12	12	12	12	12	12	12
		Annual Minimum	0.0011	0.0028	<0.000010	<0.000010	0.0011	<0.0030	<0.0000050	<0.00010	<0.00020	<0.010	0.011
		Annual Maximum	0.0083	0.141	0.000011	0.000011	0.0077	0.0039	0.000014	<0.00010	0.00053	0.018	0.0079
		Annual Mean	0.0021	0.017	0.000010	0.000010	0.0029	0.0031	0.0000084	<0.00010	0.00029	0.011	0.0018
		Annual Median	0.0014	0.0061	0.000010	0.000010	0.0030	0.0030	0.0000085	<0.00010	0.00024	0.010	0.0013
		% <LRL	0%	0%	83%	92%	0%	83%	33%	100%	42%	75%	0%
		% >BC or CCME WQG [b]	-	-	0%	0%	0%	0%	0%	-	0%	-	-
		% >BCWQG [c]	-	-	0%	-	-	0%	0%	-	0%	0%	-
		% >Level 1 Benchmark/updated EC	-	-	-	-	-	-	0%	-	-	-	8.3%
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	0%
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	0%
Upper Greenhills Creek	GH_CTF	n	12	12	12	12	12	12	12	12	12	12	12
		Annual Minimum	0.0080	0.073	<0.000010	0.000011	0.0039	<0.0030	0.0000093	<0.00010	0.00020	<0.010	0.0078
		Annual Maximum	0.030	0.316	<0.000010	0.000025	0.015	0.036	0.00057	0.00011	0.00066	<0.010	0.030
		Annual Mean	0.021	0.218	<0.000010	0.000016	0.011	0.013	0.00016	0.00010	0.00040	<0.010	0.020
		Annual Median	0.023	0.246	<0.000010	0.000014	0.012	0.0070	0.000054	0.00020	0.00039	<0.010	0.021
		% <LRL	0%	0%	100%	25%	0%	42%	0%	92%	50%	100%	0%
		% >BC or CCME WQG [b]	-	-	0%	0%	67%	0%	17%	-	0%	-	-
		% >BCWQG [c]	-	-	0%	-	-	0%	0%	-	0%	0%	-
		% >Level 1 Benchmark/updated EC	-	-	-	-	-	-	0%	-	-	-	92%
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	83%
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	58%
	GH_HWGH_BRB	n	21	21	21	21	21	21	21	21	21	21	12
		Annual Minimum	0.0076	0.060	<0.000010	<0.000010	0.0037	<0.0030	0.0000066	<0.00010	0.00020	<0.010	0.0064
		Annual Maximum	0.022	0.311	<0.000010	0.000011	0.014	0.019	0.00030	<0.00010	0.00097	<0.010	0.024
		Annual Mean	0.015	0.215	<0.000010	0.000010	0.010	0.0064	0.000066	<0.00010	0.00036	<0.010	0.015
		Annual Median	0.016	0.241	<0.000010	0.000011	0.012	0.0060	0.000018	<0.00010	0.00035	<0.010	0.016
		% <LRL	0%	0%	100%	86%	0%	67%	24%	100%	38%	100%	0%
		% >BC or CCME WQG [b]	-	-	0%	0%	67%	0%	0%	-	0%	-	-
		% >BCWQG [c]	-	-	0%	-	-	0%	0%	-	0%	0%	-
		% >Level 1 Benchmark/updated EC	-	-	-	-	-	-	0%	-	-	-	83%
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	67%
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	33%
	GH_GH1B	n	27	27	27	27	27	27	27	27	27	27	12
		Annual Minimum	0.0047	0.031	<0.000010	<0.000010	0.0021	<0.0030	<0.0000050	<0.00010	<0.00020	<0.010	0.0039
		Annual Maximum	0.013	0.201	0.000062	0.000051	0.010	0.022	0.00013	<0.00010	0.00078	0.024	0.012
		Annual Mean	0.088	0.137	0.000012	0.000012	0.0074	0.0043	0.000024	<0.00010	0.00032	0.011	0.0081
		Annual Median	0.088	0.148	0.000010	0.000010	0.0080	0.0030	0.000012	<0.00010	0.00023	0.010	0.0081
		% <LRL	0%	0%	96%	96%	0%	81%	7.4%	100%	41%	96%	0%
		% >BC or CCME WQG [b]	-	-	0%	0%	37%	0%	0%	-	0%	-	-
		% >BCWQG [c]	-	-	0%	-	-	0%	0%	-	0%	0%	-
		% >Level 1 Benchmark/updated EC	-	-	-	-	-	-	0%	-	-	-	67%
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	25%
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	0%

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[a] Screening values are applied to total dissolved solids concentrations, rather than Benchmarks/updated EC.

[b] Long-term average BC WQG or CCME mercury WQG for the protection of freshwater aquatic life. The BC WQG for total selenium were excluded because tissue-based benchmarks are considered more appropriate for screening selenium data. Working BC WQG were applied for alkalinity, antimony, barium, beryllium, chromium, thallium, and uranium.

[c] Short-term maximum BC WQG for the protection of freshwater aquatic life.

Table E.2: Summary of Water Chemistry Data for Key Constituents Measured at Routine Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2022

Watercourse	Station	Summary Statistic	Total Dissolved Solids (mg/L) [a]	Lab pH	Field pH	Dissolved Oxygen (mg/L)	Alkalinity (mg/L)	Nitrate-N (mg/L)	Nitrite-N (mg/L)	Ammonia (mg/L)	Sulphate (mg/L)	Total Chloride (mg/L)	Total Fluoride (mg/L)	Total Aluminum (mg/L)	Total Antimony (mg/L)
Lower Greenhills Creek	GH_GH1	n	22	22	60	52	44	22	22	22	22	22	22	22	22
		Annual Minimum	491	8.2	8.0	7.8	112	1.3	0.0013	<0.0050	185	0.81	0.086	0.0032	0.00033
		Annual Maximum	1,540	8.5	8.8	15	327	5.3	0.015	0.030	897	2.8	0.20	0.15	0.00048
		Annual Mean	1,239	8.4	8.3	11	262	4.4	0.0063	0.010	711	1.7	0.15	0.017	0.00040
		Annual Median	1,390	8.4	8.3	11	267	4.9	0.0060	0.0083	786	1.8	0.15	0.0078	0.00040
		% <LRL	0%	0%	0%	0%	0%	0%	23%	27%	0%	0%	0%	5%	0%
		% >BC or CCME WQG [b]	-	-	0%	3.8%	0%	82%	0%	0%	82%	0%	-	0%	0%
		% >BCWQG [c]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	-
		% >Level 1 Benchmark/updated EC	77%	-	-	-	-	0%	-	-	77%	-	-	-	-
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	0%	-	-	55%	-	-	-	-
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	0%	-	-	0%	-	-	-	-
	GH_GH2	n	12	12	23	18	23	12	12	12	12	12	12	12	12
		Annual Minimum	430	8.2	8.0	7.9	172	1.2	0.0029	<0.0050	176	1.1	0.12	0.0051	0.00030
		Annual Maximum	1,520	8.6	8.4	12	309	5.3	0.022	0.014	898	2.4	0.16	0.078	0.00045
		Annual Mean	1,116	8.4	8.3	10	248	3.8	0.0069	0.0086	616	2.0	0.14	0.021	0.00038
		Annual Median	1,280	8.4	8.3	11	252	4.4	0.0056	0.0078	740	2.0	0.14	0.0074	0.00036
		% <LRL	0%	0%	0%	0%	0%	0%	25%	25%	0%	0%	0%	8%	0%
		% >BC or CCME WQG [b]	-	-	0%	5.6%	0%	67%	0%	0%	67%	0%	-	0%	0%
		% >BCWQG [c]	-	-	-	0%	-	0%	0%	0%	-	0%	0%	-	-
		% >Level 1 Benchmark/updated EC	67%	-	-	-	-	0%	-	-	58%	-	-	-	-
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	0%	-	-	42%	-	-	-	-
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	0%	-	-	0%	-	-	-	-

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[a] Screening values are applied to total dissolved solids concentrations, rather than Benchmarks/updated EC.

[b] Long-term average BC WQG or CCME mercury WQG for the protection of freshwater aquatic life. The BC WQG for total selenium were excluded because tissue-based benchmarks are considered more appropriate for screening selenium data. Working BC WQG were applied for alkalinity, antimony, barium, beryllium, chromium, thallium, and uranium.

[c] Short-term maximum BC WQG for the protection of freshwater aquatic life.

Table E.2: Summary of Water Chemistry Data for Key Constituents Measured at Routine Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2022

Watercourse	Station	Summary Statistic	Total Arsenic (mg/L)	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Boron (mg/L)	Total Chromium (mg/L)	Total Cobalt (mg/L)	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Manganese (mg/L)	Total Mercury (mg/L)	Total Molybdenum (mg/L)
Lower Greenhills Creek	GH_GH1	n	22	22	22	22	22	22	22	22	22	22	22	22
		Annual Minimum	0.00015	0.041	<0.000020	0.010	0.00010	<0.00010	<0.010	<0.000050	0.0089	0.00088	<0.00000050	0.0011
		Annual Maximum	0.00026	0.054	<0.000020	0.012	0.00029	0.00013	0.16	0.00012	0.022	0.0052	0.00000089	0.0026
		Annual Mean	0.00021	0.047	<0.000020	0.010	0.00014	0.00010	0.020	0.000053	0.017	0.0018	0.00000056	0.0016
		Annual Median	0.00022	0.046	<0.000020	0.010	0.00013	0.00010	0.010	0.000050	0.017	0.0015	0.0000050	0.0015
		% <LRL	0%	0%	100%	23%	4.5%	95%	77%	91%	0%	0%	95%	0%
		% >BC or CCME WQG [b]	-	0%	0%	0%	0%	0%	-	0%	-	0%	0%	0%
		% >BCWQG [c]	0%	-	-	-	-	0%	0%	0%	-	0%	-	0%
		% >Level 1 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
	GH_GH2	n	12	12	12	12	12	12	12	12	12	12	12	12
		Annual Minimum	0.00015	0.042	<0.000020	<0.010	<0.00010	<0.00010	<0.010	<0.000050	0.0077	0.0016	<0.00000050	0.0011
		Annual Maximum	0.00034	0.060	<0.000020	0.013	0.00019	0.00010	0.085	0.000097	0.019	0.0063	0.0000056	0.0061
		Annual Mean	0.00022	0.048	<0.000020	0.011	0.00014	0.00010	0.029	0.000061	0.015	0.0031	0.0000010	0.0030
		Annual Median	0.00022	0.048	<0.000020	0.010	0.00012	0.00010	0.012	0.000050	0.016	0.0026	0.0000050	0.0027
		% <LRL	0%	0%	100%	33%	25%	92%	42%	67%	0%	0%	83%	0%
		% >BC or CCME WQG [b]	-	0%	0%	0%	0%	0%	-	0%	-	0%	0%	0%
		% >BCWQG [c]	0%	-	-	-	-	0%	0%	0%	-	0%	-	0%
		% >Level 1 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	-	-

>5% of samples exceed the guideline or benchmark.

>50% of samples exceed the guideline or benchmark.

>95% of samples exceed the guideline or benchmark.

Notes: mg/L = milligrams per litre; < = less than; % = percent; LRL = laboratory reporting limit; > = greater than; BC = British Columbia; WQG = Water Quality Guidelines for the protection of freshwater aquatic life; CCME = Canadian Council of Ministers of the Environment; - = no data/not calculated/not applicable; EC = Effects Concentration. The updated EC apply to nitrate, sulphate, and dissolved nickel. The Level 1 Screening Value is shown for total dissolved solids; and the Elk Valley Water Quality Plan benchmark is shown for dissolved cadmium. The BC WQG, benchmarks, updated EC, and screening values that are dependent on other constituents (e.g., hardness or chloride) were calculated based on concurrent measurements. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the BC WQG, benchmark, updated EC, or screening value.

[a] Screening values are applied to total dissolved solids concentrations, rather than Benchmarks/updated EC.

[b] Long-term average BC WQG or CCME mercury WQG for the protection of freshwater aquatic life. The BC WQG for total selenium were excluded because tissue-based benchmarks are considered more appropriate for screening selenium data. Working BC WQG were applied for alkalinity, antimony, barium, beryllium, chromium, thallium, and uranium.

[c] Short-term maximum BC WQG for the protection of freshwater aquatic life.

Table E.2: Summary of Water Chemistry Data for Key Constituents Measured at Routine Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2022

Watercourse	Station	Summary Statistic	Total Nickel (mg/L)	Total Selenium (mg/L)	Total Silver (mg/L)	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Cadmium (mg/L)	Dissolved Cobalt (mg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Nickel (mg/L)
Lower Greenhills Creek	GH_GH1	**n**	22	26	22	22	22	22	22	22	22	22	12
		Annual Minimum	0.0049	0.047	<0.000010	<0.000010	0.0027	<0.0030	<0.000050	<0.00010	0.00020	<0.010	0.0040
		Annual Maximum	0.010	0.198	<0.000010	0.000012	0.0098	0.0060	0.00011	<0.00010	0.00050	<0.010	0.0094
		Annual Mean	0.0081	0.133	<0.000010	0.000010	0.0076	0.0034	0.000017	<0.00010	0.00029	<0.010	0.0074
		Annual Median	0.0082	0.147	<0.000010	0.000010	0.0081	0.0030	0.0000071	<0.00010	0.00022	<0.010	0.0078
		% <LRL	0%	0%	100%	95%	0%	82%	27%	100%	36%	100%	0%
		% >BC or CCME WQG [b]	-	-	0%	0%	32%	0%	0%	-	0%	-	-
		% >BCWQG [c]	-	-	0%	-	-	0%	0%	-	0%	0%	-
		% >Level 1 Benchmark/updated EC	-	-	-	-	-	-	0%	-	-	-	33%
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	0%
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	0%
	GH_GH2	**n**	12	12	12	12	12	12	12	12	12	12	12
		Annual Minimum	0.0043	0.032	<0.000010	<0.000010	0.0022	<0.0030	0.0000052	<0.00010	<0.00020	<0.010	0.0037
		Annual Maximum	0.0087	0.172	<0.000010	0.000010	0.0095	0.0059	0.000086	<0.00010	0.00066	<0.010	0.0083
		Annual Mean	0.0072	0.117	<0.000010	0.000010	0.0066	0.0036	0.000025	<0.00010	0.00034	<0.010	0.0069
		Annual Median	0.0077	0.145	<0.000010	0.000010	0.0077	0.0030	0.000010	<0.00010	0.00030	<0.010	0.0074
		% <LRL	0%	0%	100%	92%	0%	67%	0%	100%	25%	100%	0%
		% >BC or CCME WQG [b]	-	-	0%	0%	8.3%	0%	0%	-	0%	-	-
		% >BCWQG [c]	-	-	0%	-	-	0%	0%	-	0%	0%	-
		% >Level 1 Benchmark/updated EC	-	-	-	-	-	-	0%	-	-	-	33%
		% >Level 2 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	0%
		% >Level 3 Benchmark/updated EC	-	-	-	-	-	-	-	-	-	-	0%

>5% of samples exceed the guideline or benchmark.
>50% of samples exceed the guideline or benchmark.
>95% of samples exceed the guideline or benchmark.

Notes: mg/L = milligrams per litre; < = less than; % = percent; LRL = laboratory reporting limit; > = greater than; BC = British Columbia; WQG = Water Quality Guidelines for the protection of freshwater aquatic life; CCME = Canadian Council of Ministers of the Environment; - = no data/not calculated/not applicable; EC = Effects Concentration. The updated EC apply to nitrate, sulphate, and dissolved nickel. The Level 1 Screening Value is shown for total dissolved solids; and the Elk Valley Water Quality Plan benchmark is shown for dissolved cadmium. The BC WQG, benchmarks, updated EC, and screening values that are dependent on other constituents (e.g., hardness or chloride) were calculated based on concurrent measurements. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the BC WQG, benchmark, updated EC, or screening value.

[a] Screening values are applied to total dissolved solids concentrations, rather than Benchmarks/updated EC.

[b] Long-term average BC WQG or CCME mercury WQG for the protection of freshwater aquatic life. The BC WQG for total selenium were excluded because tissue-based benchmarks are considered more appropriate for screening selenium data. Working BC WQG were applied for alkalinity, antimony, barium, beryllium, chromium, thallium, and uranium.

[c] Short-term maximum BC WQG for the protection of freshwater aquatic life.

Table E.3: Concentrations of Selenium Species Measured in Water Samples Collected from Biological Monitoring Areas on Greenhills and Gardine Creeks, 2022

Watercourse/ Waterbody	Biological Monitoring Area	Sample Date	Selenate (µg/L)	Selenite (µg/L)	Dimethylselenoxide (µg/L)	Methylseleninic Acid (µg/L)	Methaneselenonic Acid (µg/L)	Selenocyanate (µg/L)	Selenomethionine (µg/L)	Selenosulphate (µg/L)	Unknown Species (µg/L)	Sum of Dimethylselenoxide and Methylseleninic Acid[a]
Gardine Creek	RG_GAUT	14-Sep-22	0.510	0.131	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	RG_GANF	13-Sep-22	5.24	0.167	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Upper Greenhills Creek	RG_GHUT	15-Sep-22	244	0.422	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	0.022
	RG_GHNF	09-Sep-22	220	1.17	0.013	0.017	<0.010	<0.010	<0.010	<0.010	<0.010	0.030
	RG_GHDT	16-Sep-22	229	1.25	<0.010	0.016	<0.010	<0.010	<0.010	<0.010	<0.010	0.026 [b]
	RG_GHFF	08-Sep-22	125	0.922	<0.010	0.021	<0.010	<0.010	<0.010	<0.010	<0.010	0.031 [b]
	GH_GH1A [c]	13-Apr-22	56.2	0.406	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	0.022
		17-May-22	49.0	0.335	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	0.021
		13-Jul-22	95.6	0.683	<0.010	0.023	<0.010	<0.010	<0.010	<0.010	<0.010	0.033
		25-Jul-22	136	1.16	<0.010	0.029	<0.010	<0.010	<0.010	<0.010	<0.010	0.039
		09-Aug-22	165	1.25	<0.010	0.034	<0.010	<0.010	<0.010	<0.010	<0.010	0.044
		23-Aug-22	163	1.41	<0.010	0.035	<0.010	<0.010	<0.010	<0.010	<0.010	0.045
		08-Sep-22	154	1.27	0.011	0.039	<0.010	<0.010	<0.010	<0.010	<0.010	0.050
		20-Sep-22	153	1.12	<0.010	0.025	<0.010	<0.010	<0.010	<0.010	<0.010	0.035
Greenhills Creek Sedimentation Pond	RG_GHP	19-Sep-22	129	2.63	0.118	0.079	<0.010	<0.010	<0.010	<0.010	<0.010	0.197
Lower Greenhills Creek	GH_GH1SP_DS1 [c]	13-Apr-22	60.1	0.893	0.017	0.052	<0.010	<0.010	<0.010	<0.010	<0.010	0.069
		17-May-22	39.5	0.560	<0.010	0.025	<0.010	<0.010	<0.010	<0.010	<0.010	0.035
		13-Jul-22	85.7	0.644	<0.010	0.019	<0.010	<0.010	<0.010	<0.010	<0.010	0.029
		25-Jul-22	101	1.59	0.061	0.052	<0.010	<0.010	<0.010	<0.010	<0.010	0.113
		09-Aug-22	119	2.1	0.035	0.087	<0.010	<0.010	<0.010	<0.010	<0.010	0.122
		24-Aug-22	77.8	1.51	0.038	0.039	<0.010	<0.010	<0.010	<0.010	<0.010	0.077
		08-Sep-22	112	2.41	0.081	0.087	<0.010	<0.010	<0.010	<0.010	<0.010	0.168
		20-Sep-22	135	2.90	0.055	0.082	<0.010	<0.010	<0.010	<0.010	<0.010	0.137
	RG_GHBP	28-Feb-22	132	1.33	0.040	0.052	<0.010	<0.010	<0.010	<0.010	<0.010	0.092
		12-Sep-22	137	2.84	0.111	0.061	<0.010	<0.010	<0.010	<0.010	<0.010	0.172

Exceeds the Long-term Average BC WQG for the protection of freshwater aquatic life (2 µg/L; BCMOECCS 2021a).

Exceeds the draft screening value (0.025 µg/L) indicative of conditions that may cause an incremental increase in bioaccumulation (ADEPT 2022).

Notes: µg/L = micrograms per litre; < = less than; BC WQG = British Columbia Water Quality Guideline; LRL = Laboratory Reporting Limit.

[a] Values <LRL were replaced with the LRL.

[b] It is possible that this value is less than the draft screening value; however, because the <LRL value for dimethylselenoxide was replaced with the LRL, it is "conservatively" identified as being greater than the screening value.

[c] Data are from the 2022 Elk Valley Selenium Speciation Monitoring Program (ADEPT et al. 2023).

Table E.4: Temporal Changes in Concentrations of Water Quality Constituents with Early Warning Triggers (EWT) at Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2016 to 2022

Constituent	Station	Annual Variation [a]		Q1. Is there a positive or negative change in concentrations since the base year (b) of monitoring? MOD [b] and Significance (bolded) from Base Year (b) [c]							Q2. Is the 2022 annual mean greater or less than all annual historical means (2012 to 2020)? [d]							
		DF	P-value	2016	2017	2018	2019	2020	2021	2022	2016	2017	2018	2019	2020	2021	2022	2022 vs. 2016 to 2021
Total Dissolved Solids	GH_GC1	5	0.001	-	b	4.43	-25.6	-24.0	**-39.7**	**-29.1**	-	AB	A	BC	ABC	C	C	No
	GH_CTF	5	0.163	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_HWGH_BRB	5	0.668	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_GH1B	5	0.006	-	b	13.7	-4.95	8.81	-2.36	-7.81	-	AB	A	AB	AB	AB	B	No
	GH_GH1	6	0.001	b	13.0	**25.8**	-0.779	**17.1**	10.0	4.55	C	ABC	A	C	AB	ABC	BC	No
	GH_GH2	5	0.022	-	b	7.00	-7.01	-2.13	-5.38	-12.7	-	AB	A	AB	AB	AB	B	No
Nitrate (as N)	GH_GC1	5	0.554	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_CTF	5	0.001	-	b	0.368	-10.4	**-19.8**	**-26.4**	**-36.4**	-	A	A	AB	BC	CD	D	No
	GH_HWGH_BRB	5	0.001	-	b	0.678	-8.37	-5.40	-21.1	**-28.6**	-	A	A	A	A	AB	B	No
	GH_GH1B	5	0.001	-	b	19.1	-14.9	-5.72	**-25.9**	**-35.8**	-	AB	A	BC	AB	CD	D	No
	GH_GH1	6	0.001	b	23.9	**38.7**	-15.0	-5.35	-15.5	**-23.7**	BC	AB	A	CD	C	CD	D	No
	GH_GH2	5	0.001	-	b	-8.57	**-33.2**	**-34.1**	**-41.4**	**-49.6**	-	A	A	B	B	BC	C	No
Nitrite (as N)	GH_GC1	1	0.051	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_CTF	1	0.001	-	b	**158**	-	-	-	-	-	B	A	-	-	-	-	↑
	GH_HWGH_BRB	1	0.014	-	-	b	-	-	**-40.1**	-	-	-	A	-	-	B	-	↓
	GH_GH1B	1	0.012	-	b	**103**	-	-	-	-	-	B	A	-	-	-	-	↑
	GH_GH1	6	0.001	b	31.0	60.2	-20.0	-31.1	-33.9	-36.9	AB	AB	A	B	B	B	B	No
	GH_GH2	5	0.001	-	b	-0.645	-49.5	-56.5	**-72.5**	-44.7	-	AB	A	ABC	BC	C	ABC	No
Sulphate	GH_GC1	5	0.001	-	b	4.03	-31.0	-33.3	**-49.1**	-34.6	-	AB	A	ABC	ABC	C	BC	No
	GH_CTF	5	0.645	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_HWGH_BRB	5	0.658	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_GH1B	5	0.040	-	b	14.9	-5.08	9.49	1.17	-8.03	-	AB	A	AB	AB	AB	B	No
	GH_GH1	6	0.001	b	14.4	**32.8**	-0.104	19.5	19.8	12.5	BC	ABC	A	C	AB	ABC	ABC	No
	GH_GH2	5	0.154	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
Antimony (Sb)-Total	GH_GC1	5	0.001	-	b	54.0	-36.5	**-61.4**	**-51.4**	**-54.8**	-	AB	A	BC	C	C	C	No
	GH_CTF	5	0.001	-	b	**-18.6**	**-34.6**	**-43.8**	**-51.0**	**-57.4**	-	A	B	C	D	E	F	↓
	GH_HWGH_BRB	5	0.001	-	b	**-17.1**	**-30.8**	**-35.1**	**-46.0**	**-52.6**	-	A	B	C	C	D	E	↓
	GH_GH1B	5	0.001	-	b	11.2	**-34.6**	**-31.4**	**-40.2**	**-49.3**	-	A	A	B	B	B	C	↓
	GH_GH1	6	0.001	b	-13.7	7.85	**-43.1**	**-43.4**	**-48.7**	**-53.3**	AB	B	A	C	C	CD	D	No
	GH_GH2	5	0.001	-	b	6.18	**-35.7**	**-41.9**	**-42.4**	**-50.7**	-	A	A	B	BC	BC	C	No
Barium (Ba)-Total	GH_GC1	5	0.301	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_CTF	5	0.001	-	b	**-12.2**	**-17.2**	**-20.4**	**-21.1**	**-11.1**	-	A	BC	BC	BC	C	B	No
	GH_HWGH_BRB	5	0.001	-	b	**-11.8**	**-20.1**	**-21.9**	**-22.3**	**-13.5**	-	A	B	BC	C	C	B	No
	GH_GH1B	5	0.039	-	b	-8.95	**-23.9**	-19.6	-16.7	-16.0	-	A	AB	B	AB	AB	AB	No
	GH_GH1	6	0.001	b	-0.166	-4.93	**-27.5**	**-26.0**	**-26.6**	**-15.8**	A	A	A	C	C	C	B	No
	GH_GH2	5	0.001	-	b	-8.52	**-27.1**	**-24.0**	**-28.8**	**-21.6**	-	A	A	B	B	B	B	No

- P-value <0.05 (annual variation).
- >20% decrease in concentration.
- >33% decrease in concentration.
- >43% decrease in concentration.
- >50% decrease in concentration.
- >25% increase in concentration.
- >50% increase in concentration.
- >75% increase in concentration.
- >100% increase in concentration.
- *Bold — Significant increase or decrease from base year (b).

Notes: DF = degrees of freedom; MOD = Magnitude of Difference; - = insufficient data for comparison (i.e., < six months of recorded data or >75% of values <LRL in a given year); nc = *post hoc* test not completed because of non-significant *Year* term; < = less than; > = greater than; % = percent; LRL = laboratory reporting limit; ANOVA = Analysis of Variance.

[a] The presence of annual variation was determined by a significant *Year* term (α = 0.05) using an ANOVA with factors *Year* and *Month*.

[b] The MOD was calculated as the concentration in each year minus the concentration in the first or base year divided by the concentration in the first or base year × 100.

[c] Significance between years was determined using all pairwise comparisons with Tukey corrections.

[d] Years that share a letter are not significantly different. Letters were assigned such that "A" represents the highest value.

Table E.4: Temporal Changes in Concentrations of Water Quality Constituents with Early Warning Triggers (EWT) at Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2016 to 2022

Constituent	Station	Annual Variation [a]		Q1. Is there a positive or negative change in concentrations since the base year (b) of monitoring? MOD [b] and Significance (bolded) from Base Year (b) [c]							Q2. Is the 2022 annual mean greater or less than all annual historical means (2012 to 2020)? [d]							
		DF	P-value	2016	2017	2018	2019	2020	2021	2022	2016	2017	2018	2019	2020	2021	2022	2022 vs. 2016 to 2021
Boron (B)-Total	GH_GC1	5	0.015	-	b	-9.60	-12.0	-18.7	-20.5	**-25.3**	-	A	AB	AB	AB	AB	B	No
	GH_CTF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No
	GH_HWGH_BRB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No
	GH_GH1B	5	0.283	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_GH1	6	0.001	b	**-11.6**	**-7.43**	**-9.91**	**-11.1**	**-10.1**	-6.75	A	B	B	B	B	B	AB	No
	GH_GH2	5	0.594	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
Lithium (Li)-Total	GH_GC1	5	0.001	-	b	52.8	-8.56	-9.79	-32.0	-14.2	-	AB	A	B	B	B	B	No
	GH_CTF	5	0.001	-	b	8.10	5.59	**17.6**	**15.7**	**31.5**	-	C	BC	BC	AB	AB	A	No
	GH_HWGH_BRB	5	0.001	-	b	8.19	5.96	**27.7**	**21.1**	**33.1**	-	D	BCD	CD	AB	ABC	A	No
	GH_GH1B	5	0.001	-	b	**30.0**	-8.70	16.4	7.34	13.7	-	BC	A	C	AB	BC	AB	No
	GH_GH1	6	0.001	b	17.4	**74.0**	2.08	**28.3**	**25.9**	**36.3**	C	BC	A	C	B	B	B	No
	GH_GH2	5	0.001	-	b	**24.7**	-8.06	1.49	0.504	5.56	-	B	A	B	B	B	AB	No
Manganese (Mn)-Total	GH_GC1	5	0.001	-	b	15.1	**-69.7**	**-79.1**	-54.6	-42.8	-	A	A	BC	C	ABC	AB	No
	GH_CTF	5	0.001	-	b	-30.9	**-44.4**	**-43.5**	**-54.5**	**-60.0**	-	A	AB	B	B	B	B	No
	GH_HWGH_BRB	5	0.001	-	b	-42.5	**-61.7**	**-71.6**	**-75.1**	**-66.6**	-	A	AB	BC	C	C	C	No
	GH_GH1B	5	0.001	-	b	-45.6	**-72.5**	**-60.4**	-58.6	-33.6	-	A	ABC	C	BC	ABC	AB	No
	GH_GH1	6	0.001	b	-8.97	3.32	-27.4	-31.6	**-50.5**	**-46.1**	A	AB	A	ABC	ABC	C	BC	No
	GH_GH2	5	0.030	-	b	-11.2	-29.7	-32.3	-31.9	**-42.0**	-	A	AB	AB	AB	AB	B	No
Molybdenum (Mo)-Total	GH_GC1	5	0.033	-	b	**106**	17.9	16.5	21.7	6.80	-	B	A	AB	AB	AB	B	No
	GH_CTF	5	0.001	-	b	**-19.9**	**-34.7**	**-41.6**	**-47.9**	**-54.3**	-	A	B	C	CD	D	E	↓
	GH_HWGH_BRB	5	0.001	-	b	-19.1	**-32.5**	**-37.3**	**-45.5**	**-42.5**	-	A	AB	BC	BC	C	C	No
	GH_GH1B	5	0.001	-	b	31.4	**-24.8**	-24.4	**-32.7**	**-35.0**	-	AB	A	C	BC	C	C	No
	GH_GH1	6	0.001	b	-14.5	**36.6**	**-34.8**	**-43.6**	**-46.7**	**-48.8**	B	BC	A	CD	D	D	D	No
	GH_GH2	5	0.001	-	b	51.8	-16.3	-35.7	-16.1	**-38.2**	-	AB	A	BC	BC	BC	C	No
Nickel (Ni)-Total	GH_GC1	5	0.001	-	b	46.7	-45.8	**-57.1**	**-65.4**	-52.2	-	AB	A	BC	C	C	BC	No
	GH_CTF	5	0.001	-	b	-11.2	**-46.8**	**-50.3**	**-60.3**	**-64.2**	-	A	A	B	BC	CD	D	No
	GH_HWGH_BRB	5	0.001	-	b	-19.4	**-50.4**	**-48.9**	**-60.8**	**-63.4**	-	A	A	B	B	C	C	No
	GH_GH1B	5	0.001	-	b	-8.49	**-54.9**	**-47.7**	**-58.6**	**-60.0**	-	A	A	BC	B	C	C	No
	GH_GH1	6	0.001	b	6.86	3.89	**-51.4**	**-45.1**	**-56.4**	**-56.5**	A	A	A	BC	B	C	C	No
	GH_GH2	5	0.001	-	b	-28.6	**-60.8**	**-66.3**	**-65.6**	**-67.6**	-	A	A	B	B	B	B	No
Selenium (Se)-Total	GH_GC1	5	0.633	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_CTF	5	0.970	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_HWGH_BRB	5	0.705	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_GH1B	5	0.215	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_GH1	6	0.001	b	**37.1**	**53.4**	18.7	**45.9**	**38.7**	**32.0**	C	AB	A	BC	A	AB	AB	No
	GH_GH2	5	0.187	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No

P-value <0.05 (annual variation).
>20% decrease in concentration.
>33% decrease in concentration.
>43% decrease in concentration.
>50% decrease in concentration.
>25% increase in concentration.
>50% increase in concentration.
>75% increase in concentration.
>100% increase in concentration.
***Bold** Significant increase or decrease from base year (b).

Notes: DF = degrees of freedom; MOD = Magnitude of Difference; - = insufficient data for comparison (i.e., < six months of recorded data or >75% of values <LRL in a given year); nc = *post hoc* test not completed because of non-significant *Year* term; < = less than; > = greater than; % = percent; LRL = laboratory reporting limit; ANOVA = Analysis of Variance.

[a] The presence of annual variation was determined by a significant *Year* term (α = 0.05) using an ANOVA with factors *Year* and *Month*.

[b] The MOD was calculated as the concentration in each year minus the concentration in the first or base year divided by the concentration in the first or base year × 100.

[c] Significance between years was determined using all pairwise comparisons with Tukey corrections.

[d] Years that share a letter are not significantly different. Letters were assigned such that "A" represents the highest value.

Table E.4: Temporal Changes in Concentrations of Water Quality Constituents with Early Warning Triggers (EWT) at Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2016 to 2022

Constituent	Station	Annual Variation [a]		Q1. Is there a positive or negative change in concentrations since the base year (b) of monitoring? MOD [b] and Significance (bolded) from Base Year (b) [c]							Q2. Is the 2022 annual mean greater or less than all annual historical means (2012 to 2020)? [d]							
		DF	P-value	2016	2017	2018	2019	2020	2021	2022	2016	2017	2018	2019	2020	2021	2022	2022 vs. 2016 to 2021
Uranium (U)-Total	GH_GC1	5	0.001	-	b	10.6	**-33.0**	**-37.1**	**-45.2**	**-35.3**	-	A	A	B	B	B	B	No
	GH_CTF	5	0.813	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_HWGH_BRB	5	0.833	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_GH1B	5	0.007	-	b	16.4	-7.55	9.39	-0.660	-6.53	-	AB	A	B	AB	AB	B	No
	GH_GH1	6	0.001	b	16.3	**36.1**	-2.68	17.2	16.4	12.7	BC	AB	A	C	AB	AB	BC	No
	GH_GH2	5	0.121	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
Zinc (Zn)-Total	GH_GC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No
	GH_CTF	5	0.001	-	b	-9.72	-30.7	**-49.2**	**-58.2**	**-56.8**	-	A	A	AB	BC	C	BC	No
	GH_HWGH_BRB	5	0.238	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_GH1B	1	0.005	-	b	**-54.0**	-	-	-	-	-	A	B	-	-	-	-	↓
	GH_GH1	3	0.608	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_GH2	2	0.036	-	b	-	-	-	**-51.6**	-32.4	-	A	-	-	-	B	AB	No
Cadmium (Cd)-Dissolved	GH_GC1	5	0.011	-	b	-29.7	-11.0	-36.6	-36.5	**-46.9**	-	A	AB	AB	AB	AB	B	No
	GH_CTF	5	0.016	-	b	-37.5	97.0	121	78.5	42.8	-	AB	B	AB	A	AB	AB	No
	GH_HWGH_BRB	5	0.028	-	b	-60.2	-24.1	42.1	6.78	87.7	-	AB	B	AB	AB	AB	A	No
	GH_GH1B	5	0.002	-	b	-14.3	-6.17	80.3	49.8	69.2	-	ABC	C	BC	A	ABC	AB	No
	GH_GH1	6	0.012	b	45.1	-2.17	35.2	63.8	-13.3	26.6	AB	AB	AB	AB	A	B	AB	No
	GH_GH2	5	0.023	-	b	17.8	-15.2	4.33	-29.5	-9.74	-	AB	A	AB	AB	B	AB	No
Cobalt (Co)-Dissolved	GH_GC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No
	GH_CTF	1	0.001	-	b	**-48.4**	-	-	-	-	-	A	B	-	-	-	-	↓
	GH_HWGH_BRB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No
	GH_GH1B	1	0.187	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No
	GH_GH1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No
	GH_GH2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No

P-value <0.05 (annual variation).
>20% decrease in concentration.
>33% decrease in concentration.
>43% decrease in concentration.
>50% decrease in concentration.
>25% increase in concentration.
>50% increase in concentration.
>75% increase in concentration.
>100% increase in concentration.
***Bold** Significant increase or decrease from base year (b).

Notes: DF = degrees of freedom; MOD = Magnitude of Difference; - = insufficient data for comparison (i.e., < six months of recorded data or >75% of values <LRL in a given year); nc = *post hoc* test not completed because of non-significant *Year* term; < = less than; > = greater than; % = percent; LRL = laboratory reporting limit; ANOVA = Analysis of Variance.

[a] The presence of annual variation was determined by a significant *Year* term (α = 0.05) using an ANOVA with factors *Year* and *Month*.

[b] The MOD was calculated as the concentration in each year minus the concentration in the first or base year divided by the concentration in the first or base year × 100.

[c] Significance between years was determined using all pairwise comparisons with Tukey corrections.

[d] Years that share a letter are not significantly different. Letters were assigned such that "A" represents the highest value.

Table E.5: Comparison of Relative Monthly Mean Concentrations of Constituents Before (May to September [2017]) and After (May to September [2018 to 2022]) Calcite Treatment for Stations Upstream (GH_GH1) and Downstream (GH_GH2) of Water Treatment [a]

Constituent		Units	Sample Size [a,b]						ANOVA P-value	Does the ratio of the concentrations between GH_GH1 and GH_GH2 change among years? [c]									
										2017 vs. 2018		2017 vs. 2019		2017 vs. 2020		2017 vs. 2021		2017 vs. 2022	
			2017	2018	2019	2020	2021	2022		P-value	MOD (%) [d]	P-value	MOD (%) [d]	P-value	MOD (%) [d]	P-value	MOD (%) [d]	P-value	MOD (%) [d]
Physical Characteristics	Conductivity, Field	μS/cm	5	4	4	0	0	0	0.455	-	-	-	-	-	-	-	-	-	-
	Conductivity, Lab	μS/cm	5	4	4	4	5	4	0.980	-	-	-	-	-	-	-	-	-	-
	Hardness (as $CaCO_3$)	mg/L	5	4	4	4	5	0	0.919	-	-	-	-	-	-	-	-	-	-
	pH, Field	pH	5	4	4	4	5	4	0.751	-	-	-	-	-	-	-	-	-	-
	pH, Lab	pH	5	4	4	4	5	4	0.544	-	-	-	-	-	-	-	-	-	-
	ORP, Field	mV	5	3	4	4	5	4	0.219	-	-	-	-	-	-	-	-	-	-
	ORP, Lab	mV	5	4	4	4	5	4	0.437	-	-	-	-	-	-	-	-	-	-
	Total Suspended Solids, Lab	mg/L	5	4	4	4	5	4	0.758	-	-	-	-	-	-	-	-	-	-
	Total Dissolved Solids	mg/L	5	4	4	4	5	4	0.934	-	-	-	-	-	-	-	-	-	-
	Turbidity, Field	NTU	4	4	4	4	5	4	0.977	-	-	-	-	-	-	-	-	-	-
	Turbidity, Lab	NTU	5	4	4	4	5	4	0.470	-	-	-	-	-	-	-	-	-	-
	Dissolved Oxygen-Field	mg/L	5	4	4	4	5	4	0.413	-	-	-	-	-	-	-	-	-	-
	Dissolved Oxygen-Field	%	5	4	4	4	5	0	0.430	-	-	-	-	-	-	-	-	-	-
	Temperature-Field	°C	5	4	4	4	5	4	0.740	-	-	-	-	-	-	-	-	-	-
Acidity and Alkalinity	Acidity (as $CaCO_3$)	mg/L	0	0	0	0	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L	5	4	4	4	5	4	0.311	-	-	-	-	-	-	-	-	-	-
	Alkalinity, Carbonate (as $CaCO_3$)	mg/L	5	4	4	4	5	4	0.795	-	-	-	-	-	-	-	-	-	-
	Alkalinity, Hydroxide (as $CaCO_3$)	mg/L	0	0	0	0	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Alkalinity, Total (as $CaCO_3$)	mg/L	5	4	4	4	5	4	0.066	-	-	-	-	-	-	-	-	-	-
Anions and Nutrients	Ammonia as N	mg/L	5	4	4	4	5	3	0.046	0.302	-	0.698	-	0.804	-	0.511	-	0.536	-
	Bromide (Br)	mg/L	0	0	0	0	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Chloride (Cl)	mg/L	2	4	2	3	5	4	nd	-	-	-	-	-	-	-	-	-	-
	Fluoride (F)	mg/L	4	4	4	3	5	4	0.494	-	-	-	-	-	-	-	-	-	-
	Nitrate (as N)	mg/L	5	4	4	4	5	4	0.954	-	-	-	-	-	-	-	-	-	-
	Nitrite (as N)	mg/L	5	4	3	4	3	4	0.187	-	-	-	-	-	-	-	-	-	-
	Total Kjeldahl Nitrogen	mg/L	5	4	4	4	5	4	0.422	-	-	-	-	-	-	-	-	-	-
	Orthophosphate-Dissolved (as P)	mg/L	3	3	0	1	3	2	0.583	-	-	-	-	-	-	-	-	-	-
	Phosphorus (P)-Total	mg/L	5	4	4	4	5	4	0.041	0.702	-	0.902	-	0.795	-	0.046	88	0.933	-
	Sulphate (SO_4)	mg/L	5	4	4	4	5	4	0.838	-	-	-	-	-	-	-	-	-	-
Organic Carbon	Dissolved Organic Carbon	mg/L	5	4	4	4	5	4	0.101	-	-	-	-	-	-	-	-	-	-
	Total Organic Carbon	mg/L	5	4	4	4	5	4	0.665	-	-	-	-	-	-	-	-	-	-
Total Metals	Aluminum (Al)	mg/L	5	4	4	4	5	4	0.272	-	-	-	-	-	-	-	-	-	-
	Antimony (Sb)	mg/L	5	4	4	4	5	4	0.747	-	-	-	-	-	-	-	-	-	-
	Arsenic (As)	mg/L	5	4	4	4	5	4	0.299	-	-	-	-	-	-	-	-	-	-
	Barium (Ba)	mg/L	5	4	4	4	5	4	0.523	-	-	-	-	-	-	-	-	-	-
	Beryllium (Be)	mg/L	1	0	0	0	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Bismuth (Bi)	mg/L	0	0	0	0	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Boron (B)	mg/L	5	4	2	4	4	4	0.739	-	-	-	-	-	-	-	-	-	-
	Cadmium (Cd)	mg/L	5	4	4	4	5	4	0.073	-	-	-	-	-	-	-	-	-	-
	Calcium (Ca)	mg/L	5	4	4	4	5	4	0.683	-	-	-	-	-	-	-	-	-	-
	Chromium (Cr)	mg/L	5	2	3	4	5	4	0.683	-	-	-	-	-	-	-	-	-	-
	Cobalt (Co)	mg/L	2	2	0	0	2	2	nd	-	-	-	-	-	-	-	-	-	-
	Copper (Cu)	mg/L	2	1	1	3	3	3	nd	-	-	-	-	-	-	-	-	-	-
	Iron (Fe)	mg/L	5	4	4	4	5	4	0.430	-	-	-	-	-	-	-	-	-	-
	Lead (Pb)	mg/L	1	1	0	1	3	3	nd	-	-	-	-	-	-	-	-	-	-
	Lithium (Li)	mg/L	5	4	4	4	5	4	0.779	-	-	-	-	-	-	-	-	-	-
	Magnesium (Mg)	mg/L	5	4	4	4	5	4	0.706	-	-	-	-	-	-	-	-	-	-
	Manganese (Mn)	mg/L	5	4	4	4	5	4	0.417	-	-	-	-	-	-	-	-	-	-
	Mercury (Hg)	μg/L	4	3	4	4	5	0	0.094	-	-	-	-	-	-	-	-	-	-
	Methyl Mercury	μg/L	0	4	4	4	5	4	nd	-	-	-	-	-	-	-	-	-	-

P-value <0.05.

Positive MOD (increase in concentration of constituent at GH_GH2 relative to GH_GH1).

Negative MOD (decrease in concentration of constituent at GH_GH2 relative to GH_GH1).

Notes: ANOVA = Analysis of Variance; vs. = versus; MOD = magnitude of difference; % = percent; μS/cm = microSiemens per centimetre; - = no significant difference observed; CaCO3 = calcium carbonate; mg/L = milligrams per litre; ORP = oxidation-reduction potential; mV = millivolts; NTU = Nephelometric Turbidity Units; °C = degrees Celsius; nd = insufficient data were available to conduct the analysis; μg/L = micrograms per litre; < = less than; LRL = laboratory reporting limit.

[a] Data for months when the antiscalant addition system was not operating were excluded from the analysis.

[b] Comparison were completed as a two-sample t-test between time periods on the relative differences between areas, calculated as $\log_{10}$(GH_GH2) − $\log_{10}$(GH_GH1). Values less than the LRL were replaced with the LRL when only one of the two paired samples was <LRL. No Difference was calculated when concentrations in both paired samples were <LRL.

[c] Only comparisons with more than three difference values for both time periods were included.

[d] The MOD was calculated as the observed post-treatment concentration at $(\text{GH\_GH2}_{\text{observed post-treatment}} - \text{GH\_GH2}_{\text{predicted post-treatment}})/\text{GH\_GH2}_{\text{predicted post-treatment}} \times 100\%$, where $\text{GH\_GH2}_{\text{predicted post-treatment}}$ is the geometric mean for GH_GH2 post-treatment and $\text{GH\_GH2}_{\text{predicted post-treatment}}$ is the predicted mean concentration for GH_GH2 assuming the concentration ratio of GH_GH1 to GH_GH2 is the same as pre-treatment (i.e., $\text{GH\_GH2}_{\text{predicted post-treatment}} = 10^{[\log_{10}(\text{GH\_GH1}_{\text{post-treatment}}) + \log_{10}(\text{GH\_GH2}_{\text{pre-treatment}}) - \log_{10}(\text{GH\_GH1}_{\text{pre-treatment}})]}$).

Table E.5: Comparison of Relative Monthly Mean Concentrations of Constituents Before (May to September [2017]) and After (May to September [2018 to 2022]) Calcite Treatment for Stations Upstream (GH_GH1) and Downstream (GH_GH2) of Water Treatment [a]

Constituent		Units	Sample Size [a,b]						ANOVA P-value	Does the ratio of the concentrations between GH_GH1 and GH_GH2 change among years? [c]									
										2017 vs. 2018		2017 vs. 2019		2017 vs. 2020		2017 vs. 2021		2017 vs. 2022	
			2017	2018	2019	2020	2021	2022		P-value	MOD (%) [d]	P-value	MOD (%) [d]	P-value	MOD (%) [d]	P-value	MOD (%) [d]	P-value	MOD (%) [d]
Total Metals	Molybdenum (Mo)	mg/L	5	4	4	4	5	4	0.010	0.147	-	0.0021	140	0.158	-	0.020	87	0.026	87
	Nickel (Ni)	mg/L	5	4	4	4	5	4	0.367	-	-	-	-	-	-	-	-	-	-
	Potassium (K)	mg/L	5	4	4	4	5	4	0.381	-	-	-	-	-	-	-	-	-	-
	Selenium (Se)	µg/L	5	4	4	4	5	4	0.777	-	-	-	-	-	-	-	-	-	-
	Silicon (Si)-Total	mg/L	5	4	4	4	5	4	0.837	-	-	-	-	-	-	-	-	-	-
	Silver (Ag)	mg/L	1	0	0	0	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Sodium (Na)	mg/L	5	4	4	4	5	4	0.778	-	-	-	-	-	-	-	-	-	-
	Strontium (Sr)	mg/L	5	4	4	4	5	4	0.985	-	-	-	-	-	-	-	-	-	-
	Thallium (Tl)	mg/L	5	4	0	0	1	2	0.372	-	-	-	-	-	-	-	-	-	-
	Tin (Sn)	mg/L	0	0	0	1	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Titanium (Ti)	mg/L	0	0	0	0	5	3	nd	-	-	-	-	-	-	-	-	-	-
	Uranium (U)	mg/L	5	4	4	4	5	4	0.689	-	-	-	-	-	-	-	-	-	-
	Vanadium (V)	mg/L	2	0	1	1	2	2	nd	-	-	-	-	-	-	-	-	-	-
	Zinc (Zn)	mg/L	2	1	1	4	4	3	nd	-	-	-	-	-	-	-	-	-	-
Dissolved Metals	Aluminum (Al)	mg/L	3	1	1	0	4	4	0.525	-	-	-	-	-	-	-	-	-	-
	Antimony (Sb)	mg/L	5	4	4	4	5	4	0.211	-	-	-	-	-	-	-	-	-	-
	Arsenic (As)	mg/L	5	4	4	4	5	4	0.989	-	-	-	-	-	-	-	-	-	-
	Barium (Ba)	mg/L	5	4	4	4	5	4	0.016	0.168	-	0.626	-	0.996	-	0.947	-	0.161	-
	Beryllium (Be)	mg/L	0	0	0	0	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Bismuth (Bi)	mg/L	0	0	0	0	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Boron (B)	mg/L	5	3	3	3	4	3	0.907	-	-	-	-	-	-	-	-	-	-
	Cadmium (Cd)	mg/L	4	4	4	4	5	4	0.244	-	-	-	-	-	-	-	-	-	-
	Calcium (Ca)	mg/L	5	4	4	4	5	4	0.453	-	-	-	-	-	-	-	-	-	-
	Chromium (Cr)	mg/L	2	0	4	2	3	1	nd	-	-	-	-	-	-	-	-	-	-
	Cobalt (Co)	mg/L	2	2	0	0	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Copper (Cu)	mg/L	3	1	0	4	5	4	0.668	-	-	-	-	-	-	-	-	-	-
	Iron (Fe)	mg/L	1	0	0	0	1	0	nd	-	-	-	-	-	-	-	-	-	-
	Lead (Pb)	mg/L	1	0	0	0	1	0	nd	-	-	-	-	-	-	-	-	-	-
	Lithium (Li)	mg/L	5	4	4	4	5	4	0.234	-	-	-	-	-	-	-	-	-	-
	Magnesium (Mg)	mg/L	5	4	4	4	5	4	0.874	-	-	-	-	-	-	-	-	-	-
	Manganese (Mn)	mg/L	5	4	4	4	5	4	0.210	-	-	-	-	-	-	-	-	-	-
	Mercury (Hg)	µg/L	1	1	0	0	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Molybdenum (Mo)	mg/L	5	4	4	4	5	4	0.006	0.157	-	0.002	132	0.158	-	0.014	88	0.007	88
	Nickel (Ni)	mg/L	5	4	4	4	5	4	0.222	-	-	-	-	-	-	-	-	-	-
	Potassium (K)	mg/L	5	4	4	4	5	4	0.769	-	-	-	-	-	-	-	-	-	-
	Selenium (Se)	µg/L	5	4	4	4	5	4	0.267	-	-	-	-	-	-	-	-	-	-
	Silicon (Si)	mg/L	5	4	4	4	5	4	0.852	-	-	-	-	-	-	-	-	-	-
	Silver (Ag)	mg/L	0	0	0	0	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Sodium (Na)	mg/L	5	4	4	4	5	4	0.880	-	-	-	-	-	-	-	-	-	-
	Strontium (Sr)	mg/L	5	4	4	4	5	4	0.928	-	-	-	-	-	-	-	-	-	-
	Thallium (Tl)	mg/L	3	4	0	0	1	0	0.544	-	-	-	-	-	-	-	-	-	-
	Tin (Sn)	mg/L	0	0	0	1	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Titanium (Ti)	mg/L	0	0	0	0	1	0	nd	-	-	-	-	-	-	-	-	-	-
	Uranium (U)	mg/L	5	4	4	4	5	4	0.475	-	-	-	-	-	-	-	-	-	-
	Vanadium (V)	mg/L	0	0	0	0	0	0	nd	-	-	-	-	-	-	-	-	-	-
	Zinc (Zn)	mg/L	2	1	1	4	4	3	nd	-	-	-	-	-	-	-	-	-	-

P-value <0.05.

Positive MOD (increase in concentration of constituent at GH_GH2 relative to GH_GH1).

Negative MOD (decrease in concentration of constituent at GH_GH2 relative to GH_GH1).

Notes: ANOVA = Analysis of Variance; vs. = versus; MOD = magnitude of difference; % = percent; µS/cm = microSiemens per centimetre; - = no significant difference observed; CaCO3 = calcium carbonate; mg/L = milligrams per litre; ORP = oxidation-reduction potential; mV = millivolts; NTU = Nephelometric Turbidity Units; °C = degrees Celsius; nd = insufficient data were available to conduct the analysis; µg/L = micrograms per litre; < = less than; LRL = laboratory reporting limit.

[a] Data for months when the antiscalant addition system was not operating were excluded from the analysis.

[b] Comparison were completed as a two-sample t-test between time periods on the relative differences between areas, calculated as $\log_{10}(GH\_GH2) - \log_{10}(GH\_GH1)$. Values less than the LRL were replaced with the LRL when only one of the two paired samples was <LRL. No Difference was calculated when concentrations in both paired samples were <LRL.

[c] Only comparisons with more than three difference values for both time periods were included.

[d] The MOD was calculated as the observed post-treatment concentration at $(GH\_GH2_{observed\ post\text{-}treatment} - GH\_GH2_{predicted\ post\text{-}treatment})/GH\_GH2_{predicted\ post\text{-}treatment} \times 100\%$, where $GH\_GH2_{predicted\ post\text{-}treatment}$ is the geometric mean for GH_GH2 post-treatment and $GH\_GH2_{predicted\ post\text{-}treatment}$ is the predicted mean concentration for GH_GH2 assuming the concentration ratio of GH_GH1 to GH_GH2 is the same as pre-treatment (i.e., $GH\_GH2_{predicted\ post\text{-}treatment} = 10\text{^}[\log_{10}(GH\_GH1_{post\text{-}treatment}) + \log_{10}(GH\_GH2_{pre\text{-}treatment}) - \log_{10}(GH\_GH1_{pre\text{-}treatment})]$).

Table E.6: Depth Profiles for Greenhills Creek Sedimentation Pond, 2018 to 2022

Date	UTM Coordinates (NAD83, 11U)		Depth (m)	Temperature (°C)	pH	Dissolved Oxygen		Specific Conductance (µS/cm)
	Easting	Northing				mg/L	%	
7-Sep-18	653480	5545945	Surface	12.4	8.01	9.80	109	1,594
			1.0	12.5	8.02	9.70	110	1,594
			2.0	12.5	8.03	9.90	112	1,595
			3.0	12.5	8.04	9.90	110	1,596
			4.0	12.2	8.03	10.10	113	1,595
			5.0	12.1	8.03	10.40	116	1,604
			5.5	12.0	7.96	9.80	110	1,608
11-Oct-18	653484	5545945	Surface	4.9	8.85	15.67	123	1,691
			0.5	4.7	8.87	15.70	123	1,693
			1.0	4.6	8.88	15.73	123	1,693
			2.0	4.4	8.89	15.75	122	1,694
			3.0	4.4	8.89	15.74	122	1,694
			4.0	4.4	8.89	15.74	122	1,694
			5.0	4.4	8.89	15.81	123	1,694
24-Apr-19	653471	5545949	Surface	6.8	8.32	10.64	87	1,005
			0.5	6.7	8.36	10.93	89	1,006
			1.0	6.7	8.37	10.94	90	1,041
			1.5	6.4	8.21	10.78	89	1,228
			2.0	4.8	7.90	8.38	66	1,691
			2.5	4.4	7.87	7.73	60	1,704
			3.0	4.0	7.84	7.24	56	1,709
			3.5	4.0	7.72	4.20	32	1,718
			4.0	4.1	7.60	3.40	26	1,720
			4.5	4.1	7.58	3.28	26	1,718
			5.0	4.1	7.59	3.18	24	1,719
			5.5	4.1	7.59	3.11	24	1,719
			6.0	4.1	7.59	3.07	24	1,719
12-Sep-19	653471	5545949	Surface	14.1	8.17	10.90	107	1,365
			1.0	14.0	8.17	10.80	106	1,366
			2.0	13.8	8.18	10.90	106	1,368
			3.0	13.8	8.16	10.80	105	1,378
			4.0	13.3	8.15	11.00	106	1,393
			5.0	12.8	8.13	11.10	105	1,400
			5.5	12.7	8.09	10.80	103	1,399
10-Oct-19	653466	5545942	Surface	3.1	8.03	11.23	100	1,504
			1.0	3.4	8.08	11.24	100	1,505
			2.0	3.4	8.10	11.24	100	1,505
			3.0	3.3	8.11	11.25	100	1,506
			4.0	3.5	8.11	11.20	100	1,504
			5.0	3.5	8.11	11.17	100	1,504
			5.7	3.5	8.11	11.17	100	1,504
10-Sep-20	653478	5545938	Surface	12.8	8.39	8.95	83	2,010
			1.0	12.8	8.48	8.65	82	2,009
			2.0	12.8	8.48	8.68	81	2,009
			3.0	12.7	8.48	8.40	82	2,010
			4.0	12.4	8.47	9.04	85	2,039
			5.0	12.1	8.45	9.30	87	2,051
23-Sep-21	653654	5546040	Surface	10.4	8.34	10.42	111	1,680
			0.5	10.4	8.34	10.35	110	1,680
			1.0	10.3	8.33	10.29	110	1,680
			1.5	10.3	8.34	10.22	109	1,680
			2.0	10.2	8.33	10.44	111	1,680
21-Sep-21	653481	5545994	0.5	10.1	8.33	9.56	101	1,680
			1.0	10.0	8.33	9.73	102	1,680
			1.5	10.0	8.34	9.65	102	1,680
			2.0	9.9	8.33	9.81	103	1,680
			2.5	9.9	8.33	9.55	100	1,680
			3.0	9.9	8.33	9.76	103	1,680
			3.5	9.8	8.24	9.71	102	1,680
			4.0	9.5	8.26	9.53	99	1,690
			4.5	9.5	8.27	9.42	98	1,690
21-Sep-21	653681	5545999	0.5	10.0	8.28	9.85	103	1,680
			1.0	10.0	8.30	9.86	104	1,680
			1.5	10.0	8.31	9.48	100	1,680
			2.0	10.0	8.30	9.41	99	1,680
			2.5	10.0	8.29	9.02	95	1,670
			3.0	10.0	8.29	9.25	97	1,680
			3.5	10.0	8.29	8.95	95	1,670
23-Sep-21	653537	5545648	Surface	10.3	8.33	10.10	108	1,680
			0.5	10.3	8.33	9.95	106	1,680
			1.0	10.3	8.33	10.10	108	1,680
			1.5	10.3	8.33	9.95	106	1,680
			2.0	10.3	8.33	10.03	107	1,680
			2.5	10.3	8.33	10.00	107	1,680
			3.0	10.3	8.33	9.95	106	1,680
			3.5	10.3	8.32	9.92	106	1,680
			4.0	10.1	8.28	9.87	105	1,680
			4.5	10.0	8.26	9.89	105	1,690
			5.0	10.0	8.25	9.84	104	1,690
			5.5	9.9	8.22	9.21	97	1,690
22-Sep-21	653681	5545953	Surface	10.1	8.32	9.75	104	1,680
			0.5	10.1	8.33	9.70	104	1,680
			1.0	10.1	8.32	9.72	103	1,680
			1.5	10.1	8.32	9.75	104	1,680
			2.0	10.1	8.32	9.75	104	1,680
			2.5	10.1	8.31	9.79	104	1,680
			3.0	10.1	8.30	9.75	104	1,680
			3.5	10.1	8.30	9.77	104	1,680
			4.0	10.1	8.27	9.64	103	1,680
			4.5	10.0	8.22	8.51	90	1,680
19-Sep-22	653459	5545959	Surface	12.0	7.97	9.14	85	1,568
			1.0	12.0	8.00	9.15	85	1,568
			2.0	12.0	8.01	9.15	85	1,568
			3.0	11.9	8.01	9.17	85	1,571
			4.0	11.7	8.01	9.34	86	1,573
			5.0	11.4	8.01	9.52	88	1,579

Notes: UTM = Universal Transverse Mercator; NAD = North American Datum; m = metres; °C = degrees Celsius; mg/L = milligrams per litre; % = percent; µS/cm = microSiemens per centimetre; - = not recorded.

APPENDIX F
SUBSTRATE QUALITY

Table F.1: Pebble Counts and Calcite Measurements at RG_GAUT on Upper Gardine Creek, September 2022

RG_GAUT-1				
14-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	0	1	1	4.9
2	0	1	0.6	2.5
3	0	1	0.8	3.9
4	0	0	0	2.0
5	0	0	0	2.2
6	0	0	0	2.7
7	0	1	0.3	16.4
8	0	0	0	1.4
9	0	1	1	3.0
10	0	0	0	3.2
11	0	0	0	2.8
12	0	1	0.8	5.3
13	0	1	0.2	7.2
14	0	0	0	4.3
15	0	0	0	3.9
16	0	1	0.1	7.7
17	0	0	0	2.8
18	0	0	0	7.8
19	0	1	0.2	10.4
20	1	1	0.5	8.9
21	0	1	1	2.1
22	0	1	1	10.5
23	0	0	0	15.6
24	0	1	0.1	9.3
25	0	0	0	4.0
26	0	1	0.2	6.0
27	0	1	0.2	9.2
28	0	1	0.3	4.6
29	0	0	0	2.7
30	0	1	0.6	7.2
31	0	0	0	3.2
32	1	1	0.5	8.1
33	0	1	0.4	2.5
34	0	0	0	2.0
35	0	1	0.2	16.5
36	0	1	0.8	2.1
37	0	0	0	19.1
38	0	0	0	5.0
39	0	0	0	2.1
40	0	0	0	5.3
41	0	1	1	5.2
42	0	1	0.3	2.7
43	0	0	0	2.1
44	0	1	1	2.1
45	0	1	0.2	2.5
46	0	1	0.9	4.1
47	0	1	0.8	3.0
48	0	1	0.4	4.5
49	0	1	0.1	1.8
50	0	0	0	2.7
Cc, Cp, and Cp' =	**0.04**	**0.58**	**0.31**	**-**
Calcite Index (CI) =			**0.62**	
Calcite Index Prime (CI') =			**0.35**	

RG_GAUT-2				
14-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	0	1	0.2	2.5
2	0	1	0.2	5.0
3	0	1	0.6	4.6
4	0	1	0.2	6
5	0	1	1	2.2
6	0	1	0.1	4.0
7	0	1	1	1.9
8	0	0	0	2.5
9	0	1	1	3.6
10	0	1	0.3	6.1
11	0	1	0.3	10.4
12	0	0	0	2.8
13	0	0	0	2.0
14	0	0	0	2.9
15	0	1	0.3	3.0
16	0	1	0.8	3.8
17	0	1	0.4	9.5
18	0	0	0	3.0
19	0	1	0.3	2.5
20	0	1	0.5	4.2
21	0	1	1	6.0
22	0	1	0.5	3.8
23	0	1	0.3	8.0
24	0	1	1	2.2
25	0	1	0.1	7.0
26	0	1	0.5	8.0
27	0	1	0.1	3.5
28	0	0	0	2.1
29	0	1	0.2	10.0
30	0	1	1	3.7
31	0	1	0.4	8
32	0	1	0.2	5.5
33	0	1	1	6.2
34	0	1	0.4	6.0
35	0	0	0	3.3
36	0	0	0	2.5
37	0	1	0.2	3.0
38	0	1	0.5	5.2
39	0	0	0	2.5
40	0	0	0	2.5
41	0	1	0.4	5.0
42	0	1	1	4.0
43	0	1	0.2	2.8
44	0	0	0	4.4
45	0	1	1	3.2
46	0	1	0.2	4.4
47	0	1	0.3	4.5
48	0	1	0.7	11.4
49	0	1	0.5	15.0
50	0	1	1	2.7
Cc, Cp, and Cp' =	**0.00**	**0.78**	**0.40**	**-**
Calcite Index (CI) =			**0.78**	
Calcite Index Prime (CI') =			**0.40**	

RG_GAUT-3				
14-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	0	0	0	2.6
2	0	0	0	1.5
3	0	0	0	1.5
4	0	0	0	2.2
5	0	0	0	2.0
6	0	0	0	3.8
7	0	0	0	2.6
8	0	0	0	1.3
9	0	0	0	2.9
10	0	0	0	2.3
11	0	0	0	1.8
12	0	0	0	1.6
13	0	0	0	2.3
14	0	0	0	2.4
15	0	0	0	2.3
16	0	0	0	2.4
17	0	0	0	0.8
18	0	0	0	1.4
19	0	0	0	0.5
20	0	0	0	1.8
21	0	0	0	2.9
22	0	0	0	1.4
23	0	1	0.1	3.3
24	0	0	0	1.4
25	0	0	0	1.8
26	0	0	0	2.2
27	0	0	0	2.4
28	0	0	0	1.5
29	0	0	0	2.0
30	0	0	0	1.6
31	0	0	0	1.5
32	0	0	0	1.0
33	0	0	0	1.9
34	0	0	0	3.5
35	0	0	0	1.9
36	0	0	0	2.7
37	0	0	0	1.9
38	0	0	0	1.7
39	0	0	0	1.8
40	0	0	0	1.9
41	0	0	0	2
42	0	0	0	1.7
43	0	0	0	1.8
44	0	0	0	Fines
45	0	0	0	2.2
46	0	0	0	1.5
47	0	0	0	1.5
48	0	0	0	6.0
49	0	0	0	4.8
50	0	0	0	2.5
Cc, Cp, and Cp' =	**0.00**	**0.02**	**0.00**	**-**
Calcite Index (CI) =			**0.02**	
Calcite Index Prime (CI') =			**0.00**	

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.

[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.

[b] 0 = calcite is absent; 1 = calcite is present.

[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.1: Pebble Counts and Calcite Measurements at RG_GAUT on Upper Gardine Creek, September 2022

RG_GAUT-4				
14-Sep-22				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	0	0	0	2.8
2	0	0	0	2.4
3	0	0	0	2.8
4	0	0	0	4.0
5	0	0	0	4.0
6	0	0	0	3.2
7	0	0	0	3.8
8	0	0	0	2.8
9	0	0	0	2.7
10	0	0	0	2.6
11	0	0	0	2.2
12	0	0	0	3.0
13	0	0	0	2.6
14	0	0	0	2.5
15	0	0	0	3.1
16	0	0	0	2.4
17	0	0	0	2.1
18	0	0	0	4.2
19	0	0	0	2.7
20	0	0	0	3.6
21	0	0	0	1.8
22	0	0	0	4.3
23	0	0	0	2.4
24	0	0	0	4.9
25	0	0	0	4.8
26	0	0	0	1.8
27	0	0	0	Fines
28	0	0	0	1.6
29	0	0	0	2.0
30	0	0	0	2.7
31	0	0	0	3.3
32	0	0	0	2.6
33	0	0	0	Fines
34	0	0	0	2.6
35	0	0	0	12.7
36	0	0	0	14.8
37	0	0	0	3.2
38	0	0	0	4.0
39	0	0	0	4.5
40	0	0	0	1.8
41	0	0	0	2.4
42	0	0	0	3.9
43	0	0	0	3.9
44	0	0	0	2.3
45	0	0	0	3.7
46	0	0	0	3.9
47	0	0	0	2.1
48	0	0	0	2.5
49	0	0	0	12.6
50	0	0	0	1.9
Cc, Cp, and Cp' =	**0.00**	**0.00**	**0.00**	**-**
Calcite Index (CI) =		**0.00**		
Calcite Index Prime (CI') =		**0.00**		

RG_GAUT-5				
14-Sep-22				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	0	0	0	4.5
2	0	0	0	2.8
3	0	0	0	8.0
4	0	0	0	5.0
5	0	0	0	3.0
6	0	0	0	6
7	0	0	0	4.3
8	0	0	0	5.5
9	0	0	0	4.0
10	0	0	0	3.0
11	0	0	0	4.0
12	0	0	0	4.0
13	0	0	0	4.5
14	0	0	0	2.5
15	0	0	0	7.3
16	0	0	0	4.0
17	0	0	0	4.0
18	0	1	0.1	4.5
19	0	0	0	6.5
20	0	0	0	2.0
21	0	0	0	4.0
22	0	0	0	8.0
23	0	0	0	3.5
24	0	0	0	5.5
25	0	0	0	4.0
26	0	0	0	3.0
27	0	0	0	3.0
28	0	0	0	5.3
29	0	0	0	6.5
30	0	0	0	5.5
31	0	0	0	5.6
32	0	0	0	4.5
33	0	0	0	4.0
34	0	0	0	3.4
35	0	0	0	4.5
36	0	0	0	4.4
37	0	0	0	2.5
38	0	0	0	2.5
39	0	0	0	8.3
40	0	0	0	4.5
41	0	0	0	5.3
42	0	0	0	3.4
43	0	0	0	4.4
44	0	0	0	5.8
45	0	0	0	5.0
46	0	0	0	3
47	0	0	0	2.5
48	0	0	0	2.7
49	0	0	0	4.7
50	0	0	0	5.0
Cc, Cp, and Cp' =	**0.00**	**0.02**	**0.00**	**-**
Calcite Index (CI) =		**0.02**		
Calcite Index Prime (CI') =		**0.00**		

RG_GAUT-6				
14-Sep-22				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	0	0	0	2.3
2	0	0	0	5.2
3	0	0	0	1.6
4	0	0	0	5.4
5	0	0	0	4.8
6	0	0	0	2.7
7	0	0	0	2.0
8	0	0	0	3.7
9	0	0	0	8.8
10	0	0	0	3.2
11	0	0	0	3.3
12	0	0	0	8.2
13	0	0	0	3.6
14	0	0	0	2.1
15	0	0	0	4.3
16	0	0	0	4.9
17	0	0	0	10.2
18	0	0	0	2.1
19	0	0	0	2.3
20	0	0	0	4.2
21	0	0	0	2.0
22	0	0	0	2.3
23	0	0	0	4.0
24	0	0	0	3.8
25	0	0	0	3.2
26	0	0	0	2.7
27	0	0	0	1.3
28	0	0	0	2.3
29	0	0	0	2.0
30	0	0	0	4.6
31	0	0	0	4.1
32	0	0	0	6.2
33	0	0	0	fines
34	0	0	0	4.0
35	0	0	0	9.0
36	0	0	0	1.2
37	0	0	0	2.3
38	0	0	0	3.4
39	0	0	0	8.0
40	0	0	0	5.6
41	0	0	0	7.1
42	0	0	0	7.3
43	0	0	0	2.8
44	0	0	0	3.2
45	0	0	0	2
46	0	0	0	8.0
47	0	0	0	3.2
48	0	0	0	11.0
49	0	0	0	9.8
50	0	0	0	5.8
Cc, Cp, and Cp' =	**0.00**	**0.00**	**0.00**	**-**
Calcite Index (CI) =		**0.00**		
Calcite Index Prime (CI') =		**0.00**		

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.

[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.

[b] 0 = calcite is absent; 1 = calcite is present.

[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.2: Pebble Counts and Calcite Measurements at RG_GANF on Lower Gardine Creek, September 2022

RG_GANF-1				
13-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	0	1	0.6	8.7
2	0	0	0	4.5
3	0	1	0.4	9.5
4	0	1	0.1	12.5
5	0	1	0.4	5.9
6	0	1	0.6	6.5
7	1	1	0.7	12.5
8	1	1	0.6	3.5
9	0	1	0.3	21.5
10	1	1	0.7	4.5
11	0	1	0.7	5.0
12	0	1	0.6	5.4
13	1	1	0.8	9.5
14	1	1	0.6	8.7
15	2	1	1	6.5
16	1	1	0.7	4.3
17	0	1	0.7	4.8
18	2	1	0.7	4.5
19	2	1	1	12.5
20	2	1	1	17.4
21	1	1	0.7	8.0
22	2	1	1	10.6
23	2	1	1	12.4
24	2	1	1	6.2
25	0	1	0.5	26.7
26	0	1	0.3	3.3
27	2	1	1	18.7
28	2	1	0.9	8.2
29	2	1	1	11.5
30	2	1	1	12.2
31	0	1	0.5	4.6
32	0	1	0.4	4.5
33	2	1	1	12.0
34	2	1	1	8.8
35	2	1	1	16.2
36	2	1	1	8.0
37	2	1	1	6.3
38	1	1	1	8.0
39	2	1	1	10.0
40	2	1	1	10.6
41	2	1	1	12.0
42	2	1	0.9	7.0
43	0	1	0.7	8.5
44	2	1	0.9	11.2
45	2	1	0.9	13.1
46	0	1	0.8	6.5
47	0	1	0.8	8.0
48	0	1	0.7	6.5
49	0	1	0.6	4.5
50	0	1	1	8.0
Cc, Cp, and Cp' =	**1.04**	**0.98**	**0.76**	**-**
	Calcite Index (CI) =		**2.02**	
	Calcite Index Prime (CI') =		**1.80**	

RG_GANF-2				
13-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	1	1	1	7.0
2	2	1	1	11.5
3	2	1	1	calcite
4	0	1	0.9	2.6
5	2	1	1	5.7
6	2	1	1	8.2
7	1	1	1	6.7
8	1	1	1	4.3
9	0	1	0.8	2.4
10	2	1	1	calcite
11	0	1	0.7	3.9
12	0	1	0.4	3.8
13	0	1	0.5	2.2
14	2	1	1	calcite
15	0	1	1	8.2
16	1	1	1	5.4
17	2	1	1	calcite
18	1	1	1	9.8
19	2	1	1	calcite
20	1	1	1	10.7
21	1	1	1	8.1
22	2	1	1	calcite
23	2	1	1	9.6
24	2	1	1	calcite
25	2	1	1	calcite
26	2	1	1	calcite
27	0	1	0.9	3.1
28	2	1	1	5.8
29	2	1	1	calcite
30	2	1	1	calcite
31	1	1	1	5.0
32	2	1	1	calcite
33	2	1	1	calcite
34	0	1	0.6	13.7
35	2	1	1	calcite
36	2	1	1	calcite
37	2	1	1	calcite
38	2	1	1	16.7
39	2	1	1	calcite
40	1	1	0.9	4.8
41	2	1	1	calcite
42	2	1	1	calcite
43	2	1	1	calcite
44	2	1	1	calcite
45	2	1	1	calcite
46	1	1	1	9.8
47	1	1	1	17.5
48	2	1	1	calcite
49	2	1	1	calcite
50	1	1	1	5.3
Cc, Cp, and Cp' =	**1.44**	**1.00**	**0.95**	**-**
	Calcite Index (CI) =		**2.44**	
	Calcite Index Prime (CI') =		**2.39**	

RG_GANF-3				
13-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	1	1	1	12.0
2	1	1	0.9	9.2
3	1	1	0.8	6.0
4	2	1	1	10.5
5	1	1	0.7	4.0
6	0	1	0.9	5.3
7	0	1	0.9	10.0
8	0	1	0.8	5.3
9	2	1	1	calcite
10	1	1	0.8	calcite
11	2	1	1	8.0
12	2	1	1	calcite
13	2	1	1	11.0
14	2	1	1	12.0
15	2	1	1	10.2
16	2	1	1	calcite
17	2	1	1	5.0
18	2	1	1	6.4
19	2	1	1	8.2
20	2	1	1	6.7
21	2	1	1	15.0
22	2	1	1	11.9
23	2	1	1	14.5
24	2	1	1	10.4
25	0	1	0.9	9
26	2	1	1	calcite
27	2	1	1	10.6
28	2	1	1	calcite
29	2	1	1	calcite
30	2	1	1	13.0
31	2	1	1	7.3
32	2	1	1	15.6
33	2	1	1	calcite
34	2	1	1	calcite
35	2	1	1	calcite
36	0	1	0.6	7.6
37	1	1	0.9	5.0
38	2	1	1	calcite
39	2	1	1	calcite
40	1	1	1	16.0
41	1	1	0.7	11.0
42	0	1	0.6	9.0
43	2	1	1	9.5
44	2	1	1	13.0
45	0	1	0.8	11.0
46	2	1	1	15.8
47	2	1	0.9	11.9
48	2	1	1	18.6
49	2	1	1	calcite
50	2	1	1	10.9
Cc, Cp, and Cp' =	**1.56**	**1.00**	**0.94**	**-**
	Calcite Index (CI) =		**2.56**	
	Calcite Index Prime (CI') =		**2.50**	

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.

[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.

[b] 0 = calcite is absent; 1 = calcite is present.

[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.2: Pebble Counts and Calcite Measurements at RG_GANF on Lower Gardine Creek, September 2022

RG_GANF-4					RG_GANF-5					RG_GANF-6				
13-Sep-22					13-Sep-22					13-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**	**Pebble**	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**	**Pebble**	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	2	1	1	9.5	**1**	2	1	1	calcite	**1**	2	1	1	calcite
2	1	1	1	10.0	**2**	2	1	1	calcite	**2**	1	1	1	9.0
3	2	1	1	13.6	**3**	2	1	1	calcite	**3**	2	1	1	5.7
4	1	1	0.6	17.0	**4**	1	1	1	9.1	**4**	2	1	1	5.5
5	1	1	1	9.2	**5**	2	1	1	16.4	**5**	2	1	1	calcite
6	2	1	1	13.2	**6**	1	1	1	4.1	**6**	0	1	0.5	4.7
7	1	1	0.8	9.5	**7**	2	1	1	calcite	**7**	0	1	0.4	3.4
8	2	1	1	9.0	**8**	2	1	1	calcite	**8**	2	1	1	8.2
9	2	1	1	15.3	**9**	2	1	1	calcite	**9**	2	1	1	calcite
10	2	1	1	12.8	**10**	2	1	1	calcite	**10**	1	1	1	8.3
11	2	1	1	18.0	**11**	0	1	1	14.0	**11**	2	1	1	calcite
12	1	1	0.7	6.0	**12**	2	1	1	18.2	**12**	2	1	1	calcite
13	0	1	0.6	5.7	**13**	2	1	1	calcite	**13**	2	1	1	calcite
14	1	1	1	8.3	**14**	2	1	1	calcite	**14**	2	1	1	calcite
15	0	1	0.7	5.0	**15**	1	1	1	14.3	**15**	0	1	0.8	4.4
16	0	1	0.5	6.4	**16**	2	1	1	12.8	**16**	1	1	0.9	7.2
17	0	1	0.6	4.4	**17**	0	1	-	4.0	**17**	2	1	1	25.8
18	2	1	1	12.7	**18**	0	1	1	3.8	**18**	2	1	1	calcite
19	0	1	0.5	15.3	**19**	2	1	1	calcite	**19**	1	1	1	7.1
20	2	1	1	8.5	**20**	1	1	1	3.7	**20**	1	1	1	10.4
21	0	1	0.5	6.6	**21**	2	1	1	calcite	**21**	0	1	0.9	6.1
22	0	1	0.5	3.4	**22**	1	1	1	4.5	**22**	0	1	0.8	2.9
23	0	1	0.4	7.8	**23**	1	1	1	7.6	**23**	1	1	1	20.6
24	2	1	1	calcite	**24**	2	1	1	calcite	**24**	2	1	1	4.8
25	0	1	0.6	9.0	**25**	2	1	1	calcite	**25**	0	1	1	2.7
26	2	1	1	calcite	**26**	0	1	1	15.4	**26**	2	1	1	calcite
27	0	1	0.7	8.0	**27**	2	1	1	10.0	**27**	2	1	1	calcite
28	0	1	0.8	8.5	**28**	2	1	1	calcite	**28**	2	1	1	calcite
29	1	1	0.9	5.5	**29**	2	1	1	calcite	**29**	2	1	1	calcite
30	0	1	0.5	5.3	**30**	1	-	-	4.2	**30**	2	1	1	calcite
31	0	1	0.6	7.5	**31**	1	1	1	4.7	**31**	2	1	1	3.5
32	0	1	0.7	2.4	**32**	0	1	1	3.3	**32**	0	1	1	calcite
33	0	1	0.7	2.3	**33**	2	1	1	calcite	**33**	2	1	1	calcite
34	0	1	0.5	6.0	**34**	2	1	1	calcite	**34**	2	1	1	calcite
35	1	1	1	6.8	**35**	2	1	1	calcite	**35**	1	1	1	5.8
36	0	1	0.4	7.7	**36**	2	1	1	calcite	**36**	2	1	1	calcite
37	1	1	0.9	4.7	**37**	2	1	1	calcite	**37**	1	1	1	8.0
38	0	1	0.9	6.0	**38**	0	1	1	2.3	**38**	2	1	1	calcite
39	2	1	1	calcite	**39**	1	1	1	4.1	**39**	1	1	0.9	2.2
40	1	1	0.6	10.5	**40**	2	1	1	calcite	**40**	2	1	1	11.0
41	1	1	0.9	5.5	**41**	2	1	1	calcite	**41**	2	1	1	calcite
42	1	1	0.6	10.2	**42**	2	1	1	calcite	**42**	2	1	1	calcite
43	0	1	0.8	8.5	**43**	2	1	1	17.5	**43**	2	1	1	calcite
44	2	1	1	9	**44**	2	1	1	8.4	**44**	2	1	1	calcite
45	2	1	1	calcite	**45**	2	1	1	5.0	**45**	1	1	1	3.9
46	1	1	0.7	9.0	**46**	1	1	1	3.7	**46**	0	1	0.9	4.0
47	1	1	0.7	12.0	**47**	2	1	1	calcite	**47**	0	1	1	9.2
48	1	1	0.6	5.5	**48**	1	1	1	8.6	**48**	1	1	1	5.3
49	2	1	1	calcite	**49**	0	1	1	5.9	**49**	0	1	0.9	5.0
50	1	1	0.5	5.8	**50**	1	1	1	6.7	**50**	1	1	1	7.6
Cc, Cp, and Cp' =	**0.92**	**1.00**	**0.78**	**-**	**Cc, Cp, and Cp' =**	**1.48**	**0.98**	**0.96**	**-**	**Cc, Cp, and Cp' =**	**1.36**	**1.00**	**0.96**	**-**
Calcite Index (CI) =		**1.92**			**Calcite Index (CI) =**		**2.46**			**Calcite Index (CI) =**		**2.36**		
Calcite Index Prime (CI') =		**1.70**			**Calcite Index Prime (CI') =**		**2.44**			**Calcite Index Prime (CI') =**		**2.32**		

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.

[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.

[b] 0 = calcite is absent; 1 = calcite is present.

[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.3: Pebble Counts and Calcite Measurements at RG_GHUT on Upper Greenhills Creek, September 2022

RG_GHUT-1					RG_GHUT-2					RG_GHUT-3				
15-Sep-22					15-Sep-22					15-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**	**Pebble**	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**	**Pebble**	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	0	1	1	4.2	**1**	2	1	1	calcite	**1**	2	1	1	calcite
2	0	1	1	1.3	**2**	2	1	1	calcite	**2**	2	1	1	calcite
3	0	1	1	14.8	**3**	0	1	1	3.0	**3**	2	1	1	calcite
4	0	1	1	5	**4**	2	1	1	calcite	**4**	2	1	1	calcite
5	2	1	1	calcite	**5**	0	0	0	fines	**5**	2	1	1	calcite
6	2	1	1	calcite	**6**	2	1	1	calcite	**6**	2	1	1	calcite
7	0	1	1	3.5	**7**	0	1	0.9	3.8	**7**	2	1	1	calcite
8	1	1	1	15.7	**8**	2	1	1	7	**8**	2	1	1	calcite
9	2	1	1	calcite	**9**	0	1	1	7.0	**9**	2	1	1	calcite
10	2	1	1	calcite	**10**	0	1	1	calcite	**10**	2	1	1	calcite
11	2	1	1	calcite	**11**	0	1	1	11.3	**11**	2	1	1	calcite
12	2	1	1	calcite	**12**	2	1	1	calcite	**12**	2	1	1	calcite
13	2	1	1	calcite	**13**	0	0	0	fines	**13**	2	1	1	calcite
14	2	1	1	calcite	**14**	0	1	0.1	3.6	**14**	2	1	1	5.0
15	2	1	1	calcite	**15**	2	1	1	calcite	**15**	2	1	1	calcite
16	2	1	1	calcite	**16**	2	1	1	calcite	**16**	2	1	1	calcite
17	2	1	1	calcite	**17**	1	1	1	3.0	**17**	2	1	1	calcite
18	2	1	1	calcite	**18**	2	1	1	calcite	**18**	2	1	1	calcite
19	2	1	1	calcite	**19**	0	1	1	6.2	**19**	2	1	1	calcite
20	2	1	1	calcite	**20**	1	1	0.7	5	**20**	2	1	1	calcite
21	0	1	1	2.0	**21**	2	1	1	calcite	**21**	2	1	1	calcite
22	0	1	1	3.5	**22**	1	1	1	5.3	**22**	2	1	1	calcite
23	2	1	1	calcite	**23**	2	1	1	calcite	**23**	2	1	1	calcite
24	2	1	1	calcite	**24**	1	1	1	6.5	**24**	2	1	1	calcite
25	2	1	1	calcite	**25**	2	1	1	calcite	**25**	2	1	1	calcite
26	0	1	1	8.6	**26**	2	1	1	calcite	**26**	2	1	1	calcite
27	2	1	1	calcite	**27**	1	1	1	2.5	**27**	2	1	1	calcite
28	2	1	1	calcite	**28**	1	1	1	1.5	**28**	2	1	1	calcite
29	2	1	1	calcite	**29**	2	1	1	calcite	**29**	2	1	1	calcite
30	2	1	1	calcite	**30**	2	1	1	calcite	**30**	2	1	1	calcite
31	2	1	1	calcite	**31**	2	1	1	calcite	**31**	2	1	1	calcite
32	0	1	1	3	**32**	2	1	1	calcite	**32**	2	1	1	calcite
33	0	1	1	4	**33**	2	1	1	calcite	**33**	2	1	1	calcite
34	2	1	1	calcite	**34**	2	1	1	calcite	**34**	2	1	1	calcite
35	0	1	1	7.9	**35**	2	1	1	calcite	**35**	2	1	1	calcite
36	2	1	1	calcite	**36**	2	1	1	calcite	**36**	2	1	1	calcite
37	2	1	1	calcite	**37**	2	1	1	calcite	**37**	1	1	1	2.0
38	2	1	1	calcite	**38**	2	1	1	calcite	**38**	1	1	1	3.8
39	2	1	1	calcite	**39**	1	1	1	3	**39**	2	1	1	calcite
40	2	1	1	calcite	**40**	2	1	1	calcite	**40**	2	1	1	calcite
41	2	1	1	calcite	**41**	2	1	1	calcite	**41**	2	1	1	calcite
42	1	1	1	13	**42**	0	1	1	4	**42**	2	1	1	calcite
43	0	1	1	3.7	**43**	0	0	0	fines	**43**	2	1	1	calcite
44	2	1	1	calcite	**44**	2	1	1	calcite	**44**	2	1	1	calcite
45	1	1	1	8.0	**45**	2	1	1	calcite	**45**	2	1	1	calcite
46	0	1	1	8.6	**46**	2	1	1	calcite	**46**	2	1	1	calcite
47	2	1	1	calcite	**47**	2	1	1	calcite	**47**	2	1	1	calcite
48	2	1	1	calcite	**48**	0	0	0	fines	**48**	2	1	1	calcite
49	2	1	1	calcite	**49**	2	1	1	calcite	**49**	2	1	1	calcite
50	0	1	1	11.6	**50**	1	1	1	8.0	**50**	2	1	1	calcite
Cc, Cp, and Cp' =	**1.38**	**1.00**	**1.00**	**-**	**Cc, Cp, and Cp' =**	**1.36**	**0.92**	**0.89**	**-**	**Cc, Cp, and Cp' =**	**1.96**	**1.00**	**1.00**	**-**
Calcite Index (CI) =		**2.38**			**Calcite Index (CI) =**		**2.28**			**Calcite Index (CI) =**		**2.96**		
Calcite Index Prime (CI') =		**2.38**			**Calcite Index Prime (CI') =**		**2.25**			**Calcite Index Prime (CI') =**		**2.96**		

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.
[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.
[b] 0 = calcite is absent; 1 = calcite is present.
[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.3: Pebble Counts and Calcite Measurements at RG_GHUT on Upper Greenhills Creek, September 2021

RG_GHUT-4				
15-Sep-22				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	2	1	1	calcite
2	2	1	1	calcite
3	2	1	1	calcite
4	2	1	1	calcite
5	2	1	1	calcite
6	2	1	1	calcite
7	2	1	1	calcite
8	2	1	1	calcite
9	2	1	1	calcite
10	0	1	0.8	9.0
11	2	1	1	calcite
12	0	1	0.5	7.5
13	2	1	1	calcite
14	2	1	1	calcite
15	0	1	0.9	3.7
16	0	1	0.2	3.5
17	2	1	1	calcite
18	2	1	1	calcite
19	0	1	0.9	11.8
20	2	1	1	calcite
21	2	1	1	calcite
22	2	1	1	calcite
23	2	1	1	calcite
24	2	1	1	calcite
25	2	1	1	calcite
26	2	1	1	calcite
27	2	1	1	calcite
28	0	1	0.2	6.0
29	2	1	1	calcite
30	2	1	1	calcite
31	2	1	1	calcite
32	2	1	1	calcite
33	2	1	1	calcite
34	2	1	1	calcite
35	2	1	1	calcite
36	2	1	1	calcite
37	2	1	1	calcite
38	2	1	1	calcite
39	1	1	1	1.2
40	2	1	1	calcite
41	2	1	1	calcite
42	2	1	1	calcite
43	2	1	1	calcite
44	2	1	1	calcite
45	2	1	1	calcite
46	0	1	1	2.2
47	2	1	1	calcite
48	2	1	1	calcite
49	2	1	1	calcite
50	2	1	1	calcite
Cc, Cp, and Cp' =	1.70	1.00	0.95	-
Calcite Index (CI) =		2.70		
Calcite Index Prime (CI') =		2.65		

RG_GHUT-5				
15-Sep-22				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	2	1	1	calcite
2	2	1	1	calcite
3	2	1	1	calcite
4	0	1	1	9.2
5	1	1	1	3.0
6	0	1	0.9	4.2
7	0	1	1	4.5
8	2	1	1	calcite
9	0	1	1	8.7
10	0	1	1	3.4
11	0	1	1	3.0
12	0	1	1	5.7
13	0	1	1	4.5
14	1	1	1	4.5
15	0	1	1	4.2
16	1	1	1	5.0
17	0	1	1	3.6
18	2	1	1	calcite
19	0	1	1	10.8
20	2	1	1	calcite
21	2	1	1	calcite
22	2	1	1	calcite
23	0	1	0.7	3.5
24	2	1	1	calcite
25	2	1	1	calcite
26	2	1	1	calcite
27	2	1	1	calcite
28	1	1	1	7.8
29	2	1	1	3.5
30	2	1	1	calcite
31	2	1	1	calcite
32	2	1	1	calcite
33	2	1	1	calcite
34	2	1	1	calcite
35	2	1	1	calcite
36	2	1	1	calcite
37	2	1	1	calcite
38	2	1	1	calcite
39	2	1	1	calcite
40	2	1	1	calcite
41	2	1	1	calcite
42	2	1	1	calcite
43	0	1	1	5.2
44	1	1	1	5.6
45	0	1	1	6.0
46	0	1	0.9	3.3
47	0	1	1	1.8
48	2	1	1	calcite
49	1	1	1	4.2
50	2	1	1	calcite
Cc, Cp, and Cp' =	1.24	1.00	0.99	-
Calcite Index (CI) =		2.24		
Calcite Index Prime (CI') =		2.23		

RG_GHUT-6				
15-Sep-22				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	0	1	1	5.5
2	2	1	1	calcite
3	0	1	1	7.5
4	2	1	1	calcite
5	2	1	1	calcite
6	2	1	1	calcite
7	2	1	1	calcite
8	2	1	1	calcite
9	2	1	1	calcite
10	2	1	1	calcite
11	2	1	1	calcite
12	2	1	1	calcite
13	2	1	1	calcite
14	2	1	1	calcite
15	2	1	1	calcite
16	1	1	1	5.8
17	1	1	1	5.6
18	2	1	1	calcite
19	2	1	1	calcite
20	2	1	1	calcite
21	2	1	1	calcite
22	2	1	1	calcite
23	1	1	1	1.4
24	2	1	1	calcite
25	2	1	1	calcite
26	2	1	1	calcite
27	2	1	1	calcite
28	2	1	1	calcite
29	2	1	1	calcite
30	2	1	1	calcite
31	2	1	1	calcite
32	2	1	1	calcite
33	2	1	1	calcite
34	2	1	1	calcite
35	2	1	1	calcite
36	2	1	1	calcite
37	2	1	1	calcite
38	2	1	1	calcite
39	2	1	1	calcite
40	2	1	1	calcite
41	2	1	1	calcite
42	1	1	1	2.8
43	0	1	1	2.6
44	2	1	1	calcite
45	2	1	1	calcite
46	0	1	1	3.2
47	2	1	1	calcite
48	2	1	1	calcite
49	2	1	1	calcite
50	2	1	1	calcite
Cc, Cp, and Cp' =	1.76	1.00	1.00	-
Calcite Index (CI) =		2.76		
Calcite Index Prime (CI') =		2.76		

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.
[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.
[b] 0 = calcite is absent; 1 = calcite is present.
[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.4: Pebble Counts and Calcite Measurements at RG_GHNF on Upper Greenhills Creek, September 2022

RG_GHNF-1					RG_GHNF-2					RG_GHNF-3				
09-Sep-22					09-Sep-22					10-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**	**Pebble**	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**	**Pebble**	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	2	1	1	calcite	**1**	0	1	1	7.0	**1**	2	1	1	calcite
2	1	1	1	4.2	**2**	1	1	1	8.5	**2**	1	1	1	2.0
3	1	1	1	3.0	**3**	0	1	1	4.4	**3**	2	1	1	calcite
4	2	1	1	calcite	**4**	1	1	1	3.2	**4**	1	1	1	2.3
5	2	1	1	calcite	**5**	2	1	1	calcite	**5**	2	1	1	calcite
6	2	1	1	calcite	**6**	0	1	1	12	**6**	2	1	1	calcite
7	2	1	1	calcite	**7**	1	1	1	3.8	**7**	1	1	1	1.5
8	2	1	1	calcite	**8**	1	1	1	7.8	**8**	2	1	1	calcite
9	2	1	1	calcite	**9**	2	1	1	calcite	**9**	2	1	1	calcite
10	2	1	1	calcite	**10**	1	1	1	8	**10**	2	1	1	calcite
11	1	1	1	2.5	**11**	0	1	1	3.0	**11**	2	1	1	calcite
12	1	1	1	4	**12**	2	1	1	calcite	**12**	0	1	1	4.4
13	1	1	1	5.5	**13**	2	1	1	calcite	**13**	2	1	1	calcite
14	2	1	1	calcite	**14**	2	1	1	calcite	**14**	2	1	1	calcite
15	1	1	1	3.4	**15**	2	1	1	calcite	**15**	1	1	1	10
16	1	1	1	7.2	**16**	2	1	1	calcite	**16**	2	1	1	calcite
17	2	1	1	calcite	**17**	2	1	1	calcite	**17**	2	1	1	calcite
18	2	1	1	calcite	**18**	2	1	1	calcite	**18**	2	1	1	calcite
19	1	1	1	4.5	**19**	2	1	1	calcite	**19**	2	1	1	calcite
20	2	1	1	calcite	**20**	1	1	1	4	**20**	2	1	1	calcite
21	2	1	1	calcite	**21**	1	1	1	3.5	**21**	0	1	1	6.8
22	2	1	1	calcite	**22**	2	1	1	calcite	**22**	2	1	1	calcite
23	1	1	1	3.5	**23**	0	1	1	3.5	**23**	2	1	1	calcite
24	1	1	1	5.0	**24**	2	1	1	calcite	**24**	2	1	1	calcite
25	1	1	1	5.0	**25**	2	1	1	calcite	**25**	1	1	1	2.5
26	1	1	1	9.5	**26**	2	1	1	calcite	**26**	2	1	1	calcite
27	2	1	1	calcite	**27**	2	1	1	calcite	**27**	0	1	1	3.8
28	2	1	1	calcite	**28**	2	1	1	calcite	**28**	2	1	1	calcite
29	1	1	1	3.7	**29**	1	1	1	5.0	**29**	2	1	1	calcite
30	2	1	1	calcite	**30**	2	1	1	calcite	**30**	1	1	1	9.5
31	2	1	1	calcite	**31**	1	1	1	2.3	**31**	0	1	1	2.4
32	2	1	1	calcite	**32**	2	1	1	calcite	**32**	0	1	1	1.5
33	1	1	1	5.5	**33**	1	1	1	6.5	**33**	1	1	1	6
34	1	1	1	10.5	**34**	2	1	1	calcite	**34**	2	1	1	calcite
35	2	1	1	calcite	**35**	1	1	1	6.5	**35**	2	1	1	calcite
36	1	1	1	5.3	**36**	2	1	1	calcite	**36**	0	1	0.9	14
37	1	1	1	4.6	**37**	2	1	1	calcite	**37**	1	1	0.8	6.5
38	2	1	1	calcite	**38**	2	1	1	calcite	**38**	0	1	1	3.0
39	1	1	1	calcite	**39**	2	1	1	calcite	**39**	0	1	1	2.0
40	2	1	1	calcite	**40**	2	1	1	calcite	**40**	1	1	1	3.3
41	2	1	1	calcite	**41**	2	1	1	calcite	**41**	2	1	1	calcite
42	2	1	1	calcite	**42**	2	1	1	calcite	**42**	1	1	1	3.5
43	1	1	1	18.5	**43**	1	1	1	7.8	**43**	0	1	1	10.0
44	1	1	1	5.1	**44**	2	1	1	calcite	**44**	1	1	1	8.2
45	2	1	1	calcite	**45**	2	1	1	calcite	**45**	1	1	1	3.5
46	1	1	1	2.5	**46**	1	1	1	2.5	**46**	2	1	1	calcite
47	2	1	1	calcite	**47**	1	1	1	6	**47**	0	1	1	3.1
48	2	1	1	calcite	**48**	1	1	1	4.7	**48**	2	1	1	calcite
49	1	1	1	4	**49**	2	1	1	calcite	**49**	2	1	1	calcite
50	1	1	1	10	**50**	2	1	1	calcite	**50**	2	1	1	calcite
Cc, Cp, and Cp' =	**1.54**	**1.00**	**1.00**	**-**	**Cc, Cp, and Cp' =**	**1.50**	**1.00**	**1.00**	**-**	**Cc, Cp, and Cp' =**	**1.36**	**1.00**	**0.99**	**-**
Calcite Index (CI) =			**2.54**		**Calcite Index (CI) =**			**2.50**		**Calcite Index (CI) =**			**2.36**	
Calcite Index Prime (CI') =			**2.54**		**Calcite Index Prime (CI') =**			**2.50**		**Calcite Index Prime (CI') =**			**2.35**	

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.

[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.

[b] 0 = calcite is absent; 1 = calcite is present.

[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.4: Pebble Counts and Calcite Measurements at RG_GHNF on Upper Greenhills Creek, September 2022

RG_GHNF-4					RG_GHNF-5					RG_GHNF-6				
10-Sep-22					10-Sep-22					10-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**	**Pebble**	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**	**Pebble**	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	1	1	1	4.5	**1**	2	1	1	calcite	**1**	2	1	1	calcite
2	2	1	1	calcite	**2**	1	1	1	3.3	**2**	2	1	1	calcite
3	0	1	1	9.5	**3**	2	1	1	calcite	**3**	2	1	1	calcite
4	1	1	1	13.3	**4**	1	1	1	4.4	**4**	1	1	1	9.8
5	2	1	1	calcite	**5**	2	1	1	calcite	**5**	0	1	1	4.5
6	1	1	1	4	**6**	1	1	1	4.0	**6**	1	1	1	4.5
7	1	1	1	11.5	**7**	2	1	1	calcite	**7**	2	1	1	calcite
8	2	1	1	calcite	**8**	1	1	1	2.3	**8**	2	1	1	calcite
9	2	1	1	calcite	**9**	2	1	1	calcite	**9**	1	1	1	12.4
10	2	1	1	calcite	**10**	2	1	1	calcite	**10**	1	1	1	2.5
11	1	1	1	6.0	**11**	2	1	1	calcite	**11**	2	1	1	calcite
12	1	1	1	3	**12**	1	1	1	5.7	**12**	1	1	1	5.8
13	1	1	1	3.5	**13**	2	1	1	calcite	**13**	2	1	1	calcite
14	2	1	1	calcite	**14**	2	1	1	calcite	**14**	2	1	1	calcite
15	1	1	1	3.5	**15**	2	1	1	calcite	**15**	2	1	1	calcite
16	0	1	1	11.5	**16**	2	1	1	calcite	**16**	0	1	1	5.5
17	0	1	1	4	**17**	2	1	1	calcite	**17**	1	1	1	3.0
18	1	1	1	6.0	**18**	2	1	1	calcite	**18**	2	1	1	calcite
19	1	1	1	6.5	**19**	1	1	1	1.5	**19**	2	1	1	calcite
20	2	1	1	calcite	**20**	2	1	1	calcite	**20**	1	1	1	6.5
21	2	1	1	calcite	**21**	1	1	1	1	**21**	0	1	1	4.5
22	2	1	1	calcite	**22**	0	1	1	2.8	**22**	2	1	1	calcite
23	2	1	1	calcite	**23**	2	1	1	calcite	**23**	2	1	1	calcite
24	1	1	1	11	**24**	2	1	1	calcite	**24**	2	1	1	calcite
25	2	1	1	calcite	**25**	2	1	1	calcite	**25**	1	1	1	8.0
26	2	1	1	calcite	**26**	2	1	1	calcite	**26**	2	1	1	calcite
27	1	1	1	11.0	**27**	1	1	1	2	**27**	2	1	1	calcite
28	1	1	1	15	**28**	2	1	1	calcite	**28**	2	1	1	calcite
29	2	1	1	calcite	**29**	2	1	1	calcite	**29**	1	1	1	5.2
30	1	1	1	7.5	**30**	1	1	1	2.5	**30**	2	1	1	calcite
31	2	1	1	calcite	**31**	2	1	1	calcite	**31**	2	1	1	calcite
32	2	1	1	calcite	**32**	1	1	1	1.6	**32**	1	1	1	5.7
33	1	1	1	10.0	**33**	2	1	1	calcite	**33**	2	1	1	calcite
34	2	1	1	calcite	**34**	2	1	1	calcite	**34**	1	1	1	3.3
35	2	1	1	calcite	**35**	1	1	1	2.8	**35**	2	1	1	calcite
36	1	1	1	6	**36**	2	1	1	calcite	**36**	2	1	1	calcite
37	0	1	1	4.8	**37**	2	1	1	calcite	**37**	2	1	1	calcite
38	2	1	1	calcite	**38**	2	1	1	calcite	**38**	1	1	1	7.5
39	2	1	1	calcite	**39**	2	1	1	calcite	**39**	1	1	1	6.2
40	2	1	1	calcite	**40**	1	1	1	3.7	**40**	1	1	1	2.4
41	1	1	1	10.5	**41**	1	1	1	1.8	**41**	2	1	1	calcite
42	2	1	1	calcite	**42**	2	1	1	calcite	**42**	1	1	1	4
43	1	1	1	4.3	**43**	2	1	1	calcite	**43**	2	1	1	calcite
44	1	1	1	10.0	**44**	0	1	1	3.5	**44**	2	1	1	calcite
45	2	1	1	calcite	**45**	2	1	1	calcite	**45**	1	1	1	7.6
46	1	1	1	7.8	**46**	0	1	1	fines	**46**	2	1	1	calcite
47	1	1	1	10.2	**47**	2	1	1	calcite	**47**	1	1	1	7.0
48	2	1	1	calcite	**48**	2	1	1	calcite	**48**	2	1	1	calcite
49	2	1	1	calcite	**49**	2	1	1	calcite	**49**	2	1	1	calcite
50	2	1	1	calcite	**50**	0	1	1	fines	**50**	2	1	1	calcite
Cc, Cp, and Cp' =	**1.42**	**1.00**	**1.00**	**-**	**Cc, Cp, and Cp' =**	**1.58**	**1.00**	**1.00**	**-**	**Cc, Cp, and Cp' =**	**1.54**	**1.00**	**1.00**	**-**
Calcite Index (CI) =			**2.42**		**Calcite Index (CI) =**			**2.58**		**Calcite Index (CI) =**			**2.54**	
Calcite Index Prime (CI') =			**2.42**		**Calcite Index Prime (CI') =**			**2.58**		**Calcite Index Prime (CI') =**			**2.54**	

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.

[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.

[b] 0 = calcite is absent; 1 = calcite is present.

[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.5: Pebble Counts and Calcite Measurements at RG_GHDT on Upper Greenhills Creek, September 2022

RG_GHDT-1				
16-Sep-22				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	2	1	1	calcite
2	0	1	1	4.0
3	2	1	1	calcite
4	2	1	1	calcite
5	2	1	1	calcite
6	2	1	1	calcite
7	2	1	1	calcite
8	0	1	1	5.4
9	2	1	1	calcite
10	2	1	1	calcite
11	0	1	1	6.3
12	2	1	1	calcite
13	2	1	1	calcite
14	2	1	1	calcite
15	2	1	1	calcite
16	0	1	1	6.5
17	2	1	1	calcite
18	2	1	1	calcite
19	2	1	1	calcite
20	2	1	1	calcite
21	2	1	1	calcite
22	2	1	1	calcite
23	2	1	1	calcite
24	0	1	1	7.0
25	2	1	1	calcite
26	2	1	1	calcite
27	1	1	1	4.3
28	2	1	1	calcite
29	1	1	1	7.0
30	0	1	0.8	4.0
31	2	1	1	calcite
32	2	1	1	calcite
33	2	1	1	calcite
34	2	1	1	calcite
35	2	1	1	calcite
36	2	1	1	calcite
37	2	1	1	calcite
38	2	1	1	calcite
39	0	1	1	2.5
40	2	1	1	calcite
41	2	1	1	calcite
42	2	1	1	calcite
43	2	1	1	calcite
44	2	1	1	calcite
45	2	1	1	calcite
46	0	1	1	3.2
47	2	1	1	calcite
48	2	1	1	calcite
49	1	1	0.9	10.5
50	1	1	1	3.9
Cc, Cp, and Cp' =	**1.60**	**1.00**	**0.99**	**-**
	Calcite Index (CI) =		**2.60**	
	Calcite Index Prime (CI') =		**2.59**	

RG_GHDT-2				
16-Sep-22				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	2	1	1	calcite
2	1	1	1	1.6
3	2	1	1	calcite
4	2	1	1	calcite
5	2	1	1	calcite
6	2	1	1	calcite
7	2	1	1	calcite
8	2	1	1	calcite
9	2	1	1	calcite
10	2	1	1	calcite
11	2	1	1	3.9
12	2	1	1	calcite
13	2	1	1	calcite
14	2	1	1	calcite
15	2	1	1	calcite
16	2	1	1	calcite
17	2	1	1	calcite
18	2	1	1	calcite
19	2	1	1	calcite
20	2	1	1	calcite
21	2	1	1	calcite
22	2	1	1	calcite
23	2	1	1	calcite
24	2	1	1	calcite
25	2	1	1	calcite
26	1	1	1	2.2
27	2	1	1	calcite
28	2	1	1	calcite
29	2	1	1	calcite
30	2	1	1	calcite
31	2	1	1	calcite
32	2	1	1	calcite
33	2	1	1	calcite
34	2	1	1	calcite
35	2	1	1	calcite
36	2	1	1	calcite
37	2	1	1	calcite
38	2	1	1	calcite
39	2	1	1	calcite
40	2	1	1	calcite
41	2	1	1	calcite
42	2	1	1	calcite
43	2	1	1	calcite
44	2	1	1	calcite
45	2	1	1	calcite
46	2	1	1	calcite
47	2	1	1	calcite
48	2	1	1	calcite
49	2	1	1	calcite
50	2	1	1	calcite
Cc, Cp, and Cp' =	**1.96**	**1.00**	**1.00**	**-**
	Calcite Index (CI) =		**2.96**	
	Calcite Index Prime (CI') =		**2.96**	

RG_GHDT-3				
16-Sep-22				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	2	1	1	calcite
2	1	1	1	1.7
3	0	1	0.9	7.3
4	0	1	1	5.5
5	2	1	1	calcite
6	2	1	1	calcite
7	2	1	1	calcite
8	0	1	1	5.0
9	2	1	1	calcite
10	2	1	1	calcite
11	2	1	1	calcite
12	2	1	1	calcite
13	2	1	1	calcite
14	2	1	1	calcite
15	2	1	1	calcite
16	1	1	1	6.2
17	2	1	1	calcite
18	0	1	1	5.4
19	2	1	1	calcite
20	2	1	1	calcite
21	2	1	1	calcite
22	2	1	1	calcite
23	2	1	1	calcite
24	2	1	1	calcite
25	2	1	1	calcite
26	2	1	1	calcite
27	2	1	1	calcite
28	2	1	1	calcite
29	0	1	1	5.2
30	2	1	1	calcite
31	2	1	1	calcite
32	2	1	1	calcite
33	2	1	1	calcite
34	2	1	1	calcite
35	1	1	1	7.5
36	0	1	0.7	4.3
37	1	1	1	7.4
38	2	1	1	calcite
39	0	1	0.7	6.8
40	2	1	1	calcite
41	2	1	1	calcite
42	2	1	1	calcite
43	2	1	1	calcite
44	2	1	1	calcite
45	2	1	1	calcite
46	2	1	1	calcite
47	2	1	1	calcite
48	2	1	1	calcite
49	1	1	1	6.5
50	2	1	1	calcite
Cc, Cp, and Cp' =	**1.62**	**1.00**	**0.99**	**-**
	Calcite Index (CI) =		**2.62**	
	Calcite Index Prime (CI') =		**2.61**	

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.

[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.

[b] 0 = calcite is absent; 1 = calcite is present.

[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.5: Pebble Counts and Calcite Measurements at RG_GHDT on Upper Greenhills Creek, September 2022

RG_GHDT-4					RG_GHDT-5					RG_GHDT-6				
16-Sep-22					16-Sep-22					16-Sep-22				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)	Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)	Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	2	1	1	calcite	**1**	2	1	1	calcite	**1**	2	1	1	12.9
2	2	1	1	calcite	**2**	2	1	1	calcite	**2**	1	1	1	5.8
3	2	1	1	calcite	**3**	2	1	1	calcite	**3**	2	1	1	calcite
4	2	1	1	calcite	**4**	2	1	1	calcite	**4**	0	1	1	7.9
5	2	1	1	calcite	**5**	1	1	1	5.3	**5**	2	1	1	calcite
6	1	1	1	5.0	**6**	2	1	1	calcite	**6**	2	1	1	calcite
7	2	1	1	calcite	**7**	2	1	1	calcite	**7**	2	1	1	calcite
8	2	1	1	calcite	**8**	2	1	1	calcite	**8**	2	1	1	calcite
9	2	1	1	calcite	**9**	2	1	1	calcite	**9**	2	1	1	calcite
10	2	1	1	calcite	**10**	2	1	1	calcite	**10**	2	1	1	calcite
11	2	1	1	calcite	**11**	2	1	1	calcite	**11**	2	1	1	calcite
12	1	1	1	4.7	**12**	0	1	1	3.0	**12**	2	1	1	calcite
13	2	1	1	calcite	**13**	2	1	1	calcite	**13**	2	1	1	calcite
14	2	1	1	calcite	**14**	2	1	1	calcite	**14**	2	1	1	calcite
15	2	1	1	calcite	**15**	2	1	1	calcite	**15**	1	1	0.9	3.0
16	2	1	1	calcite	**16**	2	1	1	calcite	**16**	2	1	1	calcite
17	2	1	1	calcite	**17**	2	1	1	calcite	**17**	2	1	1	calcite
18	2	1	1	calcite	**18**	2	1	1	calcite	**18**	2	1	1	calcite
19	2	1	1	calcite	**19**	2	1	1	calcite	**19**	2	1	1	calcite
20	2	1	1	calcite	**20**	2	1	1	calcite	**20**	2	1	1	calcite
21	2	1	1	calcite	**21**	2	1	1	calcite	**21**	1	1	0.3	1.6
22	2	1	1	calcite	**22**	2	1	1	calcite	**22**	2	1	1	calcite
23	2	1	1	calcite	**23**	2	1	1	calcite	**23**	2	1	1	calcite
24	2	1	1	calcite	**24**	2	1	1	calcite	**24**	0	1	0.7	1.0
25	2	1	1	calcite	**25**	2	1	1	calcite	**25**	2	1	1	calcite
26	2	1	1	calcite	**26**	2	1	1	calcite	**26**	2	1	1	calcite
27	2	1	1	calcite	**27**	2	1	1	calcite	**27**	2	1	1	calcite
28	2	1	1	calcite	**28**	2	1	1	calcite	**28**	2	1	1	calcite
29	0	1	1	2.4	**29**	2	1	1	calcite	**29**	1	1	0.9	9.0
30	2	1	1	calcite	**30**	2	1	1	calcite	**30**	0	1	1	12.5
31	2	1	1	calcite	**31**	2	1	1	calcite	**31**	2	1	1	calcite
32	2	1	1	calcite	**32**	2	1	1	calcite	**32**	2	1	1	calcite
33	2	1	1	calcite	**33**	2	1	1	calcite	**33**	0	1	1	6.2
34	2	1	1	calcite	**34**	1	1	1	10.5	**34**	2	1	1	calcite
35	1	1	1	3.3	**35**	1	1	0.7	10.0	**35**	2	1	1	calcite
36	2	1	1	calcite	**36**	2	1	1	calcite	**36**	2	1	1	calcite
37	0	1	1	2.1	**37**	2	1	1	calcite	**37**	2	1	1	calcite
38	2	1	1	calcite	**38**	2	1	1	calcite	**38**	2	1	1	calcite
39	2	1	1	calcite	**39**	2	1	1	calcite	**39**	2	1	1	calcite
40	2	1	1	calcite	**40**	2	1	1	calcite	**40**	1	1	1	6.6
41	2	1	1	calcite	**41**	2	1	1	calcite	**41**	2	1	1	calcite
42	2	1	1	calcite	**42**	2	1	1	calcite	**42**	2	1	1	calcite
43	0	1	1	5.8	**43**	2	1	1	calcite	**43**	2	1	1	calcite
44	1	1	1	5.2	**44**	2	1	1	calcite	**44**	1	1	1	2.5
45	2	1	1	calcite	**45**	0	1	0.7	8.6	**45**	2	1	1	calcite
46	2	1	1	calcite	**46**	2	1	1	calcite	**46**	2	1	1	calcite
47	2	1	1	calcite	**47**	2	1	1	calcite	**47**	1	1	1	12.2
48	2	1	1	calcite	**48**	2	1	1	calcite	**48**	2	1	1	calcite
49	0	1	0.8	3.8	**49**	2	1	1	calcite	**49**	2	1	1	calcite
50	1	1	1	2.4	**50**	2	1	1	calcite	**50**	2	1	1	calcite
Cc, Cp, and Cp' =	**1.74**	**1.00**	**1.00**	**-**	**Cc, Cp, and Cp' =**	**1.86**	**1.00**	**0.99**	**-**	**Cc, Cp, and Cp' =**	**1.70**	**1.00**	**0.98**	**-**
Calcite Index (CI) =		**2.74**			**Calcite Index (CI) =**		**2.86**			**Calcite Index (CI) =**		**2.70**		
Calcite Index Prime (CI') =		**2.74**			**Calcite Index Prime (CI') =**		**2.85**			**Calcite Index Prime (CI') =**		**2.68**		

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.

[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.

[b] 0 = calcite is absent; 1 = calcite is present.

[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.6: Pebble Counts and Calcite Measurements at RG_GHFF on Upper Greenhills Creek, September 2022

RG_GHFF-1					RG_GHFF-2					RG_GHFF-3				
08-Sep-22					08-Sep-22					08-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**	**Pebble**	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**	**Pebble**	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	2	1	1	5.0	**1**	2	1	1	4.5	**1**	2	1	1	9.0
2	2	1	1	4.5	**2**	2	1	1	7.0	**2**	2	1	1	8.5
3	2	1	1	10.5	**3**	2	1	1	Calcite	**3**	2	1	1	13.3
4	2	1	1	Calcite	**4**	2	1	1	6.2	**4**	0	1	1	4.5
5	2	1	0.5	7.2	**5**	2	1	1	6.5	**5**	0	1	0.8	6.0
6	0	1	0.2	1.9	**6**	2	1	1	Calcite	**6**	0	1	1	4.4
7	2	1	1	11.3	**7**	2	1	1	2.5	**7**	0	1	1	9.7
8	2	1	1	25.0	**8**	2	1	1	3.7	**8**	2	1	1	12.5
9	2	1	1	Calcite	**9**	1	1	0.8	7.5	**9**	1	1	1	5.8
10	2	1	1	11.5	**10**	0	1	0.9	8.5	**10**	1	1	0.9	6.3
11	2	1	1	6.6	**11**	2	1	1	2.5	**11**	1	1	1	5.8
12	2	1	1	3.3	**12**	2	1	1	2.0	**12**	2	1	1	9.3
13	2	1	1	9.7	**13**	2	1	1	11.5	**13**	0	1	0.9	6.5
14	2	1	1	4.8	**14**	2	1	1	10.0	**14**	2	1	1	15.7
15	2	1	1	12.8	**15**	1	1	0.7	4.2	**15**	0	1	0.8	5.3
16	2	1	1	12.5	**16**	0	1	0.8	9.5	**16**	2	1	1	8.0
17	2	1	1	Calcite	**17**	1	1	0.8	6.0	**17**	2	1	1	6.4
18	2	1	1	3.1	**18**	1	1	1	6.5	**18**	2	1	1	18.5
19	2	1	1	20.0	**19**	1	1	0.8	6.8	**19**	2	1	1	8.3
20	2	1	1	12.0	**20**	1	1	0.6	3.3	**20**	2	1	1	11.4
21	0	1	1	11.0	**21**	1	1	0.8	4.8	**21**	2	1	1	10.8
22	2	1	1	8.2	**22**	2	1	1	5.5	**22**	1	1	1	14.3
23	2	1	1	Calcite	**23**	1	1	0.8	5.0	**23**	0	1	0.6	4.8
24	2	1	1	11.2	**24**	1	1	0.8	5.5	**24**	0	1	1	3.5
25	2	1	1	13.0	**25**	2	1	1	1.4	**25**	0	1	1	4.0
26	2	1	1	13.6	**26**	1	1	0.8	4.2	**26**	1	1	1	6.0
27	2	1	1	11.8	**27**	0	1	1	8.0	**27**	2	1	1	10.0
28	2	1	1	Calcite	**28**	0	1	1	5.0	**28**	2	1	1	10.6
29	2	1	1	Calcite	**29**	1	1	0.9	4.5	**29**	2	1	1	7.8
30	2	1	1	9.3	**30**	1	1	0.8	3.5	**30**	2	1	1	11.5
31	1	1	1	0.8	**31**	2	1	1	8.0	**31**	2	1	1	Calcite
32	2	1	1	4.0	**32**	2	1	1	9.0	**32**	0	1	1	22.0
33	2	1	1	Calcite	**33**	2	1	1	5.0	**33**	2	1	1	29.5
34	2	1	1	3.8	**34**	2	1	1	7.5	**34**	1	1	1	5.4
35	2	1	1	Calcite	**35**	2	1	1	7.0	**35**	0	1	1	6.9
36	1	1	0.9	3.7	**36**	2	1	1	7.0	**36**	1	1	0.7	5.0
37	2	1	1	4.8	**37**	2	1	1	9.5	**37**	2	1	1	5.2
38	2	1	1	12.5	**38**	0	1	1	4.5	**38**	1	1	1	9.3
39	2	1	1	17.0	**39**	2	1	1	6.0	**39**	1	1	1	3.8
40	2	1	1	11.5	**40**	1	1	0.9	5.0	**40**	1	1	1	7.4
41	2	1	1	5.0	**41**	2	1	1	9.0	**41**	2	1	1	8.7
42	1	1	1	5.4	**42**	1	1	1	5.5	**42**	1	1	1	6.1
43	2	1	1	Calcite	**43**	0	1	1	10.0	**43**	0	1	1	5.8
44	2	1	1	Calcite	**44**	1	1	1	6.0	**44**	1	1	1	6.0
45	2	1	1	8.5	**45**	0	1	1	4.5	**45**	2	1	1	Calcite
46	1	1	1	7.7	**46**	1	1	1	5.0	**46**	0	1	1	7.3
47	2	1	1	7.0	**47**	1	1	0.8	8.5	**47**	2	1	1	5.6
48	2	1	1	14.5	**48**	1	1	1	6.5	**48**	0	1	1	3.5
49	2	1	1	6.5	**49**	1	1	1	5.0	**49**	2	1	1	7.1
50	2	1	1	9.0	**50**	1	1	0.8	7.5	**50**	1	1	0.6	7.9
Cc, Cp, and Cp' =	**1.84**	**1.00**	**0.97**	**-**	**Cc, Cp, and Cp' =**	**1.32**	**1.00**	**0.94**	**-**	**Cc, Cp, and Cp' =**	**1.18**	**1.00**	**0.97**	**-**
Calcite Index (CI) =			**2.84**		**Calcite Index (CI) =**			**2.32**		**Calcite Index (CI) =**			**2.18**	
Calcite Index Prime (CI') =			**2.81**		**Calcite Index Prime (CI') =**			**2.26**		**Calcite Index Prime (CI') =**			**2.15**	

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.
[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.
[b] 0 = calcite is absent; 1 = calcite is present.
[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.6: Pebble Counts and Calcite Measurements at RG_GHFF on Upper Greenhills Creek, September 2022

RG_GHFF-4				
09-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	2	1	1	Calcite
2	2	1	1	4.0
3	2	1	1	3.6
4	2	1	1	Calcite
5	0	1	0.6	8.5
6	2	1	1	8.7
7	2	1	1	6.5
8	2	1	1	10.0
9	2	1	1	6.5
10	2	1	1	7.0
11	2	1	1	7.7
12	2	1	1	3.0
13	2	1	1	5.0
14	1	1	1	3.9
15	0	1	0.8	2.9
16	2	1	1	Calcite
17	2	1	1	2.5
18	2	1	1	Calcite
19	2	1	1	3.0
20	2	1	1	3.5
21	2	1	1	5.5
22	2	1	1	5.4
23	2	1	1	4.5
24	2	1	1	6.0
25	2	1	1	Calcite
26	1	1	0.5	2.0
27	2	1	1	11.5
28	2	1	1	19.0
29	2	1	1	Calcite
30	2	1	1	19.5
31	2	1	1	14.7
32	1	1	1	5.3
33	1	1	0.9	2.2
34	2	1	1	6.0
35	2	1	0.5	2.9
36	0	1	0.9	3.5
37	0	1	0.9	12.0
38	2	1	1	2.0
39	2	1	1	6.0
40	1	1	1	4.0
41	2	1	1	14.0
42	2	1	1	5.0
43	1	1	0.8	4.0
44	2	1	1	5.0
45	2	1	1	10.5
46	1	1	1	5.2
47	1	1	0.7	14.2
48	0	1	0.5	5.4
49	2	1	1	17.0
50	2	1	1	Calcite
Cc, Cp, and Cp' =	**1.64**	**1.00**	**0.94**	**-**
Calcite Index (CI) =			**2.64**	
Calcite Index Prime (CI') =			**2.58**	

RG_GHFF-5				
09-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	2	1	1	10.0
2	2	1	1	8.5
3	2	1	1	12.6
4	2	1	1	Calcite
5	0	1	1	6.3
6	1	1	1	4.0
7	1	1	1	6.2
8	2	1	1	Calcite
9	1	1	0.9	8.0
10	2	1	1	8.5
11	2	1	1	Calcite
12	2	1	1	7.6
13	1	1	0.6	3.7
14	2	1	1	9.8
15	2	1	1	14.3
16	1	1	0.8	5.5
17	1	1	1	5.7
18	2	1	1	3.5
19	2	1	1	4.0
20	0	1	1	7.5
21	0	1	0.7	7.0
22	2	1	1	Calcite
23	2	1	1	Calcite
24	0	1	1	6.8
25	2	1	1	Calcite
26	2	1	1	8.0
27	2	1	1	10.0
28	2	1	1	5.3
29	2	1	1	9.0
30	2	1	1	7.5
31	2	1	1	6.0
32	2	1	1	9.5
33	0	1	0.9	2.5
34	2	1	1	5.0
35	1	1	1	9.5
36	2	1	1	5.7
37	2	1	1	Calcite
38	1	1	1	5.5
39	2	1	1	4.0
40	0	1	1	2.4
41	2	1	1	3.0
42	0	1	1	2.8
43	2	1	1	4.3
44	2	1	1	5.5
45	2	1	1	6.0
46	2	1	1	Calcite
47	2	1	1	5.5
48	2	1	1	7.0
49	2	1	1	6.0
50	2	1	1	4.0
Cc, Cp, and Cp' =	**1.56**	**1.00**	**0.98**	**-**
Calcite Index (CI) =			**2.56**	
Calcite Index Prime (CI') =			**2.54**	

RG_GHFF-6				
09-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	2	1	1	Calcite
2	1	1	1	1.1
3	2	1	1	6.0
4	2	1	1	10.0
5	2	1	1	5.3
6	2	1	1	7.5
7	2	1	1	7.5
8	2	1	1	Calcite
9	2	1	1	2.5
10	2	1	1	2.2
11	2	1	1	2.5
12	2	1	1	Calcite
13	2	1	1	9.0
14	2	1	1	6.0
15	2	1	1	Calcite
16	2	1	1	12.0
17	2	1	1	Calcite
18	2	1	1	Calcite
19	2	1	1	7.0
20	0	1	1	1.7
21	0	1	1	1.2
22	2	1	1	2.5
23	2	1	1	1.8
24	2	1	1	3.5
25	2	1	1	9.0
26	2	1	1	7.0
27	2	1	1	6.2
28	2	1	1	6.0
29	2	1	1	20.0
30	2	1	1	19.0
31	2	1	1	12.0
32	2	1	1	5.5
33	2	1	1	1.8
34	2	1	1	17.0
35	2	1	1	8.5
36	2	1	1	11.0
37	2	1	1	Calcite
38	2	1	1	11.0
39	2	1	1	10.0
40	2	1	1	16.5
41	2	1	1	13.0
42	2	1	1	5.0
43	2	1	1	4.2
44	2	1	1	5.3
45	2	1	1	11.0
46	2	1	1	2.2
47	2	1	1	9.5
48	2	1	1	5.5
49	1	1	1	9.4
50	2	1	1	11.5
Cc, Cp, and Cp' =	**1.88**	**1.00**	**1.00**	**-**
Calcite Index (CI) =			**2.88**	
Calcite Index Prime (CI') =			**2.88**	

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.

[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.

[b] 0 = calcite is absent; 1 = calcite is present.

[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.7: Pebble Counts and Calcite Measurements at RG_GHBP on Lower Greenhills Creek, September 2022

RG_GHBP-1				
10-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	0	1	0.5	3.7
2	0	0	0	3.5
3	0	1	0.2	7.7
4	0	0	0	2.8
5	0	0	0	3.7
6	0	1	0.7	5.2
7	0	1	0.1	10.5
8	0	0	0	4.5
9	0	0	0	3.5
10	0	1	0.1	8.6
11	0	1	0.6	3.6
12	0	0	0	9.7
13	0	0	0	6.3
14	0	0	0	6.6
15	0	0	0	1.7
16	0	1	0.1	10.2
17	0	0	0	7.0
18	0	1	0.3	15.5
19	0	0	0	2.8
20	0	0	0	6.0
21	0	0	0	7.5
22	0	0	0	2.1
23	0	0	0	15.0
24	0	0	0	7.7
25	0	0	0	9.6
26	0	0	0	5.0
27	0	0	0	4.5
28	0	0	0	2.2
29	0	0	0	3.5
30	0	0	0	7.0
31	0	0	0	5.3
32	0	0	0	7.0
33	0	0	0	5.4
34	0	0	0	8.7
35	0	0	0	9.0
36	0	0	0	7.1
37	0	0	0	7.1
38	0	1	0.5	6.6
39	0	0	0	6.0
40	0	0	0	11.5
41	0	0	0	3.8
42	0	0	0	4.0
43	0	0	0	14.0
44	0	0	0	10.5
45	0	0	0	4.8
46	0	0	0	3.1
47	0	0	0	2.7
48	0	0	0	1.6
49	0	0	0	3.7
50	0	0	0	5.4
Cc, Cp, and Cp' =	**0.00**	**0.18**	**0.06**	**-**
Calcite Index (CI) =		**0.18**		
Calcite Index Prime (CI') =		**0.06**		

RG_GHBP-2				
12-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	0	0	0	9.0
2	0	0	0	4.9
3	0	0	0	6.5
4	0	0	0	6.7
5	0	0	0	3.4
6	0	0	0	3.3
7	0	0	0	4.0
8	0	0	0	7.5
9	0	0	0	4.6
10	0	0	0	5.8
11	0	0	0	5.5
12	0	0	0	5.8
13	0	0	0	6.2
14	0	0	0	4.7
15	0	0	0	5.0
16	0	0	0	5.4
17	0	0	0	9.3
18	0	0	0	7.5
19	0	1	0.2	3.7
20	0	0	0	7.4
21	0	0	0	5.2
22	0	0	0	8.4
23	0	0	0	3.4
24	0	0	0	4.7
25	0	0	0	3.3
26	0	0	0	4.8
27	0	0	0	5.7
28	0	0	0	5.0
29	0	0	0	4.5
30	0	0	0	9.7
31	0	0	0	5.8
32	0	0	0	8.0
33	0	0	0	7.0
34	0	0	0	5.0
35	0	0	0	4.4
36	0	0	0	5.0
37	0	1	0.3	5.7
38	0	0	0	8.6
39	0	0	0	3.7
40	0	0	0	4.9
41	0	1	0.4	9.0
42	0	0	0	6.0
43	0	0	0	5.8
44	0	0	0	3.6
45	0	1	1	11.2
46	0	0	0	3.0
47	0	0	0	11.2
48	0	0	0	4.7
49	0	0	0	6.5
50	0	0	0	6.5
Cc, Cp, and Cp' =	**0.00**	**0.08**	**0.04**	**-**
Calcite Index (CI) =		**0.08**		
Calcite Index Prime (CI') =		**0.04**		

RG_GHBP-3				
12-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	0	1	0.4	8.5
2	0	1	0.1	6.5
3	0	1	0.5	4.5
4	0	1	0.3	8.0
5	0	1	0.5	10.5
6	0	1	0.1	7.8
7	0	1	0.1	7.5
8	0	0	0	7.6
9	0	1	0.4	8.5
10	0	1	0.1	8.5
11	0	1	0.1	7.9
12	0	1	0.1	6.0
13	0	1	0.5	10.0
14	0	1	0.1	9.0
15	0	1	0.4	9.3
16	0	1	0.4	11.0
17	0	1	0.1	11.5
18	0	0	0	5.5
19	0	0	0	6.0
20	0	0	0	5.4
21	0	1	0.4	13.0
22	0	1	0.2	6.0
23	0	1	0.1	7.5
24	0	1	0.7	7.9
25	0	1	0.4	5.0
26	0	1	0.2	5.7
27	0	1	0.3	6.4
28	0	1	0.1	6.7
29	0	1	0.1	9.0
30	0	1	0.1	8.8
31	0	1	0.1	12.0
32	0	1	0.1	6.5
33	0	1	0.2	7.0
34	0	1	0.9	15.0
35	0	1	0.1	7.0
36	0	1	0.1	7.2
37	0	1	0.4	6.8
38	0	1	0.1	6.0
39	0	1	0.3	6.4
40	0	1	0.4	6.9
41	0	0	0	5.5
42	0	1	0.7	9.5
43	0	1	0.7	11.5
44	0	1	0.5	10.5
45	0	1	0.2	7.5
46	0	1	0.4	6.0
47	0	1	0.2	7.4
48	0	1	0.4	7.1
49	0	1	0.4	9.4
50	0	1	0.3	6.5
Cc, Cp, and Cp' =	**0.00**	**0.90**	**0.27**	**-**
Calcite Index (CI) =		**0.90**		
Calcite Index Prime (CI') =		**0.27**		

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.

[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.

[b] 0 = calcite is absent; 1 = calcite is present.

[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.7: Pebble Counts and Calcite Measurements at RG_GHBP on Lower Greenhills Creek, September 2022

RG_GHBP-4					RG_GHBP-5					RG_GHBP-6				
12-Sep-22					12-Sep-22					12-Sep-22				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**	**Pebble**	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**	**Pebble**	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	0	1	0.5	8.5	**1**	0	1	0.4	5.0	**1**	1	1	1	15.0
2	0	1	0.5	8.0	**2**	0	1	0.5	4.6	**2**	1	1	1	10.7
3	0	1	0.7	14.5	**3**	0	1	0.5	5.3	**3**	2	1	1	7.0
4	0	1	0.3	10.1	**4**	0	1	0.9	9.4	**4**	2	1	1	11.0
5	0	1	0.4	5.0	**5**	1	1	0.8	8.5	**5**	2	1	1	12.2
6	0	0	0	4.5	**6**	2	1	1	18.0	**6**	2	1	1	13.3
7	0	1	0.9	4.0	**7**	0	1	0.7	5.5	**7**	2	1	1	12.5
8	0	1	0.4	7.6	**8**	0	1	1	9.4	**8**	2	1	1	8.2
9	0	1	0.6	7.7	**9**	0	1	0.6	7.8	**9**	0	1	0.5	1.8
10	0	1	0.3	5.7	**10**	0	1	0.4	9.5	**10**	2	1	1	calcite
11	0	1	0.6	11.3	**11**	0	1	0.4	1.5	**11**	0	1	0.7	3.3
12	0	1	0.9	5.4	**12**	0	1	0.9	4.5	**12**	2	1	1	6.5
13	0	1	0.7	6.5	**13**	0	1	0.8	0.5	**13**	0	0	0	4.2
14	0	1	0.2	6.3	**14**	0	1	0.8	7.5	**14**	1	1	0.8	6.2
15	0	1	0.6	7.7	**15**	1	1	0.7	14.2	**15**	2	1	1	8.8
16	0	1	0.6	5.6	**16**	0	1	0.9	9.0	**16**	0	1	1	13.2
17	0	1	0.2	4.2	**17**	0	1	0.95	19.5	**17**	0	1	0.8	8.0
18	0	1	1	9.0	**18**	2	1	1	14.3	**18**	0	1	0.6	12.1
19	0	1	0.3	5.3	**19**	0	1	1	8.9	**19**	0	1	0.5	6.3
20	0	1	0.8	5.0	**20**	2	1	1	7.8	**20**	1	1	0.4	18.5
21	0	1	1	5.0	**21**	0	1	0.4	7.7	**21**	2	1	1	7.2
22	0	1	1	4.0	**22**	0	1	0.7	4.6	**22**	0	1	0.9	14.5
23	0	1	0.7	2.4	**23**	0	1	1	11.3	**23**	2	1	1	6.0
24	0	1	0.8	9.4	**24**	0	1	0.9	9.5	**24**	0	1	0.4	8.9
25	0	1	1	11.2	**25**	1	1	0.9	10.0	**25**	0	1	0.7	6.4
26	0	1	1	6.3	**26**	0	1	1	11.8	**26**	0	1	1	7.5
27	0	1	1	7.3	**27**	0	1	1	8.5	**27**	2	1	1	7.5
28	0	1	1	7.5	**28**	0	1	0.7	10.4	**28**	0	1	1	8.7
29	1	1	1	calcite	**29**	2	1	1	5.5	**29**	2	1	1	12.0
30	0	1	1	7.4	**30**	2	1	1	9.0	**30**	0	1	1	10.3
31	0	1	1	12.2	**31**	2	1	1	10.3	**31**	1	1	0.9	19.0
32	0	1	1	11.7	**32**	0	1	1	8.5	**32**	2	1	1	10.5
33	0	1	1	5.9	**33**	0	1	0.8	7.5	**33**	0	1	0.9	6.7
34	1	1	1	4.4	**34**	2	1	1	5.0	**34**	2	1	1	7.0
35	0	1	1	11.9	**35**	0	1	0.7	5.4	**35**	1	1	1	18.0
36	0	1	1	11.0	**36**	0	1	1	4.3	**36**	2	1	1	11.5
37	0	1	0.9	5.7	**37**	2	1	1	5.3	**37**	0	1	1	7.4
38	0	1	0.9	6.8	**38**	2	1	1	9.5	**38**	0	1	1	6.8
39	0	1	1	7.1	**39**	0	1	1	8.0	**39**	0	1	0.3	2.8
40	0	1	1	4.7	**40**	0	1	-	4.7	**40**	0	1	1	3.7
41	0	1	1	5.0	**41**	0	1	1	8.3	**41**	2	1	1	11.2
42	0	1	0.9	4.6	**42**	0	1	0.2	4.0	**42**	0	1	0.8	1.6
43	0	1	0.7	8.9	**43**	0	1	1	11.5	**43**	0	0	0	0.9
44	0	1	0.8	6.0	**44**	0	1	0.9	9.5	**44**	0	1	1	9.2
45	1	1	0.8	11.0	**45**	0	1	0.4	8.5	**45**	0	0	0	2.8
46	0	1	1	6.0	**46**	0	1	0.8	7.7	**46**	2	1	1	17.0
47	0	1	1	7.8	**47**	1	1	0.5	9.2	**47**	0	1	0.6	6.2
48	0	1	0.9	7.2	**48**	2	1	0.5	7.0	**48**	0	1	0.4	3.4
49	0	1	0.8	5.0	**49**	0	1	0.8	10.5	**49**	1	1	0.9	5.0
50	0	1	1	8.5	**50**	0	1	0.8	7.2	**50**	1	1	0.9	6.5
Cc, Cp, and Cp' =	**0.06**	**0.98**	**0.77**	**-**	**Cc, Cp, and Cp' =**	**0.48**	**1.00**	**0.79**	**-**	**Cc, Cp, and Cp' =**	**0.88**	**0.94**	**0.82**	**-**
	Calcite Index (CI) =		**1.04**			**Calcite Index (CI) =**		**1.48**			**Calcite Index (CI) =**		**1.82**	
	Calcite Index Prime (CI') =		**0.83**			**Calcite Index Prime (CI') =**		**1.27**			**Calcite Index Prime (CI') =**		**1.70**	

Notes: cm = centimetres; C_c = calcite concretion score; C_p = calcite presence score; C_p' = calcite presence score prime; - = no data/not applicable; % = percent.

[a] 0 = particle can be removed with no resistance; 1 = some resistance, but particle is still movable; 2 = particle is immovable/fully concreted.

[b] 0 = calcite is absent; 1 = calcite is present.

[c] 0 = calcite is absent; 0.5 = 50% of the rock surface is covered in calcite; 1 = the rock is fully covered in calcite. Proportional coverage is expressed in 10% increments.

Table F.8: Comparison of Calcite Presence and Concretion Scores Among Treated (RG_GHBP) and Untreated (RG_GHUT, RG_GHNF, and RG_GHFF) Areas of Greenhills Creek, 2017 to 2022 [a]

Calcite	P-values			Year	Calcite Presence/Concretion Score				Area Contrasts							Temporal Contrasts							
									Letter Contrasts							RG_GHUT		RG_GHNF		RG_GHFF		RG_GHBP	
	Year x Area	Year	Area		RG_GHUT	RG_GHNF	RG_GHFF	RG_GHBP	RG_GHUT	RG_GHNF	RG_GHFF	RG_GHBP	RG_GHUT	RG_GHNF	RG_GHFF	Letter	MOD (%) [c]	Letter	MOD (%) [c]	Letter	MOD (%) [c]	Letter	MOD (%) [c]
Presence Score (C_p) [d]	<0.001	0.036	<0.001	2017	0.995	0.999	0.995	0.682	A	A	A	B	46	46	46	A	-	A	-	A	-	B	-
				2018	0.999	0.999	0.999	0.627	A	A	A	B	59	59	59	A	0.34	A	0	A	0.34	BC	-8.1
				2019	0.995	0.999	0.999	0.743	A	A	A	B	34	34	34	A	0.0011	A	0	A	0.34	B	8.9
				2020	0.992	0.999	0.999	0.568	A	A	A	B	75	76	75.7	A	-0.33	A	0	A	0.34	C	-17
				2021	0.999	0.999	0.995	0.890	A	A	A	A	12	12	12	A	0.34	A	0	A	0.0022	A	30
				2022	0.999	0.999	0.999	0.661	A	A	A	B	51	51	51	A	0.34	A	0	A	0.34	BC	-3.1
Concretion Score (C_c)	<0.001	<0.001	<0.001	2017	1.13	1.81	1.16	0.0796	A	A	A	B	1,316	2,170	1,361	C	-	AB	-	B	-	A	-
				2018	1.54	1.62	1.60	0.0755	A	A	A	B	1,943	2,051	2,018	AB	37	BC	-10	A	37	A	-5.2
				2019	1.78	1.97	1.59	0.0566	A	A	A	B	3,038	3,378	2,703	A	58	A	9.0	A	36	AB	-29
				2020	1.46	1.73	1.33	0.0487	A	A	A	B	2,888	3,451	2,629	B	29	ABC	40	AB	28	B	-39
				2021	0.96	1.17	1.50	0.0082	A	A	A	B	11,536	14,066	18,061	C	-15	D	9	A	29	C	-90
				2022	1.576	1.49	1.57	0.0487	A	A	A	B	3,135	2,949	3,113	AB	40	C	-18	A	35	B	-39

Relevant p-value <0.05.
P-value <0.05 and MOD <0 (i.e., score is lower relative to the score for RG_GHBP or decreased relative to 2017).
P-value <0.05 and MOD >0 (i.e., score is higher relative to the score for RG_GHBP or increased relative to 2017).

Notes: MOD = Magnitude of Difference; % = percent; < = less than; - = no data/not applicable; > = greater than; GLMM = Generalized Linear Mixed Model; HSD = Honestly Significant Difference. Letters A, B, and C are used to illustrate similarities and differences among areas and years (e.g., areas assigned an "A" have significantly higher calcite presence scores than areas assigend a "B").

[a] The differences among areas and years for calcite presence and concretion scores were compared using a GLMM with factors *Area* and *Year* and *Area x Year* assuming a negative binomial distribution. *Post hoc* comparisons were corrected for multiple comparisons using a Tukey's HSD test.

[b] MOD = $(Score_{Exposed}-Score_{GHBP})/Score_{GHBP}$.
[c] MOD = $(Score_{year}-Score_{2017})/Score_{2017}$.
[d] Binomial (i.e., "0" or "1") calcite presence scores (C_p) were included in the analysis, rather than proportional presence scores (C_p') because multiple years of data were available for the former (i.e., 2017 to 2022) but not the latter (i.e., 2021 and 2022 only).

Table F.9: Bulk Sediment Quality at Biological Monitoring Areas on Greenhills and Gardine Creeks, September 2022

	Constituent	Units	BC WSQG [a]		Gardine Creek				
					RG_GAUT				
			Upper	Lower	RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5
Physical Tests	Moisture	%	-	-	22.7	26.1	38.1	31.1	25.4
	pH (1:2)	pH	-	-	8.25	8.26	8.02	8.15	8.2
Particle Size	% Gravel (>2 mm)	%	-	-	5.5	10.2	1.9	4.1	5.5
	% Sand (2.00 mm to 1.00 mm)	%	-	-	4.4	6.1	1.4	2.1	5.5
	% Sand (1.00 mm to 0.50 mm)	%	-	-	13.6	13.5	2.5	7.4	12.2
	% Sand (0.50 mm to 0.25 mm)	%	-	-	14.9	13.8	3.0	11.5	10.2
	% Sand (0.25 mm to 0.125 mm)	%	-	-	11.9	9.4	4.8	8.9	6.0
	% Sand (0.125 mm to 0.063 mm)	%	-	-	7.8	6.9	7.6	8.9	8.2
	% Silt (0.063 mm to 0.0312 mm)	%	-	-	13.0	12.8	26.3	18.7	17.2
	% Silt (0.0312 mm to 0.004 mm)	%	-	-	21.1	20.6	42.3	29.4	27.1
	% Clay (<4 µm)	%	-	-	7.8	6.7	10.2	9.0	8.1
Organic Carbon	Total Organic Carbon	%	-	-	11.2	9.36	22.0	13.3	14.4
Metals	Aluminum (Al)	mg/kg	-	-	9,440	8,130	6,860	9,840	10,600
	Antimony (Sb)	mg/kg	-	-	0.90	0.89	0.86	0.97	0.88
	Arsenic (As)	mg/kg	5.90	17.0	6.89	6.99	5.22	6.81	6.46
	Barium (Ba)	mg/kg	-	-	318	312	306	347	370
	Beryllium (Be)	mg/kg	-	-	0.83	0.78	0.73	0.81	0.81
	Bismuth (Bi)	mg/kg	-	-	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)	mg/kg	-	-	7.6	5.4	5.4	8.2	9.5
	Cadmium (Cd)	mg/kg	0.600	3.50	0.809	0.918	0.978	0.958	0.891
	Calcium (Ca)	mg/kg	-	-	11,800	12,000	13,400	12,700	12,200
	Chromium (Cr)	mg/kg	37.3	90.0	13.3	11.6	11.1	14.6	14.9
	Cobalt (Co)	mg/kg	-	-	11.5	11.1	7.57	10.7	10.3
	Copper (Cu)	mg/kg	35.7	197	19.8	20.0	21.6	21.0	20.4
	Iron (Fe)	mg/kg	21,200	43,766	20,400	19,500	12,700	18,800	18,700
	Lead (Pb)	mg/kg	35.0	91.3	14	13.6	11.6	13.4	12.7
	Lithium (Li)	mg/kg	-	-	13.5	12.4	8.9	12.3	13.1
	Magnesium (Mg)	mg/kg	-	-	4,410	3,920	3,420	4,090	4,100
	Manganese (Mn)	mg/kg	460	1,100	548	622	357	508	486
	Mercury (Hg)	mg/kg	0.170	0.486	0.0623	0.0668	0.0898	0.0737	0.0748
	Molybdenum (Mo)	mg/kg	25.0	23,000	1.40	1.42	1.27	1.45	1.34
	Nickel (Ni)	mg/kg	16.0	75.0	33.8	33.1	25.8	33.3	31.2
	Phosphorus (P)	mg/kg	-	-	1,340	1,300	1,020	1,270	1,300
	Potassium (K)	mg/kg	-	-	1,850	1,500	1,380	2,060	2,270
	Selenium (Se)	mg/kg	2 [b]		1.18	1.22	1.57	1.49	1.32
	Silver (Ag)	mg/kg	0.500	-	0.25	0.27	0.37	0.30	0.27
	Sodium (Na)	mg/kg	-	-	63	56	54	66	70
	Strontium (Sr)	mg/kg	-	-	51	47.8	50.7	52.4	50.6
	Sulfur (S)	mg/kg	-	-	<1,000	<1,000	<1,000	<1,000	<1,000
	Thallium (Tl)	mg/kg	-	-	0.178	0.14	0.135	0.167	0.169
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)	mg/kg	-	-	17.1	10.1	13.0	18.3	17.6
	Tungsten (W)	mg/kg	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U)	mg/kg	-	-	0.825	0.845	1.00	0.941	0.881
	Vanadium (V)	mg/kg	-	-	29.4	26.5	24.4	33.6	34.0
	Zinc (Zn)	mg/kg	123	315	114	113	90.7	124	110
	Zirconium (Zr)	mg/kg	-	-	1.3	1.2	1.4	1.1	1.0
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	0.00671	0.0889	0.092	0.167	0.384	0.204	0.138
	Acenaphthylene	mg/kg	0.00587	0.128	<0.050	<0.050	0.056	<0.050	<0.050
	Acridine	mg/kg	-	-	0.140	0.282	0.646	0.320	0.218
	Anthracene	mg/kg	0.0469	0.245	<0.050	<0.050	<0.050	<0.050	<0.050
	Benz(a)anthracene	mg/kg	0.0317	0.385	<0.050	0.090	0.206	0.108	0.070
	Benzo(a)pyrene	mg/kg	0.0319	0.782	<0.050	0.060	0.123	0.064	<0.050
	Benzo(b&j)fluoranthene	mg/kg	-	-	0.130	0.248	0.507	0.268	0.184
	Benzo(b+j+k)fluoranthene	mg/kg	-	-	0.130	0.248	0.567	0.268	0.184
	Benzo(g,h,i)perylene	mg/kg	0.170	3.20	0.056	0.094	0.187	0.097	0.065
	Benzo(k)fluoranthene	mg/kg	0.240	13.4	<0.050	<0.050	0.060	<0.050	<0.050
	Chrysene	mg/kg	0.0571	0.862	0.303	0.537	1.13	0.579	0.43
	Dibenz(a,h)anthracene	mg/kg	0.00622	0.135	<0.050	<0.050	0.091	<0.050	<0.050
	Fluoranthene	mg/kg	0.111	2.36	<0.050	0.073	0.162	0.084	0.057
	Fluorene	mg/kg	0.0212	0.144	0.214	0.395	0.947	0.476	0.32
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.200	3.20	<0.050	<0.050	0.059	<0.050	<0.050
	1-Methylnaphthalene	mg/kg	-	-	1.32	2.38	5.49	2.80	1.94
	2-Methylnaphthalene	mg/kg	0.0202	0.201	2.55	4.65	10.8	5.52	3.81
	Naphthalene	mg/kg	0.0346	0.391	0.858	1.57	3.74	1.84	1.28
	Phenanthrene	mg/kg	0.0419	0.515	0.982	1.79	4.09	2.15	1.47
	Pyrene	mg/kg	0.0530	0.875	0.105	0.180	0.386	0.210	0.148
	Quinoline	mg/kg	-	-	<0.050	<0.050	<0.050	<0.050	<0.050

- Concentration is <LRL and LRL exceeds the lower WSQG.
- Concentration is <LRL and LRL exceeds the upper WSQG.
- Concentration exceeds the lower WSQG.
- Concentration exceeds the upper WSQG.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; % = percent; - = no data/not applicable; > = greater than; mm = millimetres; < = less than; µm = micrometres; mg/kg = milligrams per kilogram; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.9: Bulk Sediment Quality at Biological Monitoring Areas on Greenhills and Gardine Creeks, September 2022

	Constituent	Units	BC WSQG [a]		Gardine Creek				
					RG_GANF				
			Lower	Upper	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5
Physical Tests	Moisture	%	-	-	42.6	46.9	39.0	48.5	49.8
	pH (1:2)	pH	-	-	8.15	8.20	8.16	8.24	8.16
Particle Size	% Gravel (>2 mm)	%	-	-	<1.0	<1.0	4.9	<1.0	1.1
	% Sand (2.00 mm to 1.00 mm)	%	-	-	1.6	2.2	11.9	1	5.4
	% Sand (1.00 mm to 0.50 mm)	%	-	-	5.6	3.8	10.6	2.3	9.4
	% Sand (0.50 mm to 0.25 mm)	%	-	-	9.1	11.5	9.3	3.1	10.3
	% Sand (0.25 mm to 0.125 mm)	%	-	-	12	17.3	11.2	6.6	11.4
	% Sand (0.125 mm to 0.063 mm)	%	-	-	7.5	10.7	6.2	4.8	5.9
	% Silt (0.063 mm to 0.0312 mm)	%	-	-	12.5	14.3	9	11.4	11.9
	% Silt (0.0312 mm to 0.004 mm)	%	-	-	32	27.3	22.6	42.2	28.6
	% Clay (<4 µm)	%	-	-	19.7	12.4	14.3	28.2	16
Organic Carbon	Total Organic Carbon	%	-	-	16.5	13.3	11.5	23.8	17.8
Metals	Aluminum (Al)	mg/kg	-	-	8,260	8,980	6,830	5,980	6,680
	Antimony (Sb)	mg/kg	-	-	0.75	0.58	0.63	0.68	0.67
	Arsenic (As)	mg/kg	5.90	17.0	5.56	5.28	4.55	4.24	5.46
	Barium (Ba)	mg/kg	-	-	225	229	212	216	206
	Beryllium (Be)	mg/kg	-	-	0.70	0.74	0.59	0.59	0.66
	Bismuth (Bi)	mg/kg	-	-	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)	mg/kg	-	-	8.7	9.0	6.0	<5.0	<5.0
	Cadmium (Cd)	mg/kg	0.600	3.50	0.727	0.689	0.681	0.711	0.714
	Calcium (Ca)	mg/kg	-	-	59,300	58,600	82,100	83,100	65,600
	Chromium (Cr)	mg/kg	37.3	90.0	11.9	12.4	9.78	8.86	9.80
	Cobalt (Co)	mg/kg	-	-	7.31	7.68	7.02	6.79	8.27
	Copper (Cu)	mg/kg	35.7	197	15.7	14.7	14.4	14.9	16.0
	Iron (Fe)	mg/kg	21,200	43,766	14,500	16,300	12,700	10,800	15,600
	Lead (Pb)	mg/kg	35.0	91.3	10.7	10.7	9.64	9.43	11.1
	Lithium (Li)	mg/kg	-	-	11.6	12.6	10.5	9.4	11.3
	Magnesium (Mg)	mg/kg	-	-	3,620	3,750	3,830	3,580	3,930
	Manganese (Mn)	mg/kg	460	1,100	380	478	402	346	516
	Mercury (Hg)	mg/kg	0.170	0.486	0.0509	0.0391	0.0448	0.0610	0.0532
	Molybdenum (Mo)	mg/kg	25.0	23,000	1.24	1.09	1.09	1.18	1.23
	Nickel (Ni)	mg/kg	16.0	75.0	25.4	24.7	23.1	21.9	25.8
	Phosphorus (P)	mg/kg	-	-	976	1,010	846	831	1,000
	Potassium (K)	mg/kg	-	-	2,030	2,090	1,590	1,390	1,360
	Selenium (Se)	mg/kg	2 [b]		1.54	1.21	1.21	1.31	1.19
	Silver (Ag)	mg/kg	0.500	-	0.30	0.21	0.24	0.25	0.22
	Sodium (Na)	mg/kg	-	-	69	74	70	66	67
	Strontium (Sr)	mg/kg	-	-	64.0	64.9	70.1	72.0	62.9
	Sulfur (S)	mg/kg	-	-	1,100	1,100	1,500	1,600	1,200
	Thallium (Tl)	mg/kg	-	-	0.154	0.159	0.131	0.112	0.124
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)	mg/kg	-	-	15.0	14.2	11.6	10.8	11.8
	Tungsten (W)	mg/kg	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U)	mg/kg	-	-	0.815	0.763	0.747	0.751	0.792
	Vanadium (V)	mg/kg	-	-	27.5	28.2	22.5	21.2	22.3
	Zinc (Zn)	mg/kg	123	315	90.7	88.5	79.2	78.0	91.8
	Zirconium (Zr)	mg/kg	-	-	<1.0	<1.0	1.2	<1.0	1.0
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	0.00671	0.0889	0.256	0.138	0.239	0.580	0.508
	Acenaphthylene	mg/kg	0.00587	0.128	<0.050	<0.050	<0.050	0.095	0.084
	Acridine	mg/kg	-	-	0.429	0.207	0.346	0.905	0.829
	Anthracene	mg/kg	0.0469	0.245	<0.050	<0.050	<0.050	<0.050	<0.050
	Benz(a)anthracene	mg/kg	0.0317	0.385	0.133	0.051	0.129	0.316	0.299
	Benzo(a)pyrene	mg/kg	0.0319	0.782	0.092	<0.050	0.064	0.178	0.163
	Benzo(b&j)fluoranthene	mg/kg	-	-	0.301	0.118	0.223	0.568	0.541
	Benzo(b+j+k)fluoranthene	mg/kg	-	-	0.366	0.118	0.313	0.682	0.762
	Benzo(g,h,i)perylene	mg/kg	0.170	3.20	0.060	<0.050	0.066	0.196	0.213
	Benzo(k)fluoranthene	mg/kg	0.240	13.4	0.065	<0.050	0.090	0.114	0.221
	Chrysene	mg/kg	0.0571	0.862	0.715	0.314	0.552	1.40	1.29
	Dibenz(a,h)anthracene	mg/kg	0.00622	0.135	0.056	<0.050	<0.050	0.111	0.103
	Fluoranthene	mg/kg	0.111	2.36	0.114	0.053	0.099	0.246	0.222
	Fluorene	mg/kg	0.0212	0.144	0.615	0.338	0.568	1.40	1.25
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.200	3.20	<0.050	<0.050	<0.050	0.074	0.071
	1-Methylnaphthalene	mg/kg	-	-	3.48	2.13	3.29	7.80	6.97
	2-Methylnaphthalene	mg/kg	0.0202	0.201	6.34	3.80	6.14	14.5	13.0
	Naphthalene	mg/kg	0.0346	0.391	2.26	1.50	2.26	5.15	4.66
	Phenanthrene	mg/kg	0.0419	0.515	2.45	1.32	2.24	5.36	4.94
	Pyrene	mg/kg	0.0530	0.875	0.231	0.114	0.200	0.472	0.431
	Quinoline	mg/kg	-	-	<0.050	<0.050	<0.050	<0.050	<0.050

Concentration is <LRL and LRL exceeds the lower WSQG.
Concentration is <LRL and LRL exceeds the upper WSQG.
Concentration exceeds the lower WSQG.
Concentration exceeds the upper WSQG.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; % = percent; - = no data/not applicable; > = greater than; mm = millimetres; < = less than; µm = micrometres; mg/kg = milligrams per kilogram; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.9: **Bulk Sediment Quality at Biological Monitoring Areas on Greenhills and Gardine Creeks, September 2022**

	Constituent	Units	BC WSQG [a]		Greenhills Creek Sedimentation Pond					
					RG_GHP					
			Lower	Upper	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Physical Tests	Moisture	%	-	-	73.0	69.0	60.5	65.5	61.2	65.8
	pH (1:2)	pH	-	-	7.80	8.09	7.94	8.04	7.85	7.95
Particle Size	% Gravel (>2 mm)	%	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	% Sand (2.00 mm to 1.00 mm)	%	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	% Sand (1.00 mm to 0.50 mm)	%	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	% Sand (0.50 mm to 0.25 mm)	%	-	-	<1.0	4.0	<1.0	<1.0	<1.0	<1.0
	% Sand (0.25 mm to 0.125 mm)	%	-	-	<1.0	8.9	<1.0	2.1	<1.0	<1.0
	% Sand (0.125 mm to 0.063 mm)	%	-	-	6.8	9.9	1.2	4.8	<1.0	1.5
	% Silt (0.063 mm to 0.0312 mm)	%	-	-	23.4	15.7	13.0	17.9	13.8	20.5
	% Silt (0.0312 mm to 0.004 mm)	%	-	-	48.5	40.9	50.9	45.6	50.2	47.9
	% Clay (<4 µm)	%	-	-	20.2	19.6	34.6	29.2	34.7	28.8
Organic Carbon	Total Organic Carbon	%	-	-	17.5	18.8	17.8	25.1	18.7	26.1
Metals	Aluminum (Al)	mg/kg	-	-	7,280	5120	8,320	7,180	8,840	7,720
	Antimony (Sb)	mg/kg	-	-	1.23	1.11	1.25	1.02	1.21	1.11
	Arsenic (As)	mg/kg	5.90	17.0	4.94	3.37	6.30	5.28	6.71	5.77
	Barium (Ba)	mg/kg	-	-	400	259	343	294	346	285
	Beryllium (Be)	mg/kg	-	-	0.63	0.46	0.83	0.70	0.86	0.81
	Bismuth (Bi)	mg/kg	-	-	<0.20	<0.20	0.20	<0.20	0.20	<0.20
	Boron (B)	mg/kg	-	-	5.7	<5.0	5.9	5.6	<5.0	<5.0
	Cadmium (Cd)	mg/kg	0.600	3.50	1.46	1.32	1.40	1.16	1.52	1.30
	Calcium (Ca)	mg/kg	-	-	104,000	180,000	48,300	55,700	60,300	72,000
	Chromium (Cr)	mg/kg	37.3	90.0	11.4	8.18	13.5	10.9	13.7	12.0
	Cobalt (Co)	mg/kg	-	-	8.92	6.85	11.3	8.58	12.2	9.74
	Copper (Cu)	mg/kg	35.7	197	22.2	17.0	26.7	23.5	29.9	25.0
	Iron (Fe)	mg/kg	21,200	43,766	11,500	7,860	14,500	11,400	14,600	11,800
	Lead (Pb)	mg/kg	35.0	91.3	10.7	8.13	13.7	11.6	14.7	12.3
	Lithium (Li)	mg/kg	-	-	7.2	5.3	8.9	7.8	8.3	7.8
	Magnesium (Mg)	mg/kg	-	-	5,900	5,620	4,920	4,440	4,880	4,500
	Manganese (Mn)	mg/kg	460	1,100	216	176	530	215	671	585
	Mercury (Hg)	mg/kg	0.170	0.486	0.0822	0.0628	0.117	0.0933	0.111	0.0930
	Molybdenum (Mo)	mg/kg	25.0	23,000	1.54	1.15	1.68	1.36	1.83	1.59
	Nickel (Ni)	mg/kg	16.0	75.0	64.5	64.4	66.6	59.0	70.6	67.4
	Phosphorus (P)	mg/kg	-	-	847	697	1,040	964	1,040	874
	Potassium (K)	mg/kg	-	-	1,730	1,260	1,910	1,730	2,140	1,880
	Selenium (Se)	mg/kg	2 [b]		80.9	76.2	16.8	28.6	14.2	9.02
	Silver (Ag)	mg/kg	0.500	-	0.35	0.26	0.45	0.39	0.44	0.40
	Sodium (Na)	mg/kg	-	-	81	95	66	65	70	69
	Strontium (Sr)	mg/kg	-	-	83.7	152	59.0	58.8	65.7	67.7
	Sulfur (S)	mg/kg	-	-	6,600	3,400	1,200	1,800	1,200	1,400
	Thallium (Tl)	mg/kg	-	-	0.181	0.113	0.146	0.102	0.118	0.096
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)	mg/kg	-	-	9.0	7.4	10.5	8.6	5.9	6.7
	Tungsten (W)	mg/kg	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U)	mg/kg	-	-	2.87	4.16	1.24	1.42	1.25	1.08
	Vanadium (V)	mg/kg	-	-	26.6	19.5	31.5	28.0	34.4	29.9
	Zinc (Zn)	mg/kg	123	315	128	106	138	117	148	128
	Zirconium (Zr)	mg/kg	-	-	1.8	1.1	<1.0	1.0	<1.0	<1.0
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	0.00671	0.0889	0.540	0.430	0.435	0.738	0.469	0.751
	Acenaphthylene	mg/kg	0.00587	0.128	0.078	0.058	0.066	0.101	0.068	0.111
	Acridine	mg/kg	-	-	0.929	0.768	0.802	1.37	0.879	1.46
	Anthracene	mg/kg	0.0469	0.245	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
	Benz(a)anthracene	mg/kg	0.0317	0.385	0.354	0.245	0.260	0.398	0.276	0.416
	Benzo(a)pyrene	mg/kg	0.0319	0.782	0.232	0.172	0.173	0.263	0.182	0.29
	Benzo(b&j)fluoranthene	mg/kg	-	-	0.857	0.664	0.733	0.979	0.715	0.997
	Benzo(b+j+k)fluoranthene	mg/kg	-	-	0.939	0.736	0.833	1.09	0.795	1.09
	Benzo(g,h,i)perylene	mg/kg	0.170	3.20	0.257	0.203	0.217	0.289	0.208	0.324
	Benzo(k)fluoranthene	mg/kg	0.240	13.4	0.082	0.072	0.10	0.11	0.080	0.091
	Chrysene	mg/kg	0.0571	0.862	1.85	1.30	1.47	2.04	1.49	2.21
	Dibenz(a,h)anthracene	mg/kg	0.00622	0.135	0.157	0.119	0.122	0.173	0.122	0.188
	Fluoranthene	mg/kg	0.111	2.36	0.298	0.197	0.220	0.306	0.229	0.311
	Fluorene	mg/kg	0.0212	0.144	1.36	1.12	1.10	2.01	1.26	2.08
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.200	3.20	0.130	0.098	0.093	0.133	0.096	0.137
	1-Methylnaphthalene	mg/kg	-	-	7.02	5.49	5.48	9.71	5.86	10.0
	2-Methylnaphthalene	mg/kg	0.0202	0.201	12.5	10.0	9.54	18.0	10.1	18.2
	Naphthalene	mg/kg	0.0346	0.391	4.09	3.33	2.98	6.31	3.16	6.28
	Phenanthrene	mg/kg	0.0419	0.515	5.25	4.11	4.40	6.90	4.68	7.25
	Pyrene	mg/kg	0.0530	0.875	0.540	0.434	0.489	0.680	0.481	0.684
	Quinoline	mg/kg	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

Concentration is <LRL and LRL exceeds the lower WSQG.
Concentration is <LRL and LRL exceeds the upper WSQG.
Concentration exceeds the lower WSQG.
Concentration exceeds the upper WSQG.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; % = percent; - = no data/not applicable; > = greater than; mm = millimetres; < = less than; µm = micrometres; mg/kg = milligrams per kilogram; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.9: Bulk Sediment Quality at Biological Monitoring Areas on Greenhills and Gardine Creeks, September 2022

	Constituent	Units	BC WSQG [a]		Lower Greenhills Creek				
					RG_GHBP				
			Lower	Upper	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5
Physical Tests	Moisture	%	-	-	40.5	57.6	44.1	53.3	60.8
	pH (1:2)	pH	-	-	8.40	8.26	8.31	8.21	8.34
Particle Size	% Gravel (>2 mm)	%	-	-	<1.0	<1.0	<1.0	2.1	5.0
	% Sand (2.00 mm to 1.00 mm)	%	-	-	2.0	2.4	<1.0	7.1	12.8
	% Sand (1.00 mm to 0.50 mm)	%	-	-	11.2	8.3	<1.0	5.9	17.0
	% Sand (0.50 mm to 0.25 mm)	%	-	-	21.3	15.0	1.8	7.4	13.3
	% Sand (0.25 mm to 0.125 mm)	%	-	-	13.4	9.9	5.6	12.3	9.6
	% Sand (0.125 mm to 0.063 mm)	%	-	-	5.3	4.3	5.4	6.3	4.6
	% Silt (0.063 mm to 0.0312 mm)	%	-	-	10.5	10.6	18.6	14.7	6.8
	% Silt (0.0312 mm to 0.004 mm)	%	-	-	21.4	25.5	37.9	27.1	15.9
	% Clay (<4 µm)	%	-	-	14.9	24.0	30.5	17.1	15.0
Organic Carbon	Total Organic Carbon	%	-	-	8.79	12.3	16.4	10.4	8.96
Metals	Aluminum (Al)	mg/kg	-	-	9,390	6,480	7,440	6,190	4,100
	Antimony (Sb)	mg/kg	-	-	0.83	0.83	0.78	0.62	0.33
	Arsenic (As)	mg/kg	5.90	17.0	6.95	6.26	7.36	4.45	2.86
	Barium (Ba)	mg/kg	-	-	196	173	223	232	136
	Beryllium (Be)	mg/kg	-	-	0.79	0.68	0.68	0.58	0.36
	Bismuth (Bi)	mg/kg	-	-	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)	mg/kg	-	-	10	5.8	5.8	6.3	6.2
	Cadmium (Cd)	mg/kg	0.600	3.50	1.01	1.20	1.40	1.23	1.10
	Calcium (Ca)	mg/kg	-	-	41,500	50,400	62,700	71,300	107,000
	Chromium (Cr)	mg/kg	37.3	90.0	14.1	10.8	12.4	9.85	6.25
	Cobalt (Co)	mg/kg	-	-	8.55	7.62	9.61	7.51	5.08
	Copper (Cu)	mg/kg	35.7	197	17.0	16.7	19.0	16.0	10.1
	Iron (Fe)	mg/kg	21,200	43,766	20,400	17,900	21,800	12,900	9,010
	Lead (Pb)	mg/kg	35.0	91.3	13.2	12.6	11.7	10.3	6.32
	Lithium (Li)	mg/kg	-	-	13.9	11.7	12.0	9.2	6.4
	Magnesium (Mg)	mg/kg	-	-	6,020	5,310	6,010	5,530	5,010
	Manganese (Mn)	mg/kg	460	1,100	520	433	701	435	281
	Mercury (Hg)	mg/kg	0.170	0.486	0.0408	0.0491	0.0422	0.0545	0.0305
	Molybdenum (Mo)	mg/kg	25.0	23,000	1.66	1.84	1.52	1.22	0.72
	Nickel (Ni)	mg/kg	16.0	75.0	63.5	51.6	68.9	65.3	46.3
	Phosphorus (P)	mg/kg	-	-	1,290	1,240	1,190	1,080	725
	Potassium (K)	mg/kg	-	-	2,050	1,300	1,990	1,390	1,020
	Selenium (Se)	mg/kg	2 [b]		6.85	5.54	6.14	8.40	7.66
	Silver (Ag)	mg/kg	0.500	-	0.20	0.24	0.20	0.24	0.13
	Sodium (Na)	mg/kg	-	-	76	59	104	72	69
	Strontium (Sr)	mg/kg	-	-	49.4	50.4	55.6	58.7	60.8
	Sulfur (S)	mg/kg	-	-	<1,000	<1,000	<1,000	1,400	1,700
	Thallium (Tl)	mg/kg	-	-	0.237	0.192	0.192	0.180	0.107
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)	mg/kg	-	-	15.8	10.3	11.4	9.8	9.1
	Tungsten (W)	mg/kg	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U)	mg/kg	-	-	1.04	1.13	1.06	1.36	0.959
	Vanadium (V)	mg/kg	-	-	30.4	23.0	26.2	21.8	14.0
	Zinc (Zn)	mg/kg	123	315	132	136	149	124	103
	Zirconium (Zr)	mg/kg	-	-	1.2	1.1	1.0	1.1	<1.0
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	0.00671	0.0889	0.067	0.133	0.178	0.088	0.175
	Acenaphthylene	mg/kg	0.00587	0.128	<0.050	<0.050	<0.050	<0.050	<0.050
	Acridine	mg/kg	-	-	0.094	0.270	0.356	0.176	0.360
	Anthracene	mg/kg	0.0469	0.245	<0.050	<0.050	<0.050	<0.050	<0.050
	Benz(a)anthracene	mg/kg	0.0317	0.385	<0.050	0.085	0.102	0.056	0.105
	Benzo(a)pyrene	mg/kg	0.0319	0.782	<0.050	<0.050	0.055	<0.050	0.056
	Benzo(b&j)fluoranthene	mg/kg	-	-	0.076	0.191	0.218	0.115	0.231
	Benzo(b+j+k)fluoranthene	mg/kg	-	-	0.076	0.191	0.218	0.115	0.231
	Benzo(g,h,i)perylene	mg/kg	0.170	3.20	<0.050	0.076	0.090	0.054	0.096
	Benzo(k)fluoranthene	mg/kg	0.240	13.4	<0.050	<0.050	<0.050	<0.050	<0.050
	Chrysene	mg/kg	0.0571	0.862	0.208	0.442	0.530	0.286	0.488
	Dibenz(a,h)anthracene	mg/kg	0.00622	0.135	<0.050	<0.050	<0.050	<0.050	0.050
	Fluoranthene	mg/kg	0.111	2.36	<0.050	0.081	0.094	0.051	0.103
	Fluorene	mg/kg	0.0212	0.144	0.144	0.319	0.430	0.213	0.438
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.200	3.20	<0.050	<0.050	<0.050	<0.050	<0.050
	1-Methylnaphthalene	mg/kg	-	-	0.847	1.59	2.14	1.09	2.19
	2-Methylnaphthalene	mg/kg	0.0202	0.201	1.45	2.77	3.80	1.84	3.94
	Naphthalene	mg/kg	0.0346	0.391	0.426	0.755	1.07	0.509	1.16
	Phenanthrene	mg/kg	0.0419	0.515	0.650	1.73	2.17	1.22	2.03
	Pyrene	mg/kg	0.0530	0.875	0.0640	0.134	0.161	0.088	0.159
	Quinoline	mg/kg	-	-	<0.050	<0.050	<0.050	<0.050	<0.050

Concentration is <LRL and LRL exceeds the lower WSQG.
Concentration is <LRL and LRL exceeds the upper WSQG.
Concentration exceeds the lower WSQG.
Concentration exceeds the upper WSQG.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; % = percent; - = no data/not applicable; > = greater than; mm = millimetres; < = less than; µm = micrometres; mg/kg = milligrams per kilogram; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.10: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GAUT-1 on Gardine Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	595	1,850	8,080	<2,545	<10,625	<645	9,440
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.700	<0.4	<1.1	<0.2	0.900
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.0540	0.516	0.408	<5	<1.03	<6.03	0.570	6.89
Barium (Ba)	mg/kg	-	-	44.2	35.7	51.3	25.3	120	156	276	87.0	318
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.300	<0.2	0.380	<0.9	<1.28	<0.5	0.830
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	7.60
Cadmium (Cd)	mg/kg	0.600	3.50	0.152	0.166	0.385	0.0800	0.0740	0.783	0.857	0.551	0.809
Calcium (Ca)	mg/kg	-	-	3,750	2,760	3,020	1,040	678	10,570	11,248	5,780	11,800
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.800	3.66	11.4	<9.96	<21.4	<5.8	13.3
Cobalt (Co)	mg/kg	-	-	0.170	0.700	4.46	1.10	2.85	6.43	9.28	5.16	11.5
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.690	6.38	12.3	<8.07	<20.4	<1.19	19.8
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,810	1,890	11,600	<5,800	<17,400	<3,860	20,400
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.26	0.800	7.04	<5.06	<12.1	<3.76	14.0
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	7.00	<20	<27	<10	13.5
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	4,410
Manganese (Mn)	mg/kg	460	1,100	36.1	101	218	19.9	43.4	375	418	319	548
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0623
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.960	<2	<2.96	<1	1.40
Nickel (Ni)	mg/kg	16.0	75.0	<0.5	<2	11.3	6.08	11.4	<19.9	<31.3	<13.3	33.8
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	183	-	-	<283	<283	<233	1,340
Potassium (K)	mg/kg	-	-	140	-	-	-	-	140	140	-	1,850
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	<0.2	0.900	0.460	<1.5	<1.96	<0.4	1.18
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	0.100	<0.1	0.120	<0.4	<0.52	<0.2	0.250
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	63.0
Strontium (Sr)	mg/kg	-	-	12.9	5.40	6.18	4.75	19.1	29.2	48.3	11.6	51.0
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	<1,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.137	<0.2	<0.337	<0.1	0.178
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	1.70	16.8	<8.7	<25.5	<6	17.1
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	<0.05	0.161	0.255	0.346	<0.516	<0.862	<0.211	0.825
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.78	4.26	28.9	<7.44	<36.3	<2.98	29.4
Zinc (Zn)	mg/kg	123	315	<1	5.00	26.5	8.90	62.7	<41.4	<104	31.5	114

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.11: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GAUT-2 on Gardine Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	609	1,740	7,710	<2,449	<10,159	<659	8,130
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.760	<0.4	<1.16	<0.2	0.890
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.0580	0.556	0.495	<5	<1.16	<6.16	0.614	6.99
Barium (Ba)	mg/kg	-	-	46.1	35.0	50.8	23.7	126	156	282	85.8	312
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.290	<0.2	0.330	<0.89	<1.22	<0.49	0.780
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	5.40
Cadmium (Cd)	mg/kg	0.600	3.50	0.173	0.190	0.445	0.0850	0.0740	0.893	0.967	0.635	0.918
Calcium (Ca)	mg/kg	-	-	3,800	3,010	3,320	1,050	518	11,180	11,698	6,330	12,000
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.900	3.77	11.0	<10.2	<21.2	<5.9	11.6
Cobalt (Co)	mg/kg	-	-	0.240	0.710	4.17	1.03	2.78	6.15	8.93	4.88	11.1
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.650	7.32	12.6	<8.97	<21.6	<1.15	20.0
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,680	1,960	10,400	<5,740	<16,140	<3,730	19,500
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.19	0.880	6.99	<5.07	<12.1	<3.69	13.6
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	6.40	<20	<26.4	<10	12.4
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,920
Manganese (Mn)	mg/kg	460	1,100	56.7	96.6	191	17.1	39.9	361	401	288	622
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0668
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	1.07	<2	<3.07	<1	1.42
Nickel (Ni)	mg/kg	16.0	75.0	<0.5	<2	10.6	6.02	11.4	<19.1	<30.5	<12.6	33.1
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	142	-	-	<242	<242	<192	1,300
Potassium (K)	mg/kg	-	-	130	-	-	-	-	130	130	-	1,500
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	<0.2	1.01	0.350	<1.61	<1.96	<0.4	1.22
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	0.100	<0.1	0.140	<0.4	<0.54	<0.2	0.270
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	56.0
Strontium (Sr)	mg/kg	-	-	12.6	5.80	6.63	4.64	20.8	29.7	50.5	12.4	47.8
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	<1,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.145	<0.2	<0.345	<0.1	0.140
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	2.20	24.8	<9.2	<34	<6	10.1
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.0510	0.178	0.279	0.339	<0.558	<0.897	0.229	0.845
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.90	4.45	28.6	<7.75	<36.4	<3.1	26.5
Zinc (Zn)	mg/kg	123	315	<1	4.70	26.4	9.10	59.9	<41.2	<101	31.1	113

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.12: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GAUT-3 on Gardine Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	579	2,260	5,480	<2,939	<8,419	<629	6,860
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.730	<0.4	<1.13	<0.2	0.860
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.105	0.686	0.886	<5	<1.73	<6.73	0.791	5.22
Barium (Ba)	mg/kg	-	-	55.9	31.3	50.9	25.6	114	164	278	82.2	306
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.350	<0.2	0.320	<0.95	<1.27	<0.55	0.730
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	5.40
Cadmium (Cd)	mg/kg	0.600	3.50	0.201	0.190	0.560	0.118	0.0600	1.07	1.13	0.750	0.978
Calcium (Ca)	mg/kg	-	-	5,520	2,990	3,460	1,140	173	13,110	13,283	6,450	13,400
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.750	5.43	7.90	<11.7	<19.6	<5.75	11.1
Cobalt (Co)	mg/kg	-	-	0.300	0.790	3.18	1.40	2.18	5.67	7.85	3.97	7.57
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.530	12.9	10.8	<14.4	<25.2	<1.03	21.6
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,310	2,960	6,430	<6,370	<12,800	<3,360	12,700
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	2.82	1.90	6.04	<5.72	<11.8	<3.32	11.6
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	<20	<25	<10	8.90
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,420
Manganese (Mn)	mg/kg	460	1,100	109	107	118	15.0	26.5	349	376	225	357
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0898
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.860	<2	<2.86	<1	1.27
Nickel (Ni)	mg/kg	16.0	75.0	<0.5	<2	9.49	8.69	8.30	<20.7	<29	<11.5	25.8
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	180	-	-	<280	<280	<230	1,020
Potassium (K)	mg/kg	-	-	140	-	-	-	-	140	140	-	1,380
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	<0.2	1.64	0.430	<2.24	<2.67	<0.4	1.57
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.280	<0.4	<0.68	<0.2	0.370
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	54.0
Strontium (Sr)	mg/kg	-	-	16.8	5.60	6.87	4.86	19.1	34.1	53.2	12.5	50.7
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	<1,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.118	<0.2	<0.318	<0.1	0.135
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	3.90	24.6	<10.9	<35.5	<6	13.0
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.0760	0.217	0.432	0.281	<0.775	<1.06	0.293	1.00
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.42	6.59	23.0	<9.41	<32.4	<2.62	24.4
Zinc (Zn)	mg/kg	123	315	<1	4.60	26.1	14.6	45.8	<46.3	<92.1	30.7	90.7

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.13: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GAUT-4 on Gardine Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	628	2,000	6,410	<2,728	<9,138	<678	9,840
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.690	<0.4	<1.09	<0.2	0.970
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.0680	0.550	0.596	<5	<1.26	<6.26	0.618	6.81
Barium (Ba)	mg/kg	-	-	48.6	36.2	53.6	25.3	126	164	290	89.8	347
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.300	<0.2	0.310	<0.9	<1.21	<0.5	0.810
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	8.20
Cadmium (Cd)	mg/kg	0.600	3.50	0.166	0.193	0.489	0.0940	0.0730	0.942	1.01	0.682	0.958
Calcium (Ca)	mg/kg	-	-	4,470	2,870	3,300	1,140	348	11,780	12,128	6,170	12,700
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.750	4.21	9.20	<10.5	<19.7	<5.75	14.6
Cobalt (Co)	mg/kg	-	-	0.220	0.800	4.08	1.24	2.70	6.34	9.04	4.88	10.7
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.570	8.60	11.9	<10.2	<22.1	<1.07	21.0
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,680	2,380	9,620	<6,160	<15,780	<3,730	18,800
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.05	1.14	6.94	<5.19	<12.1	<3.55	13.4
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	5.40	<20	<25.4	<10	12.3
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	4,090
Manganese (Mn)	mg/kg	460	1,100	59.6	111	195	19.4	38.0	385	423	306	508
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0737
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.900	<2	<2.9	<1	1.45
Nickel (Ni)	mg/kg	16.0	75.0	<0.5	<2	10.8	6.96	10.4	<20.3	<30.7	<12.8	33.3
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	132	-	-	<232	<232	<182	1,270
Potassium (K)	mg/kg	-	-	150	-	-	-	-	150	150	-	2,060
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	<0.2	1.17	0.480	<1.77	<2.25	<0.4	1.49
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.180	<0.4	<0.58	<0.2	0.300
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	66.0
Strontium (Sr)	mg/kg	-	-	15.0	5.70	6.72	4.95	18.1	32.4	50.5	12.4	52.4
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	<1,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.122	<0.2	<0.322	<0.1	0.167
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	2.30	19.4	<9.3	<28.7	<6	18.3
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.0590	0.188	0.329	0.291	<0.626	<0.917	0.247	0.941
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.63	5.37	24.3	<8.4	<32.7	<2.83	33.6
Zinc (Zn)	mg/kg	123	315	<1	5.30	26.8	10.5	57.7	<43.6	<101	32.1	124

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.14: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GAUT-5 on Gardine Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	592	1,950	7,120	<2,642	<9,762	<642	10,600
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.740	<0.4	<1.14	<0.2	0.880
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.535	0.723	<5	<1.36	<6.36	<0.585	6.46
Barium (Ba)	mg/kg	-	-	46.8	34.7	54.6	25.1	130	161	291	89.3	370
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.270	<0.2	0.360	<0.87	<1.23	<0.47	0.810
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	9.50
Cadmium (Cd)	mg/kg	0.600	3.50	0.177	0.175	0.422	0.0800	0.0790	0.854	0.933	0.597	0.891
Calcium (Ca)	mg/kg	-	-	4,530	3,010	3,270	1,120	403	11,930	12,333	6,280	12,200
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.710	4.05	10.0	<10.3	<20.3	<5.71	14.9
Cobalt (Co)	mg/kg	-	-	0.170	0.600	3.72	1.18	2.54	5.67	8.21	4.32	10.3
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.550	8.14	11.0	<9.69	<20.7	<1.05	20.4
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,560	2,490	8,610	<6,150	<14,760	<3,610	18,700
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	2.86	1.22	6.40	<5.08	<11.5	<3.36	12.7
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	5.60	<20	<25.6	<10	13.1
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	4,100
Manganese (Mn)	mg/kg	460	1,100	40.4	97.1	262	23.4	34.5	423	457	359	486
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0748
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.940	<2	<2.94	<1	1.34
Nickel (Ni)	mg/kg	16.0	75.0	<0.5	<2	10.8	6.78	9.90	<20.1	<30	<12.8	31.2
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	143	-	-	<243	<243	<193	1,300
Potassium (K)	mg/kg	-	-	140	-	-	-	-	140	140	-	2,270
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	<0.2	1.11	0.460	<1.71	<2.17	<0.4	1.32
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.160	<0.4	<0.56	<0.2	0.270
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	70.0
Strontium (Sr)	mg/kg	-	-	14.6	5.60	6.59	4.97	19.2	31.8	51	12.2	50.6
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	<1,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.155	<0.2	<0.355	<0.1	0.169
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	2.40	25.2	<9.4	<34.6	<6	17.6
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.0670	0.195	0.338	0.325	<0.65	<0.975	0.262	0.881
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.64	5.32	26.9	<8.36	<35.3	<2.84	34.0
Zinc (Zn)	mg/kg	123	315	<1	4.70	24.4	10.2	54.4	<40.3	<94.7	29.1	110

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.15: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GANF-1 on Gardine Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	598	1,630	6,540	<2,328	<8,868	<648	8,260
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.690	<0.4	<1.09	<0.2	0.750
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.0880	0.536	0.460	<5	<1.13	<6.13	0.624	5.56
Barium (Ba)	mg/kg	-	-	22.9	52.8	39.3	23.6	132	139	271	92.1	225
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.290	<0.2	0.310	<0.89	<1.2	<0.49	0.700
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	8.70
Cadmium (Cd)	mg/kg	0.600	3.50	0.109	0.295	0.396	0.0730	0.0750	0.873	0.948	0.691	0.727
Calcium (Ca)	mg/kg	-	-	3,750	41,800	7,900	1,220	423	54,670	55,093	49,700	59,300
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.820	3.62	9.40	<9.94	<19.3	<5.82	11.9
Cobalt (Co)	mg/kg	-	-	0.260	0.920	3.44	1.02	2.45	5.64	8.09	4.36	7.31
Copper (Cu)	mg/kg	35.7	197	1.09	<0.5	<0.5	7.33	12.2	<9.42	<21.6	<1	15.7
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,580	1,970	8,370	<5,650	<14,020	<3,630	14,500
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.34	1.12	5.93	<5.46	<11.4	<3.84	10.7
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	5.10	<20	<25.1	<10	11.6
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,620
Manganese (Mn)	mg/kg	460	1,100	86.0	104	105	10.9	32.5	306	338	209	380
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0509
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.810	<2	<2.81	<1	1.24
Nickel (Ni)	mg/kg	16.0	75.0	0.500	2.10	10.0	5.95	9.30	18.6	27.8	12.1	25.4
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	180	-	-	<280	<280	<230	976
Potassium (K)	mg/kg	-	-	160	-	-	-	-	160	160	-	2,030
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	<0.2	1.55	0.450	<2.15	<2.6	<0.4	1.54
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.190	<0.4	<0.59	<0.2	0.300
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	69.0
Strontium (Sr)	mg/kg	-	-	7.35	24.9	7.78	4.34	20.7	44.4	65.1	32.7	64.0
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,100
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.129	<0.2	<0.329	<0.1	0.154
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	17.1	14.3	<24.1	<38.4	<6	15.0
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.168	0.191	0.255	0.251	<0.664	<0.915	0.359	0.815
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.77	4.97	23.3	<8.14	<31.4	<2.97	27.5
Zinc (Zn)	mg/kg	123	315	<1	6.90	31.3	7.90	52.0	<47.1	<99.1	38.2	90.7

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.16: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GANF-2 on Gardine Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	490	1,630	6,910	<2,220	<9,130	<540	8,980
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.620	<0.4	<1.02	<0.2	0.580
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.0660	0.450	0.446	<5	<1.01	<6.01	0.516	5.28
Barium (Ba)	mg/kg	-	-	25.9	52.3	32.0	23.4	106	134	240	84.3	229
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.280	<0.2	0.330	<0.88	<1.21	<0.48	0.740
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	9.00
Cadmium (Cd)	mg/kg	0.600	3.50	0.102	0.231	0.335	0.0670	0.0730	0.735	0.808	0.566	0.689
Calcium (Ca)	mg/kg	-	-	3,620	43,600	10,300	1,410	454	58,930	59,384	53,900	58,600
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.740	3.30	9.70	<9.54	<19.2	<5.74	12.4
Cobalt (Co)	mg/kg	-	-	0.270	0.750	3.28	0.920	2.54	5.22	7.76	4.03	7.68
Copper (Cu)	mg/kg	35.7	197	1.05	<0.5	0.520	6.69	11.1	<8.76	<19.9	<1.02	14.7
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,220	2,030	8,960	<5,350	<14,310	<3,270	16,300
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.30	0.880	5.71	<5.18	<10.9	<3.8	10.7
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	6.20	<20	<26.2	<10	12.6
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,750
Manganese (Mn)	mg/kg	460	1,100	94.9	116	146	13.6	35.0	370	406	262	478
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0391
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.900	<2	<2.9	<1	1.09
Nickel (Ni)	mg/kg	16.0	75.0	0.530	2.00	9.36	5.73	9.60	17.6	27.2	11.4	24.7
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	132	-	-	<232	<232	<182	1,010
Potassium (K)	mg/kg	-	-	150	-	-	-	-	150	150	-	2,090
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	<0.2	1.19	0.540	<1.79	<2.33	<0.4	1.21
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.130	<0.4	<0.53	<0.2	0.210
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	74.0
Strontium (Sr)	mg/kg	-	-	7.85	24.8	8.12	4.67	19.2	45.4	64.6	32.9	64.9
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,100
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.128	<0.2	<0.328	<0.1	0.159
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	17.4	16.8	<24.4	<41.2	<6	14.2
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.158	0.152	0.233	0.254	<0.593	<0.847	0.310	0.763
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.36	4.38	23.6	<7.14	<30.7	<2.56	28.2
Zinc (Zn)	mg/kg	123	315	<1	5.30	25.8	7.30	52.1	<39.4	<91.5	31.1	88.5

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.17: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GANF-3 on Gardine Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	431	1,310	6,860	<1,841	<8,701	<481	6,830
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.630	<0.4	<1.03	<0.2	0.630
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.357	0.319	<5	<0.776	<5.78	<0.407	4.55
Barium (Ba)	mg/kg	-	-	16.8	50.7	47.6	22.2	110	137	247	98.3	212
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.270	<0.2	0.340	<0.87	<1.21	<0.47	0.590
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	6.00
Cadmium (Cd)	mg/kg	0.600	3.50	0.112	0.232	0.306	0.0620	0.0830	0.712	0.795	0.538	0.681
Calcium (Ca)	mg/kg	-	-	3,170	47,500	28,200	1,840	662	80,710	81,372	75,700	82,100
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.910	2.56	9.40	<8.97	<18.4	<5.91	9.78
Cobalt (Co)	mg/kg	-	-	0.160	0.540	4.14	0.920	2.68	5.76	8.44	4.68	7.02
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.570	5.16	11.7	<6.73	<18.4	<1.07	14.4
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,990	1,520	11,000	<4,610	<15,610	<3,040	12,700
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	4.24	<0.5	5.57	<5.74	<11.3	<4.74	9.64
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	6.50	<20	<26.5	<10	10.5
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,830
Manganese (Mn)	mg/kg	460	1,100	45.3	87.2	292	14.3	44.8	439	484	379	402
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0448
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.880	<2	<2.88	<1	1.09
Nickel (Ni)	mg/kg	16.0	75.0	<0.5	<2	10.2	5.20	10.0	<17.9	<27.9	<12.2	23.1
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	61.0	-	-	<161	<161	<111	846
Potassium (K)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	1,590
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	<0.2	0.960	0.460	<1.56	<2.02	<0.4	1.21
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.120	<0.4	<0.52	<0.2	0.240
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	70.0
Strontium (Sr)	mg/kg	-	-	4.94	25.5	16.9	5.13	19.1	52.5	71.6	42.4	70.1
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,500
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.128	<0.2	<0.328	<0.1	0.131
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	1.90	15.1	<8.9	<24	<6	11.6
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.152	0.187	0.192	0.302	<0.581	<0.883	0.339	0.747
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.45	3.45	23.3	<6.3	<29.6	<2.65	22.5
Zinc (Zn)	mg/kg	123	315	<1	4.40	26.6	5.80	58.4	<37.8	<96.2	31.0	79.2

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.18: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GANF-4 on Gardine Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	458	1,400	5,760	<1,958	<7,718	<508	5,980
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.710	<0.4	<1.11	<0.2	0.680
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.366	0.495	<5	<0.961	<5.96	<0.416	4.24
Barium (Ba)	mg/kg	-	-	20.4	54.0	45.0	23.3	114	143	257	99.0	216
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.320	<0.2	0.310	<0.92	<1.23	<0.52	0.590
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	<5
Cadmium (Cd)	mg/kg	0.600	3.50	0.143	0.272	0.388	0.0810	0.0640	0.884	0.948	0.660	0.711
Calcium (Ca)	mg/kg	-	-	3,580	45,200	30,600	1,990	313	81,370	81,683	75,800	83,100
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.980	3.12	8.30	<9.6	<17.9	<5.98	8.86
Cobalt (Co)	mg/kg	-	-	0.230	0.710	3.69	0.830	2.33	5.46	7.79	4.40	6.79
Copper (Cu)	mg/kg	35.7	197	1.04	<0.5	0.670	8.19	11.6	<10.4	<22	<1.17	14.9
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,980	1,560	7,230	<4,640	<11,870	<3,030	10,800
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	4.38	0.640	5.08	<6.02	<11.1	<4.88	9.43
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	<20	<25	<10	9.40
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,580
Manganese (Mn)	mg/kg	460	1,100	46.7	85.3	151	9.00	29.6	292	322	236	346
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0610
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.820	<2	<2.82	<1	1.18
Nickel (Ni)	mg/kg	16.0	75.0	<0.5	<2	9.97	5.53	8.70	<18	<26.7	<12	21.9
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	53.0	-	-	<153	<153	<103	831
Potassium (K)	mg/kg	-	-	160	-	-	-	-	160	160	-	1,390
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	<0.2	1.21	0.340	<1.81	<2.15	<0.4	1.31
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	0.110	<0.1	0.160	<0.41	<0.57	<0.21	0.250
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	66.0
Strontium (Sr)	mg/kg	-	-	5.71	24.9	18.9	5.32	20.5	54.8	75.3	43.8	72.0
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,600
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.111	<0.2	<0.311	<0.1	0.112
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	16.4	15.6	<23.4	<39	<6	10.8
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.148	0.190	0.232	0.250	<0.62	<0.87	0.338	0.751
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.86	4.50	21.5	<7.76	<29.3	<3.06	21.2
Zinc (Zn)	mg/kg	123	315	<1	4.10	30.7	7.40	50.7	<43.2	<93.9	34.8	78.0

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.19: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GANF-5 on Gardine Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	470	1,520	5,490	<2,090	<7,580	<520	6,680
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.630	<0.4	<1.03	<0.2	0.670
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.382	0.479	<5	<0.961	<5.96	<0.432	5.46
Barium (Ba)	mg/kg	-	-	21.0	51.0	37.0	22.7	103	132	235	88.0	206
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.290	<0.2	0.300	<0.89	<1.19	<0.49	0.660
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	<5
Cadmium (Cd)	mg/kg	0.600	3.50	0.142	0.272	0.372	0.0770	0.0620	0.863	0.925	0.644	0.714
Calcium (Ca)	mg/kg	-	-	4,010	43,600	17,600	1,740	389	66,950	67,339	61,200	65,600
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.800	3.24	7.80	<9.54	<17.3	<5.8	9.80
Cobalt (Co)	mg/kg	-	-	0.200	0.590	3.48	0.970	2.19	5.24	7.43	4.07	8.27
Copper (Cu)	mg/kg	35.7	197	1.02	<0.5	<0.5	7.78	10.7	<9.8	<20.5	<1	16.0
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,020	1,860	7,230	<4,980	<12,210	<3,070	15,600
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.57	0.920	5.37	<5.49	<10.9	<4.07	11.1
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	<20	<25	<10	11.3
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,930
Manganese (Mn)	mg/kg	460	1,100	53.1	98.3	179	11.8	29.7	342	372	277	516
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0532
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.790	<2	<2.79	<1	1.23
Nickel (Ni)	mg/kg	16.0	75.0	<0.5	<2	9.66	5.96	8.30	<18.1	<26.4	<11.7	25.8
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	76.0	-	-	<176	<176	<126	1,000
Potassium (K)	mg/kg	-	-	150	-	-	-	-	150	150	-	1,360
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	<0.2	1.25	0.390	<1.85	<2.24	<0.4	1.19
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	0.100	<0.1	0.160	<0.4	<0.56	<0.2	0.220
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	67.0
Strontium (Sr)	mg/kg	-	-	6.52	24.3	11.7	4.84	18.9	47.4	66.3	36.0	62.9
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,200
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.102	<0.2	<0.302	<0.1	0.124
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	16.5	12.8	<23.5	<36.3	<6	11.8
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.145	0.181	0.235	0.240	<0.611	<0.851	0.326	0.792
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.42	4.32	19.6	<7.14	<26.7	<2.62	22.3
Zinc (Zn)	mg/kg	123	315	<1	4.50	27.7	7.90	47.8	<41.1	<88.9	32.2	91.8

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.20: Differences in Concentrations of Sediment Quality Constituents Among Sampling Areas on Lower Greenhills and Gardine Creeks, 2019 to 2022

ANOVA Model [a]							Area Magnitude of Difference																	
							Area Effects [b]						Area Effects by Year [c]											
													2019						2020					
	Constituent	Units	Assumed Distribution	Area	Year	Area:Year	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF	RG_GHP vs RG_GHB	RG_GHP vs RG_GAU	RG_GHP vs RG_GAN	RG_GHBP vs RG_GAU	RG_GHBP vs RG_GAN	RG_GAUT vs RG_GAN	RG_GHP vs RG_GHB	RG_GHP vs RG_GAU	RG_GHP vs RG_GAN	RG_GHBP vs RG_GAU	RG_GHBP vs RG_GAN	RG_GAUT vs RG_GAN
	Moisture	%	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	-25.8	-25.6	-40.7	-40.5	ns	55.9	ns	ns	-49.2	-28.8	40.2
	pH (1:2 soil:water)	pH units	lognormal	0.848	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-4.55	3.83	ns	8.78	6.24	-2.33	nc	nc	nc	nc	nc	nc
	Silt (0.0312 mm to 0.004 mm)	%	lognormal	<0.001	0.053	<0.001	nc	nc	nc	nc	nc	nc	-47.0	-66.8	-50.9	-37.3	ns	47.5	ns	-80.2	-54.9	-73.5	-39.9	127
	Silt (0.063 mm to 0.0312 mm)	%	lognormal	0.001	0.900	<0.001	nc	nc	nc	nc	nc	nc	74.0	ns	92.9	ns	ns	ns	101	-41.0	74.5	-70.7	ns	196
	Clay (<4 µm)	%	lognormal	<0.001	0.001	<0.001	nc	nc	nc	nc	nc	nc	-74.8	-84.7	-82.6	-39.1	-31.0	ns	-57.3	-85.5	-83.1	-66.1	-60.3	ns
Physical Tests	Sand (0.125 mm to 0.063 mm)	%	lognormal	<0.001	0.781	<0.001	nc	nc	nc	nc	nc	nc	631	839	828	ns	ns	ns	302	530	1,529	ns	305	159
	Sand (0.25 mm to 0.125 mm)	%	lognormal	<0.001	0.902	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	105	ns	ns	542	1,867	2,820	206	355	ns
	Sand (0.50 mm to 0.25 mm)	%	lognormal	<0.001	0.710	0.020	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	420	163	ns
	Sand (1.00 mm to 0.50 mm)	%	lognormal	<0.001	0.413	0.578	ns	ns	ns	134	ns	-52.1	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sand (2.00 mm to 1.00 mm)	%	lognormal	<0.001	0.140	0.366	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Gravel (>2 mm)	%	lognormal	<0.001	0.565	0.708	ns	ns	ns	175	ns	-72.8	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Organic Carbon	Total Organic Carbon	%	lognormal	<0.001	0.004	<0.001	nc	nc	nc	nc	nc	nc	ns	-56.4	-49.1	-40.5	ns	ns	ns	-66.1	-51.0	-60.1	-42.3	ns
	Aluminum (Al)	mg/kg	lognormal	<0.001	<0.001	0.083	-33.0	ns	-18.7	56.5	21.4	-22.4	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Antimony (Sb)	mg/kg	lognormal	<0.001	0.010	0.008	nc	nc	nc	nc	nc	nc	-43.8	-27.7	-51.8	ns	ns	-33.3	-31.8	ns	-47.8	ns	ns	-29.5
	Arsenic (As)	mg/kg	lognormal	<0.001	0.005	0.200	-31.1	ns	-22.1	52.6	ns	-25.9	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Barium (Ba)	mg/kg	lognormal	<0.001	<0.001	0.018	nc	nc	nc	nc	nc	nc	-37.3	-25.7	-27.0	ns	ns	ns	-31.6	ns	-23.7	ns	ns	ns
	Beryllium (Be)	mg/kg	lognormal	<0.001	0.270	0.187	-36.6	ns	-25.0	47.8	ns	-20.0	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Boron (B)	mg/kg	lognormal	0.006	<0.001	0.186	25.4	33.5	ns	ns	ns	-18.5	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Cadmium (Cd)	mg/kg	lognormal	<0.001	0.569	0.010	nc	nc	nc	nc	nc	nc	-32.6	-53.7	-57.4	-31.2	-36.8	ns	ns	-55.1	-58.2	-55.2	-58.4	ns
	Calcium (Ca)	mg/kg	lognormal	<0.001	0.655	0.088	ns	-77.9	ns	-83.5	ns	499	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Chromium (Cr)	mg/kg	lognormal	<0.001	<0.001	0.376	-29.6	ns	-24.8	33.0	ns	-19.8	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Cobalt (Co)	mg/kg	lognormal	<0.001	0.002	0.160	-32.2	ns	-29.9	61.1	ns	-35.8	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Copper (Cu)	mg/kg	lognormal	<0.001	0.332	0.040	nc	nc	nc	nc	nc	nc	-50.0	-42.0	-51.5	ns	ns	ns	-37.3	-43.7	-55.0	ns	-28.2	ns
	Iron (Fe)	mg/kg	lognormal	<0.001	0.032	0.051	ns	36.3	ns	63.6	ns	-28.8	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Metals	Lead (Pb)	mg/kg	lognormal	<0.001	0.111	0.080	-35.2	ns	-30.9	43.6	ns	-25.7	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Lithium (Li)	mg/kg	lognormal	<0.001	0.171	0.009	nc	nc	nc	nc	nc	nc	ns	55.7	ns	99.1	61.8	ns	ns	57.1	ns	94.8	41.7	-27.2
	Magnesium (Mg)	mg/kg	lognormal	<0.001	<0.001	0.157	15.6	-29.9	-18.0	-39.4	-29.1	17.0	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Manganese (Mn)	mg/kg	lognormal	0.002	0.465	0.737	ns	40.6	ns	ns	ns	-21.4	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Mercury (Hg)	mg/kg	lognormal	<0.001	<0.001	0.001	nc	nc	nc	nc	nc	nc	-59.9	-56.8	-51.5	ns	ns	ns	-35.5	-46.4	-51.4	ns	ns	ns
	Molybdenum (Mo)	mg/kg	lognormal	<0.001	0.027	0.186	-29.0	-28.9	-41.6	ns	-17.8	-17.9	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Nickel (Ni)	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-47.6	-36.4	-58.4	-34.6	109	-30.5	-53.3	-66.7	-77.6	-32.8
	Phosphorus (P)	mg/kg	lognormal	0.001	0.007	0.390	ns	18.8	ns	23.9	ns	-16.5	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Potassium (K)	mg/kg	lognormal	<0.001	<0.001	0.149	-32.2	ns	-28.9	28.2	ns	-18.2	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Selenium (Se)	mg/kg	lognormal	<0.001	0.603	0.001	nc	nc	nc	nc	nc	nc	ns	-86.6	-90.3	-83.1	-87.8	ns	ns	-90.1	-89.3	-94.8	-94.4	ns
	Silver (Ag)	mg/kg	lognormal	<0.001	0.626	0.162	-48.9	-38.3	-45.8	20.9	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sodium (Na)	mg/kg	lognormal	0.002	<0.001	0.045	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	34.0	ns	ns	-21.4	ns	ns
	Strontium (Sr)	mg/kg	lognormal	<0.001	0.808	0.216	ns	-23.4	ns	ns	ns	36.7	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sulphur (S)	mg/kg	lognormal	<0.001	0.474	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	137	ns	ns	ns	-46.9	ns

P-value <0.05.

Positive MOD (higher concentration of constituent at second biological monitoring area relative to the first).

Negative MOD (lower concentration of constituent at second biological monitoring area relative to the first).

Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.

[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. Constituents that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1}*100$ for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.

[c] The MOD was calculated as$[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1}*100$ for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.20: Differences in Concentrations of Sediment Quality Constituents Among Sampling Areas on Lower Greenhills and Gardine Creeks, 2019 to 2022

ANOVA Model [a]							Area Magnitude of Difference																	
							Area Effects [b]						Area Effects by Year [c]											
													2019						2020					
Constituent		Units	Assumed Distribution	Area	Year	Area:Year	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF	RG_GHP vs RG_GHB	RG_GHP vs RG_GAU	RG_GHP vs RG_GAN	RG_GHBP vs RG_GAU	RG_GHBP vs RG_GAN	RG_GAUT vs RG_GAN	RG_GHP vs RG_GHB	RG_GHP vs RG_GAU	RG_GHP vs RG_GAN	RG_GHBP vs RG_GAU	RG_GHBP vs RG_GAN	RG_GAUT vs RG_GAN
Metals	Thallium (Tl)	mg/kg	lognormal	<0.001	<0.001	0.081	30.5	30.8	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Tin (Sn)	mg/kg	lognormal	0.031	<0.001	<0.001	nc	nc	nc	nc	nc	nc	36.4	113	ns	55.9	-35.0	-58.3	ns	ns	ns	ns	ns	ns
	Titanium (Sn)	mg/kg	lognormal	0.031	<0.001	<0.001	nc	nc	nc	nc	nc	nc	36.4	113	ns	55.9	-35.0	-58.3	ns	ns	ns	ns	ns	ns
	Uranium (U)	mg/kg	lognormal	<0.001	0.515	0.003	nc	nc	nc	nc	nc	nc	ns	-39.9	-43.6	-46.4	-49.6	ns	65.3	-45.0	-34.3	-66.7	-60.2	ns
	Vanadium (V)	mg/kg	lognormal	<0.001	<0.001	0.164	-38.7	ns	-33.6	38.2	ns	-21.6	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Zinc (Zn)	mg/kg	lognormal	<0.001	0.005	<0.001	nc	nc	nc	nc	nc	nc	-26.7	-24.7	-40.7	ns	-19.1	-21.2	ns	-28.0	-45.0	-37.9	-52.5	-23.6
	Zirconium (Zr)	mg/kg	lognormal	0.022	<0.001	0.100	ns	ns	ns	ns	ns	-20.2	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Polycyclic Aromatic Hydrocarbons	Acenaphthylene	mg/kg	lognormal	0.002	<0.001	0.454	-59.6	-63.7	-50.7	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Benz(a)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-69.7	ns	ns	ns	ns	-83.5	ns	-78.6	ns	ns
	Benzo(a)pyrene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-65.6	-88.3	-60.4	-66.1	ns	239	ns	-86.8	-75.3	-81.4	-65.1	ns
	Benzo(b&j)fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-62.0	-85.9	-62.3	-62.8	ns	167	ns	-83.2	-71.6	-68.7	ns	ns
	Benzo(b+j+k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-62.6	-85.7	-61.7	-61.7	ns	167	ns	-83.8	-71.7	-69.3	ns	ns
	Benzo(e)pyrene	mg/kg	lognormal	<0.001	<0.001	0.003	nc	nc	nc	nc	nc	nc	-62.8	-86.7	-60.9	-64.3	ns	194	ns	-83.4	-72.0	-72.4	-53.5	ns
	Benzo(g,h,i)perylene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	-81.2	-68.9	-66.3	ns	ns	ns	-80.5	-65.6	-74.9	-55.8	ns
	Benzo(k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-58.9	ns	ns	ns	ns	-78.3	-68.5	-68.0	-53.5	ns
	Chrysene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-65.0	-86.8	-72.3	-62.3	ns	111	ns	-80.8	-59.4	-75.5	ns	ns
	Dibenz(a,h)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-68.7	ns	ns	ns	ns	-84.0	-73.4	-71.8	-53.1	ns
	Fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-62.4	-87.2	-78.7	-65.8	ns	ns	ns	-86.9	-77.6	-76.8	-60.4	ns
	Fluorene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-64.8	-88.6	-74.8	-67.7	ns	122	ns	-89.6	-81.9	-81.2	-67.1	ns
	Indeno(1,2,3-c,d)pyrene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-69.7	ns	-82.2	ns	ns	ns	ns	-83.0	-72.5	-76.9	-62.6	ns
	1-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-64.7	-86.7	-71.4	-62.2	ns	114	ns	-86.8	-78.0	-74.4	-57.1	ns
	2-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-65.5	-86.8	-71.8	-61.7	ns	113	ns	-86.2	-77.1	-73.2	-55.6	ns
	Naphthalene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-66.1	-87.6	-73.1	-63.4	ns	117	ns	-86.3	-77.8	-73.1	-56.2	ns
	Perylene	mg/kg	lognormal	0.019	<0.001	0.364	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Phenanthrene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-61.0	-86.7	-73.1	-65.9	ns	103	ns	-85.7	-77.6	-71.3	-55.0	ns
	Pyrene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-58.8	-79.1	-72.0	-49.4	ns	ns	-53.7	-82.5	-71.2	-62.2	ns	ns

P-value <0.05.
Positive MOD (higher concentration of constituent at second biological monitoring area relative to the first).
Negative MOD (lower concentration of constituent at second biological monitoring area relative to the first).
Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.
[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. Constituents that had >75% censored data were excluded from the analyses.
[b] The MOD was calculated as $[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1} * 100$ for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.
[c] The MOD was calculated as $[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1} * 100$ for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.20: Differences in Concentrations of Sediment Quality Constituents Among Sampling Areas on Lower Greenhills and Gardine Creeks, 2019 to 2022

ANOVA Model [a]							Area Magnitude of Difference Area Effects by Year [c]											
							2021						2022					
Constituent		Units	Assumed Distribution	Area	Year	Area:Year	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF
	Moisture	%	lognormal	<0.001	<0.001	<0.001	34.6	ns	ns	-32.5	ns	31.1	-22.9	-57.1	-31.2	-44.3	ns	60.2
	pH (1:2 soil:water)	pH units	lognormal	0.848	<0.001	<0.001	ns	-8.10	-7.71	-7.42	-7.03	ns	4.52	2.91	2.99	ns	ns	ns
	Silt (0.0312 mm to 0.004 mm)	%	lognormal	<0.001	0.053	<0.001	-41.4	-71.9	-62.6	-52.1	-36.3	ns	-48.0	-42.6	-36.7	ns	ns	ns
	Silt (0.063 mm to 0.0312 mm)	%	lognormal	0.001	0.9	<0.001	70.5	ns	ns	-50.2	ns	ns	ns	ns	ns	ns	ns	ns
	Clay (<4 µm)	%	lognormal	<0.001	0.001	<0.001	-64.5	-77.2	-76.3	-35.8	-33.2	ns	-28.3	-69.5	-36.0	-57.5	ns	110
Physical Tests	Sand (0.125 mm to 0.063 mm)	%	lognormal	<0.001	0.781	<0.001	342	555	885	ns	123	ns	ns	177	139	ns	ns	ns
	Sand (0.25 mm to 0.125 mm)	%	lognormal	<0.001	0.902	<0.001	684	1,759	2,503	137	232	ns	598	458	702	ns	ns	ns
	Sand (0.50 mm to 0.25 mm)	%	lognormal	<0.001	0.71	0.02	ns	ns	ns	203	174	ns	966	1,020	846	ns	ns	ns
	Sand (1.00 mm to 0.50 mm)	%	lognormal	<0.001	0.413	0.578	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sand (2.00 mm to 1.00 mm)	%	lognormal	<0.001	0.14	0.366	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Gravel (>2 mm)	%	lognormal	<0.001	0.565	0.708	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Organic Carbon	Total Organic Carbon	%	lognormal	<0.001	0.003	<0.001	ns	-60.4	-51.1	-46.0	-33.2	ns	-45.8	-34.0	ns	ns	ns	ns
	Aluminum (Al)	mg/kg	lognormal	<0.001	<0.001	0.083	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Antimony (Sb)	mg/kg	lognormal	<0.001	0.01	0.008	-33.3	ns	ns	90.3	ns	-29.7	-44.2	ns	-42.8	ns	ns	ns
	Arsenic (As)	mg/kg	lognormal	<0.001	0.005	0.200	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Barium (Ba)	mg/kg	lognormal	<0.001	<0.001	0.018	-41.7	-25.5	-35.2	27.7	ns	ns	-40.7	ns	-31.6	74.8	ns	-34.1
	Beryllium (Be)	mg/kg	lognormal	<0.001	0.27	0.187	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Boron (B)	mg/kg	lognormal	0.006	<0.001	0.186	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Cadmium (Cd)	mg/kg	lognormal	<0.001	0.569	0.01	ns	-42.3	-52.6	-37.2	-48.4	ns	ns	-32.9	-48.0	ns	-40.4	ns
	Calcium (Ca)	mg/kg	lognormal	<0.001	0.655	0.088	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Chromium (Cr)	mg/kg	lognormal	<0.001	<0.001	0.376	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Cobalt (Co)	mg/kg	lognormal	<0.001	0.002	0.16	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Copper (Cu)	mg/kg	lognormal	<0.001	0.332	0.04	-32.1	-33.4	-50.6	ns	-27.3	-25.9	-34.9	ns	-36.2	33.3	ns	-26.4
	Iron (Fe)	mg/kg	lognormal	<0.001	0.032	0.051	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Lead (Pb)	mg/kg	lognormal	<0.001	0.111	0.08	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Metals	Lithium (Li)	mg/kg	lognormal	<0.001	0.171	0.009	ns	43.8	ns	96.3	ns	-31.0	37.9	59.8	47.9	ns	ns	ns
	Magnesium (Mg)	mg/kg	lognormal	<0.001	<0.001	0.157	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Manganese (Mn)	mg/kg	lognormal	0.002	0.465	0.737	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Mercury (Hg)	mg/kg	lognormal	<0.001	<0.001	0.001	-37.1	-34.6	-37.2	ns	ns	ns	-53.4	ns	-46.1	71.1	ns	-32.5
	Molybdenum (Mo)	mg/kg	lognormal	<0.001	0.027	0.186	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Nickel (Ni)	mg/kg	lognormal	<0.001	<0.001	<0.001	57.6	-41.9	-63.8	-63.1	-77.0	-37.7	ns	-52.1	-63.0	-46.5	-58.7	-22.9
	Phosphorus (P)	mg/kg	lognormal	0.001	0.007	0.390	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Potassium (K)	mg/kg	lognormal	<0.001	<0.001	0.149	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Selenium (Se)	mg/kg	lognormal	<0.001	0.603	0.001	ns	-90.5	-87.6	-93.3	-91.4	ns	-74.6	-95.0	-95.2	-80.3	-81.2	ns
	Silver (Ag)	mg/kg	lognormal	<0.001	0.626	0.162	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sodium (Na)	mg/kg	lognormal	0.002	<0.001	0.045	ns	-21.8	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Strontium (Sr)	mg/kg	lognormal	<0.001	0.808	0.216	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sulphur (S)	mg/kg	lognormal	<0.001	0.474	<0.001	ns	-60.5	ns	-56.0	ns	135	-51.6	ns	ns	ns	ns	ns

P-value <0.05.
Positive MOD (higher concentration of constituent at second biological monitoring area relative to the first).
Negative MOD (lower concentration of constituent at second biological monitoring area relative to the first).

Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.

[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. Constituents that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as [$EMM_{station\ 2}$- $EMM_{station\ 1}$]/$EMM_{station\ 1}$*100 for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.

[c] The MOD was calculated as[$EMM_{station\ 2}$- $EMM_{station\ 1}$]/$EMM_{station\ 1}$*100 for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.20: Differences in Concentrations of Sediment Quality Constituents Among Sampling Areas on Lower Greenhills and Gardine Creeks, 2019 to 2022

ANOVA Model [a]							Area Magnitude of Difference											
							Area Effects by Year [c]											
							2021						2022					
Constituent		Units	Assumed Distribution	Area	Year	Area:Year	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF
Metals	Thallium (Tl)	mg/kg	lognormal	<0.001	<0.001	0.081	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Tin (Sn)	mg/kg	lognormal	0.031	<0.001	<0.001	ns	112	64.7	129	78.0	ns	40.5	88.7	59.8	ns	ns	ns
	Titanium (Sn)	mg/kg	lognormal	0.031	<0.001	<0.001	ns	112	64.7	129	78.0	ns	40.5	88.7	59.8	ns	ns	ns
	Uranium (U)	mg/kg	lognormal	<0.001	0.515	0.003	ns	-41.6	-34.7	-58.7	-53.8	ns	-36.9	-48.7	-55.7	ns	ns	ns
	Vanadium (V)	mg/kg	lognormal	<0.001	<0.001	0.164	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Zinc (Zn)	mg/kg	lognormal	<0.001	0.005	<0.001	ns	-28.4	-47.0	-30.8	-48.8	-26.0	ns	ns	-32.6	ns	-33.2	-22.2
	Zirconium (Zr)	mg/kg	lognormal	0.022	<0.001	0.100	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Polycyclic Aromatic Hydrocarbons	Acenaphthylene	mg/kg	lognormal	0.002	<0.001	0.454	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Benz(a)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	ns	ns	ns	ns	-77.3	-72.0	ns	ns	ns	ns
	Benzo(a)pyrene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	-53.9	ns	-67.9	-58.6	ns	-81.2	-72.9	-56.4	ns	132	ns
	Benzo(b&j)fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	-49.1	ns	ns	ns	ns	-81.2	-70.5	-63.1	ns	96.0	ns
	Benzo(b+j+k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	ns	ns	ns	ns	-83.1	-72.8	-58.9	ns	142	ns
	Benzo(e)pyrene	mg/kg	lognormal	<0.001	<0.001	0.003	ns	ns	ns	-52.7	ns	ns	nc	nc	nc	nc	nc	nc
	Benzo(g,h,i)perylene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	ns	-57.5	-53.3	ns	-72.6	-63.0	-62.2	ns	ns	ns
	Benzo(k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	ns	ns	ns	ns	ns	-61.0	ns	ns	ns	163
	Chrysene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	ns	ns	ns	ns	-78.3	-68.2	-56.3	ns	101	ns
	Dibenz(a,h)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	ns	ns	ns	ns	-76.8	-71.1	-56.2	ns	ns	ns
	Fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	-54.7	ns	ns	ns	ns	-73.0	-70.9	-50.5	ns	ns	ns
	Fluorene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	-68.5	-56.1	-64.6	ns	ns	-80.2	-71.2	ns	ns	157	ns
	Indeno(1,2,3-c,d)pyrene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	ns	ns	ns	ns	ns	-70.8	-59.5	ns	ns	ns
	1-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	-67.0	-53.6	-62.2	ns	ns	-79.1	-64.7	ns	ns	186	ns
	2-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	-66.9	-52.9	-61.3	ns	ns	-79.6	-61.4	ns	ns	202	ns
	Naphthalene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	-70.4	-55.9	-64.9	ns	ns	-82.5	-60.5	ns	126	290	ns
	Perylene	mg/kg	lognormal	0.019	<0.001	0.364	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Phenanthrene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	-61.8	ns	-56.2	ns	ns	-73.0	-64.8	ns	ns	ns	ns
	Pyrene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	ns	ns	ns	ns	-79.0	-65.6	-53.1	ns	123	ns

P-value <0.05.
Positive MOD (higher concentration of constituent at second biological monitoring area relative to the first).
Negative MOD (lower concentration of constituent at second biological monitoring area relative to the first).
Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.
[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. Constituents that had >75% censored data were excluded from the analyses.
[b] The MOD was calculated as [$EMM_{station\ 2}$- $EMM_{station\ 1}$]/$EMM_{station\ 1}$*100 for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.
[c] The MOD was calculated as[$EMM_{station\ 2}$- $EMM_{station\ 1}$]/$EMM_{station\ 1}$*100 for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.21: Differences in Concentrations of Sediment Quality Constituents Among Sampling Areas on Lower Greenhills and Gardine Creeks, Based on Sequential Extraction Analysis, 2019 to 2022

ANOVA Model [a]							Area Magnitude of Difference																	
							Area Effects [b]						Area Effects by Year [c]											
													2019						2020					
Constituent	Fraction	Units	Assumed Distribution	Area	Year	Area:Year	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF
Aluminum (Al)	Fraction 3	mg/kg	lognormal	<0.001	0.568	<0.001	nc	nc	nc	nc	nc	nc	-48.5	ns	-17.5	99.2	60.1	-19.6	-56.9	ns	-27.9	161	67.4	-35.9
	Fraction 4	mg/kg	lognormal	<0.001	0.071	<0.001	nc	nc	nc	nc	nc	nc	-41.5	ns	ns	71.3	56.7	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.131	-16.0	ns	-11.9	33.7	ns	-21.6	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Antimony (Sb)	Fraction 5	mg/kg	lognormal	<0.001	0.310	<0.001	nc	nc	nc	nc	nc	nc	-40.9	-40.2	-47.2	ns	ns	ns	-39.5	ns	-46.4	61.3	ns	-45.0
Arsenic (As)	Fraction 2	mg/kg	lognormal	0.133	0.004	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.121	0.127	-34.9	-18.4	-33.1	25.4	ns	-18.0	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	0.665	0.066	0.029	nc	nc	nc	nc	nc	nc	ns	-43.7	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.011	nc	nc	nc	nc	nc	nc	-25.2	ns	ns	47.4	ns	ns	-46.2	ns	ns	121	39.3	-37.0
	Sum of 2 and 3	mg/kg	lognormal	0.003	0.014	0.008	nc	nc	nc	nc	nc	nc	-43.6	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Barium (Ba)	Fraction 1	mg/kg	lognormal	<0.001	0.001	<0.001	nc	nc	nc	nc	nc	nc	-39.4	66.6	ns	175	42.6	-48.1	-68.7	96.7	ns	528	148	-60.5
	Fraction 2	mg/kg	lognormal	<0.001	0.001	<0.001	nc	nc	nc	nc	nc	nc	-33.8	-35.5	ns	ns	42.5	46.1	-36.4	-17.9	ns	29.1	71.2	32.7
	Fraction 3	mg/kg	lognormal	0.003	0.596	0.080	ns	ns	ns	27.6	ns	-18.5	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	0.002	0.012	<0.001	nc	nc	nc	nc	nc	nc	-31.5	-37.0	-41.0	ns	ns	ns	ns	-28.1	-38.5	-29.8	-39.9	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.500	0.105	-34.7	-27.0	-28.9	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.042	0.002	nc	nc	nc	nc	nc	nc	-20.4	ns	-16.3	ns	ns	ns	-30.1	ns	-19.1	48.0	ns	-21.8
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.637	<0.001	nc	nc	nc	nc	nc	nc	-28.8	-26.3	-23.4	ns	ns	ns	-34.9	-15.9	-26.6	29.1	ns	-12.7
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.069	0.086	-22.4	-12.9	ns	12.3	21.4	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Beryllium (Be)	Fraction 3	mg/kg	lognormal	<0.001	0.010	<0.001	nc	nc	nc	nc	nc	nc	-37.7	-34.9	-33.1	ns	ns	ns	-48.2	-24.1	-43.1	46.5	ns	-25.0
	Fraction 5	mg/kg	lognormal	<0.001	0.002	0.005	nc	nc	nc	nc	nc	nc	-31.6	ns	-26.8	33.9	ns	-20.0	-35.3	ns	-41.9	31.2	ns	-31.6
Cadmium (Cd)	Fraction 1	mg/kg	lognormal	<0.001	0.053	<0.001	nc	nc	nc	nc	nc	nc	-56.8	ns	-57.8	ns	ns	ns	ns	ns	-81.8	ns	ns	-73.5
	Fraction 2	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-27.4	-71.6	-57.2	-60.9	-41.0	51.0	-53.7	-70.9	-62.5	-37.3	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.002	<0.001	nc	nc	nc	nc	nc	nc	ns	-58.3	-56.8	-50.5	-48.8	ns	80.5	-50.6	-59.1	-72.7	-77.3	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.204	<0.001	nc	nc	nc	nc	nc	nc	-41.0	-60.5	-54.5	-33.1	ns	ns	ns	-60.1	-55.5	-66.9	-63.0	ns
	Fraction 5	mg/kg	lognormal	0.003	<0.001	0.006	nc	nc	nc	nc	nc	nc	ns	ns	-31.7	ns	ns	ns	-39.5	ns	-30.2	46.6	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-31.6	-61.7	-57.0	-44.0	-37.2	ns	-66.4	-57.5	-66.0	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.001	<0.001	nc	nc	nc	nc	nc	nc	-29.9	-58.1	-55.1	-40.3	-36.0	ns	ns	-54.1	-63.4	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	-64.6	-57.0	-55.2	-45.6	ns	ns	-60.3	-60.6	-66.2	-66.5	ns
Calcium (Ca)	Fraction 1	mg/kg	lognormal	0.293	0.053	0.003	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	-30.0	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.002	0.015	nc	nc	nc	nc	nc	nc	ns	-91.3	38.9	-91.3	39.9	1,501	58.8	-91.5	84.6	-94.7	ns	2,074
	Fraction 3	mg/kg	lognormal	<0.001	0.036	0.017	nc	nc	nc	nc	nc	nc	259	-65.3	ns	-90.3	ns	294	608	-64.0	ns	-94.9	-70.4	483
	Fraction 4	mg/kg	lognormal	<0.001	0.003	<0.001	nc	nc	nc	nc	nc	nc	37.3	-36.3	ns	-53.6	-26.3	59.0	82.4	-33.5	ns	-63.5	-38.1	69.8
	Fraction 5	mg/kg	lognormal	<0.001	0.095	<0.001	nc	nc	nc	nc	nc	nc	622	797	491	ns	ns	ns	201	491	374	96.0	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.005	0.218	70.0	-79.5	42.8	-87.9	ns	596	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.008	0.200	71.3	-78.0	43.6	-87.2	ns	553	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.011	0.111	74.3	-88.2	47.6	-93.2	ns	1,152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

P-value <0.05.
Positive MOD (higher concentration of constituent at second biological monitoring area relative to the first).
Negative MOD (lower concentration of constituent at second biological monitoring area relative to the first).
Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.

[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. If the concentrations in one or more fractions was <LRL, the fraction sum was the sum of the LRL values. Constituents that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1} * 100$ for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.

[c] The MOD was calculated as $[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1} * 100$ for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.21: Differences in Concentrations of Sediment Quality Constituents Among Sampling Areas on Lower Greenhills and Gardine Creeks, Based on Sequential Extraction Analysis, 2019 to 2022

ANOVA Model [a]							Area Magnitude of Difference – Area Effects [b]						Area Magnitude of Difference – Area Effects by Year [c] – 2019						Area Magnitude of Difference – Area Effects by Year [c] – 2020					
Constituent	Fraction	Units	Assumed Distribution	Area	Year	Area:Year	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF
Chromium (Cr)	Fraction 3	mg/kg	lognormal	<0.001	0.005	<0.001	nc	nc	nc	nc	nc	nc	-40.7	-22.5	-28.3	30.7	ns	ns	-52.3	ns	-32.1	74.3	42.2	-18.4
	Fraction 4	mg/kg	lognormal	0.061	0.126	0.013	nc	nc	nc	nc	nc	nc	ns	-31.9	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.011	0.216	-18.3	ns	-18.7	20.2	ns	-17.2	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Cobalt (Co)	Fraction 1	mg/kg	lognormal	0.776	<0.001	0.012	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	0.046	0.025	<0.001	nc	nc	nc	nc	nc	nc	-60.7	ns	-60.7	131	ns	-56.8	ns	ns	ns	ns	-46.5	ns
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-29.8	50.2	ns	114	ns	-41.5	-65.2	33.5	-40.7	284	70.5	-55.5
	Fraction 4	mg/kg	lognormal	<0.001	0.263	<0.001	nc	nc	nc	nc	nc	nc	43.8	ns	ns	ns	-34.5	ns	71.3	ns	ns	-27.0	-52.4	-34.9
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-41.7	ns	-28.4	58.2	ns	-22.3	-47.8	ns	-33.0	81.6	ns	-29.3
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.013	<0.001	nc	nc	nc	nc	nc	nc	ns	28.8	-26.0	ns	ns	-42.5	-27.0	37.1	-30.2	87.9	ns	-49.1
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-28.8	ns	ns	-37.8	-32.9	24.8	-30.3	86.0	ns	-44.1
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-35.8	38.5	-20.9	116	23.2	-42.9	-52.3	28.6	-37.8	169	30.5	-51.6
Copper (Cu)	Fraction 4	mg/kg	lognormal	<0.001	0.011	<0.001	nc	nc	nc	nc	nc	nc	-39.4	-73.1	-60.8	-55.6	-35.3	ns	ns	-60.9	-60.6	-57.7	-57.4	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-51.5	-35.5	-43.0	33.0	ns	ns	-52.7	-30.1	-49.0	47.8	ns	-27.1
Iron (Fe)	Fraction 3	mg/kg	lognormal	<0.001	0.298	<0.001	nc	nc	nc	nc	nc	nc	-49.3	ns	ns	113	64.2	-23.0	-53.3	ns	-22.0	173	67.1	-38.8
	Fraction 4	mg/kg	lognormal	0.013	0.779	0.036	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.018	nc	nc	nc	nc	nc	nc	ns	39.5	ns	70.1	ns	ns	-33.6	38.6	ns	109	ns	-37.3
Lead (Pb)	Fraction 3	mg/kg	lognormal	<0.001	<0.001	0.007	nc	nc	nc	nc	nc	nc	-32.2	-26.9	-32.0	ns	ns	ns	-20.7	-26.1	-25.6	ns	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.124	<0.001	nc	nc	nc	nc	nc	nc	-61.4	-53.1	ns	ns	ns	ns	ns	ns	-48.8	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.002	<0.001	nc	nc	nc	nc	nc	nc	-40.5	ns	ns	56.5	ns	ns	-55.2	ns	-42.5	100	ns	-35.8
Lithium (Li)	Fraction 5	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	65.7	29.1	61.2	25.6	-22.1	ns	82.7	ns	94.1	ns	-40.6
Manganese (Mn)	Fraction 1	mg/kg	lognormal	0.493	<0.001	0.007	nc	nc	nc	nc	nc	nc	-75.9	-81.4	ns	ns	ns	ns	359	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	0.190	<0.001	0.188	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 3	mg/kg	lognormal	<0.001	0.012	0.005	nc	nc	nc	nc	nc	nc	85.0	130	108	ns	ns	ns	ns	127	ns	234	ns	-59.3
	Fraction 4	mg/kg	lognormal	<0.001	0.019	0.038	nc	nc	nc	nc	nc	nc	ns	110	ns	84.7	ns	ns	ns	99.9	ns	186	ns	-58.7
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.002	nc	nc	nc	nc	nc	nc	-29.6	ns	ns	69.7	ns	-30.8	-44.0	ns	ns	125	ns	-40.3
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.036	0.781	24.4	49.6	ns	ns	ns	-22.2	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.025	0.718	ns	44.7	ns	ns	ns	-23.0	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.065	0.178	ns	58.8	ns	ns	ns	-27.2	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Molybdenum (Mo)	Fraction 5	mg/kg	lognormal	<0.001	0.294	0.010	nc	nc	nc	nc	nc	nc	-30.1	ns	-37.7	ns	ns	ns	-48.4	ns	-45.2	50.8	ns	ns
Nickel (Ni)	Fraction 1	mg/kg	lognormal	<0.001	0.180	<0.001	nc	nc	nc	nc	nc	nc	ns	-36.4	-57.9	-50.1	-67.0	-33.7	166	ns	-61.5	-73.3	-85.5	-45.8
	Fraction 2	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	46.0	-46.7	-65.5	-63.5	-76.4	-35.3	164	-52.7	-63.8	-82.1	-86.3	-23.3
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	33.8	-20.7	-51.5	-40.7	-63.8	-38.9	67.0	-31.1	-64.3	-58.7	-78.6	-48.1
	Fraction 4	mg/kg	lognormal	<0.001	0.104	<0.001	nc	nc	nc	nc	nc	nc	106	ns	ns	-61.6	-64.9	ns	329	ns	-35.9	-81.9	-85.0	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.004	nc	nc	nc	nc	nc	nc	-40.5	ns	-34.5	41.3	ns	ns	-44.8	ns	-40.3	56.1	ns	-30.6
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.009	<0.001	nc	nc	nc	nc	nc	nc	53.5	-26.1	-51.5	-51.8	-68.4	-34.3	144	-33.0	-59.6	-72.6	-83.5	-39.7
	Sum of 1 to 5	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	28.0	-23.3	-47.0	-40.1	-58.6	-31.0	90.7	-27.7	-54.5	-62.1	-76.2	-37.1
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	36.8	-27.4	-55.1	-46.9	-67.2	-38.2	89.3	-36.3	-64.2	-66.4	-81.1	-43.8

P-value <0.05.
Positive MOD (higher concentration of constituent at second biological monitoring area relative to the first).
Negative MOD (lower concentration of constituent at second biological monitoring area relative to the first).

Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.

[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. If the concentrations in one or more fractions was <LRL, the fraction sum was the sum of the LRL values. Constituents that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1}*100$ for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.

[c] The MOD was calculated as $[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1}*100$ for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.21: Differences in Concentrations of Sediment Quality Constituents Among Sampling Areas on Lower Greenhills and Gardine Creeks, Based on Sequential Extraction Analysis, 2019 to 2022

ANOVA Model [a]							Area Magnitude of Difference																	
							Area Effects [b]						Area Effects by Year [c]											
													2019						2020					
Constituent	Fraction	Units	Assumed Distribution	Area	Year	Area:Year	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF
Phosphorus (P)	Fraction 3	mg/kg	lognormal	<0.001	0.182	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	-54.7	ns	ns	-56.7
Potassium (K)	Fraction 1	mg/kg	lognormal	0.987	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	0.987	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	0.987	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Selenium (Se)	Fraction 1	mg/kg	lognormal	<0.001	0.510	0.028	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.392	<0.001	nc	nc	nc	nc	nc	nc	165	-81.6	-99.4	-93.0	-99.8	-96.8	314	-99.8	-81.5	-100.0	-95.5	8,285
	Fraction 4	mg/kg	lognormal	<0.001	0.120	<0.001	nc	nc	nc	nc	nc	nc	ns	-92.7	-90.4	-91.2	-88.5	ns	96.4	-91.6	-88.5	-95.7	-94.1	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.011	<0.001	nc	nc	nc	nc	nc	nc	-60.4	-88.6	-88.3	-71.3	-70.6	ns	ns	-84.8	-87.1	-83.6	-86.1	ns
Silver (Ag)	Fraction 5	mg/kg	lognormal	<0.001	0.979	<0.001	nc	nc	nc	nc	nc	nc	-57.5	-69.2	-55.2	ns	ns	ns	-48.0	-60.0	-56.1	ns	ns	ns
Strontium (Sr)	Fraction 1	mg/kg	lognormal	<0.001	0.001	0.210	ns	189	42.0	159	27.2	-50.9	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 2	mg/kg	lognormal	<0.001	0.007	0.002	nc	nc	nc	nc	nc	nc	ns	-62.4	58.2	-57.6	78.5	321	ns	-52.1	102	-63.1	55.2	321
	Fraction 3	mg/kg	lognormal	<0.001	0.025	0.022	nc	nc	nc	nc	nc	nc	ns	ns	ns	-62.0	ns	ns	187	ns	ns	-72.0	ns	ns
	Fraction 4	mg/kg	lognormal	0.049	0.021	0.005	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.035	0.031	nc	nc	nc	nc	nc	nc	ns	-24.6	-34.0	ns	ns	ns	-38.9	-28.8	-36.0	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.004	0.043	nc	nc	nc	nc	nc	nc	ns	ns	ns	-35.7	ns	68.8	60.1	ns	65.4	-35.0	ns	58.8
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.033	0.013	nc	nc	nc	nc	nc	nc	ns	-21.9	ns	-33.4	ns	34.6	ns	ns	ns	-22.3	ns	32.7
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.016	0.024	nc	nc	nc	nc	nc	nc	ns	-52.5	ns	-62.7	ns	206	88.0	-41.2	88.7	-68.7	ns	221
Thallium (Tl)	Fraction 5	mg/kg	lognormal	0.007	0.030	0.059	ns	ns	-12.8	ns	-16.9	-12.7	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Titanium (Sn)	Fraction 4	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.015	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	97.6	ns	146	37.8	-43.9
Uranium (U)	Fraction 1	mg/kg	lognormal	<0.001	0.020	0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.021	<0.001	nc	nc	nc	nc	nc	nc	ns	-82.9	-44.5	-86.3	-55.5	225	211	ns	ns	ns	-74.2	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.034	<0.001	nc	nc	nc	nc	nc	nc	97.9	-50.0	-41.2	-74.8	-70.3	ns	160	-54.1	-41.3	-82.3	-77.5	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.135	<0.001	nc	nc	nc	nc	nc	nc	ns	-45.6	-36.7	ns	ns	ns	ns	-42.6	-37.2	-41.9	-36.4	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.172	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-27.6	ns	ns	-21.9	-43.2	ns	-38.7	38.0	ns	-21.8
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.062	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	89.8	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.074	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.024	<0.001	nc	nc	nc	nc	nc	nc	ns	-72.6	-44.3	-82.8	-65.2	103	181	ns	ns	ns	-76.0	ns
Vanadium (V)	Fraction 3	mg/kg	lognormal	<0.001	0.002	<0.001	nc	nc	nc	nc	nc	nc	-55.5	-26.3	-48.5	65.8	ns	-30.1	-63.5	-23.5	-51.0	109	34.2	-35.9
	Fraction 4	mg/kg	lognormal	<0.001	0.067	0.004	nc	nc	nc	nc	nc	nc	-33.5	-33.9	-36.0	ns	ns	ns	ns	ns	-39.1	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.002	0.368	-31.3	ns	-28.3	31.4	ns	-20.6	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Zinc (Zn)	Fraction 2	mg/kg	lognormal	<0.001	0.003	<0.001	nc	nc	nc	nc	nc	nc	ns	-55.4	-61.0	-61.9	-66.6	ns	83.6	-52.8	-60.8	-74.3	-78.7	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.005	<0.001	nc	nc	nc	nc	nc	nc	ns	-47.0	-54.9	-44.4	-52.7	ns	82.9	-40.3	-54.4	-67.3	-75.1	-23.7
	Fraction 4	mg/kg	lognormal	<0.001	0.006	<0.001	nc	nc	nc	nc	nc	nc	-37.7	-51.4	-48.8	ns	ns	ns	ns	-46.8	-54.5	-56.5	-62.7	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.011	nc	nc	nc	nc	nc	nc	-41.0	ns	-26.6	54.8	ns	ns	-41.6	ns	-33.0	48.1	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.002	<0.001	nc	nc	nc	nc	nc	nc	ns	-49.5	-56.8	-49.1	-56.4	ns	82.6	-43.5	-56.1	-69.1	-76.0	-22.3

(grey) P-value <0.05.
(blue) Positive MOD (higher concentration of constituent at second biological monitoring area relative to the first).
(green) Negative MOD (lower concentration of constituent at second biological monitoring area relative to the first).

Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.

[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. If the concentrations in one or more fractions was <LRL, the fraction sum was the sum of the LRL values. Constituents that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1}*100$ for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.

[c] The MOD was calculated as $[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1}*100$ for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.21: Differences in Concentrations of Sediment Quality Constituents Among Sampling Areas on Lower Greenhills and Gardine Creeks, Based on Sequential Extraction Analysis, 2019 to 2022

ANOVA Model [a]							Area Magnitude of Difference – Area Effects by Year [c]											
							2021						2022					
Constituent	Fraction	Units	Assumed Distribution	Area	Year	Area:Year	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF
Aluminum (Al)	Fraction 3	mg/kg	lognormal	<0.001	0.568	<0.001	-57.5	ns	-36.8	147	48.6	-39.9	-29.3	ns	ns	61.3	30.7	-19.0
	Fraction 4	mg/kg	lognormal	<0.001	0.071	<0.001	-63.8	ns	ns	244	158	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.131	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Antimony (Sb)	Fraction 5	mg/kg	lognormal	<0.001	0.310	<0.001	-56.9	ns	ns	186	118	-23.8	-24.1	ns	-24.4	ns	ns	ns
Arsenic (As)	Fraction 2	mg/kg	lognormal	0.133	0.004	<0.001	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.121	0.127	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	0.665	0.066	0.029	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.011	-28.9	ns	-27.0	43.9	ns	-28.7	ns	ns	ns	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	0.003	0.014	0.008	ns	ns	ns	ns	ns	ns	-51.3	ns	-39.7	82.1	ns	ns
Barium (Ba)	Fraction 1	mg/kg	lognormal	<0.001	0.001	<0.001	ns	179	ns	122	ns	-50.6	-33.2	171	ns	306	78.7	-56.0
	Fraction 2	mg/kg	lognormal	<0.001	0.001	<0.001	-14.2	-27.2	ns	-15.2	24.7	47.0	-32.1	-37.9	ns	ns	38.0	51.0
	Fraction 3	mg/kg	lognormal	0.003	0.596	0.080	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	0.002	0.012	<0.001	-61.3	ns	ns	128	101	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.500	0.105	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.042	0.002	-19.7	ns	ns	46.1	32.3	ns	-19.2	ns	ns	36.8	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.637	<0.001	-30.2	ns	-12.6	40.3	25.2	ns	-17.1	ns	-15.2	16.2	ns	-11.9
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.069	0.086	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Beryllium (Be)	Fraction 3	mg/kg	lognormal	<0.001	0.010	<0.001	ns	ns	-21.3	ns	ns	ns	-21.7	ns	ns	21.9	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.002	0.005	-36.1	ns	-26.8	41.4	ns	-18.9	ns	ns	ns	ns	ns	ns
Cadmium (Cd)	Fraction 1	mg/kg	lognormal	<0.001	0.053	<0.001	ns	ns	-71.4	ns	ns	-69.4	ns	88.5	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	<0.001	<0.001	-37.6	-67.4	-59.2	-47.8	-34.7	ns	ns	-63.2	-47.8	-68.6	-55.4	42.0
	Fraction 3	mg/kg	lognormal	<0.001	0.002	<0.001	347	ns	-32.0	-83.1	-84.8	ns	ns	ns	-39.0	-33.2	-47.6	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.204	<0.001	ns	ns	-31.7	-49.1	-50.9	ns	ns	ns	-33.8	ns	ns	ns
	Fraction 5	mg/kg	lognormal	0.003	<0.001	0.006	ns	ns	-28.9	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	<0.001	<0.001	-100.0	-41.5	-50.5	,440,023,77	,985,494,34	ns	ns	-28.4	-35.8	-39.9	-46.1	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.001	<0.001	ns	-38.7	-49.0	ns	ns	ns	ns	-27.3	-34.3	-38.4	-44.3	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	154	-47.2	-46.4	-79.2	-78.9	ns	ns	-42.3	-44.3	-49.9	-51.6	ns
Calcium (Ca)	Fraction 1	mg/kg	lognormal	0.293	0.053	0.003	ns	ns	ns	43.7	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.002	0.015	ns	-93.7	ns	-94.3	ns	1,759	ns	-92.7	ns	-93.0	ns	1,414
	Fraction 3	mg/kg	lognormal	<0.001	0.036	0.017	647	ns	423	-94.8	ns	1,246	ns	-77.2	ns	-82.7	ns	406
	Fraction 4	mg/kg	lognormal	<0.001	0.003	<0.001	61.0	ns	87.1	-46.3	ns	117	ns	-30.5	ns	-43.0	ns	47.1
	Fraction 5	mg/kg	lognormal	<0.001	0.095	<0.001	1,077	341	430	-62.6	-55.0	ns	262	182	218	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.005	0.218	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.008	0.200	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.011	0.111	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

P-value <0.05.
Positive MOD (higher concentration of constituent at second biological monitoring area relative to the first).
Negative MOD (lower concentration of constituent at second biological monitoring area relative to the first).
Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.

[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. If the concentrations in one or more fractions was <LRL, the fraction sum was the sum of the LRL values. Constituents that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1}*100$ for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.

[c] The MOD was calculated as $[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1}*100$ for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.21: Differences in Concentrations of Sediment Quality Constituents Among Sampling Areas on Lower Greenhills and Gardine Creeks, Based on Sequential Extraction Analysis, 2019 to 2022

ANOVA Model [a]							Area Magnitude of Difference											
							Area Effects by Year [c]											
							2021						2022					
Constituent	Fraction	Units	Assumed Distribution	Area	Year	Area:Year	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF
Chromium (Cr)	Fraction 3	mg/kg	lognormal	<0.001	0.005	<0.001	ns	-25.4	-39.4	-31.6	-44.5	-18.8	-41.8	-24.7	-18.3	29.4	40.4	ns
	Fraction 4	mg/kg	lognormal	0.061	0.126	0.013	-38.3	ns	ns	51.8	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.011	0.216	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Cobalt (Co)	Fraction 1	mg/kg	lognormal	0.776	<0.001	0.012	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	0.046	0.025	<0.001	ns	ns	ns	ns	ns	ns	-43.7	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	-74.8	ns	-49.6	377	100	-58.1	-29.5	ns	ns	31.6	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.263	<0.001	ns	57.0	ns	94.9	45.5	ns	53.4	ns	ns	ns	-39.8	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	<0.001	-54.1	ns	-32.3	92.7	47.6	-23.4	ns	ns	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.013	<0.001	-56.1	22.5	-32.9	179	52.9	-45.2	-21.4	ns	-19.6	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.001	<0.001	-55.5	ns	-32.7	149	51.2	-39.4	-18.1	ns	-15.5	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	-64.1	ns	-43.0	231	59.0	-51.9	-32.7	-15.7	-21.5	25.3	ns	ns
Copper (Cu)	Fraction 4	mg/kg	lognormal	<0.001	0.011	<0.001	-44.1	-38.9	-34.9	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	<0.001	-63.8	-32.5	-49.8	86.7	38.9	-25.6	ns	ns	ns	ns	ns	ns
Iron (Fe)	Fraction 3	mg/kg	lognormal	<0.001	0.298	<0.001	-22.3	ns	-30.4	56.2	ns	-42.7	-33.2	ns	ns	50.2	31.3	ns
	Fraction 4	mg/kg	lognormal	0.013	0.779	0.036	ns	62.2	ns	78.8	76.8	ns	60.6	61.0	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.018	-30.1	ns	ns	58.5	ns	ns	ns	ns	ns	ns	ns	ns
Lead (Pb)	Fraction 3	mg/kg	lognormal	<0.001	<0.001	0.007	-15.0	-29.2	-19.1	-16.8	ns	ns	-23.9	-35.5	-20.4	-15.2	ns	23.4
	Fraction 4	mg/kg	lognormal	<0.001	0.124	<0.001	ns	ns	-42.3	ns	ns	-46.2	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.002	<0.001	-63.8	ns	-39.4	154	67.3	-34.0	ns	ns	ns	ns	ns	ns
Lithium (Li)	Fraction 5	mg/kg	lognormal	<0.001	<0.001	<0.001	47.9	49.2	ns	ns	-22.4	-23.1	ns	ns	ns	ns	ns	ns
Manganese (Mn)	Fraction 1	mg/kg	lognormal	0.493	<0.001	0.007	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	0.190	<0.001	0.188	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 3	mg/kg	lognormal	<0.001	0.012	0.005	ns	ns	ns	ns	ns	-54.5	ns	ns	ns	ns	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.019	0.038	ns	75.9	ns	149	ns	-59.8	ns	80.3	ns	ns	ns	-37.3
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.002	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.036	0.781	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.025	0.718	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.065	0.178	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Molybdenum (Mo)	Fraction 5	mg/kg	lognormal	<0.001	0.294	0.010	ns	ns	-47.9	ns	-40.4	-35.3	ns	ns	ns	ns	ns	ns
Nickel (Ni)	Fraction 1	mg/kg	lognormal	<0.001	0.180	<0.001	-45.9	-65.7	-77.8	-36.6	-58.9	-35.1	ns	ns	-77.2	ns	-81.7	ns
	Fraction 2	mg/kg	lognormal	<0.001	<0.001	<0.001	-48.3	-75.1	-77.5	-51.8	-56.5	ns	ns	ns	-84.3	ns	-83.2	ns
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	-67.9	-50.4	-73.8	54.4	-18.6	-47.2	ns	-64.8	-67.2	-69.2	-71.4	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.104	<0.001	-40.7	ns	ns	ns	ns	ns	133	-31.1	-43.0	-70.4	-75.5	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.004	-46.1	ns	-37.5	59.5	ns	-27.3	ns	ns	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.009	<0.001	-57.7	-48.8	-66.8	ns	ns	-35.2	32.5	ns	-69.6	ns	-77.1	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	<0.001	<0.001	-55.2	-41.0	-61.2	31.5	ns	-34.3	25.8	ns	-60.7	ns	-68.8	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	-62.8	-56.8	-74.8	ns	-32.3	-41.6	ns	ns	-73.9	ns	-76.0	ns

P-value <0.05.
Positive MOD (higher concentration of constituent at second biological monitoring area relative to the first).
Negative MOD (lower concentration of constituent at second biological monitoring area relative to the first).
Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.
[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. If the concentrations in one or more fractions was <LRL, the fraction sum was the sum of the LRL values. Constituents that had >75% censored data were excluded from the analyses.
[b] The MOD was calculated as [$EMM_{station\ 2}$- $EMM_{station\ 1}$]/$EMM_{station\ 1}$*100 for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.
[c] The MOD was calculated as[$EMM_{station\ 2}$- $EMM_{station\ 1}$]/$EMM_{station\ 1}$*100 for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.21: Differences in Concentrations of Sediment Quality Constituents Among Sampling Areas on Lower Greenhills and Gardine Creeks, Based on Sequential Extraction Analysis, 2019 to 2022

ANOVA Model [a]							Area Magnitude of Difference											
							Area Effects by Year [c]											
							2021						2022					
Constituent	Fraction	Units	Assumed Distribution	Area	Year	Area:Year	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF	RG_GHP vs RG_GHBP	RG_GHP vs RG_GAUT	RG_GHP vs RG_GANF	RG_GHBP vs RG_GAUT	RG_GHBP vs RG_GANF	RG_GAUT vs RG_GANF
Phosphorus (P)	Fraction 3	mg/kg	lognormal	<0.001	0.182	<0.001	-38.8	ns	-52.3	ns	ns	-48.3	ns	83.0	ns	ns	ns	-41.9
Potassium (K)	Fraction 1	mg/kg	lognormal	0.987	<0.001	<0.001	ns	50.4	56.6	50.4	56.6	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	0.987	<0.001	<0.001	ns	50.4	56.6	50.4	56.6	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	0.987	<0.001	<0.001	ns	50.4	56.6	50.4	56.6	ns	ns	ns	ns	ns	ns	ns
Selenium (Se)	Fraction 1	mg/kg	lognormal	<0.001	0.510	0.028	-81.4	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.392	<0.001	ns	-85.0	-73.7	-77.0	-59.6	ns	ns	-99.9	-99.8	-99.9	-99.8	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.120	<0.001	-73.7	-91.1	-84.8	-66.2	ns	ns	ns	-94.0	-93.6	-90.3	-89.6	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.011	<0.001	-85.3	-87.4	-86.7	ns	ns	ns	-61.6	-91.6	-91.7	-78.2	-78.3	ns
Silver (Ag)	Fraction 5	mg/kg	lognormal	<0.001	0.979	<0.001	-69.2	ns	ns	121	141	ns	-35.5	-34.6	-41.8	ns	ns	ns
Strontium (Sr)	Fraction 1	mg/kg	lognormal	<0.001	0.001	0.210	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 2	mg/kg	lognormal	<0.001	0.007	0.002	ns	-66.6	52.6	-74.8	ns	357	ns	-75.9	ns	-69.2	ns	343
	Fraction 3	mg/kg	lognormal	<0.001	0.025	0.022	342	ns	190	-81.0	ns	244	ns	ns	ns	ns	ns	ns
	Fraction 4	mg/kg	lognormal	0.049	0.021	0.005	-20.3	ns	25.0	41.0	56.9	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.035	0.031	ns	ns	-26.8	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.004	0.043	96.6	ns	85.5	-49.4	ns	86.6	ns	-32.7	ns	ns	ns	55.3
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.033	0.013	54.2	ns	43.7	-38.2	ns	50.6	ns	-27.8	ns	ns	ns	35.1
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.016	0.024	128	-52.9	94.7	-79.3	ns	313	ns	-65.9	ns	-60.3	ns	205
Thallium (Tl)	Fraction 5	mg/kg	lognormal	0.007	0.030	0.059	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Titanium (Sn)	Fraction 4	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	-85.7	209	-89.0	ns	2,066	587	ns	379	-84.6	ns	353
	Fraction 5	mg/kg	lognormal	<0.001	0.015	<0.001	109	44.1	ns	-31.2	-51.2	-29.1	ns	50.8	ns	82.0	ns	-32.1
Uranium (U)	Fraction 1	mg/kg	lognormal	<0.001	0.020	0.001	ns	ns	-67.3	ns	ns	ns	-70.3	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.021	<0.001	ns	-81.2	ns	-71.1	ns	237	ns	-87.2	-65.5	-83.5	-55.5	170
	Fraction 3	mg/kg	lognormal	<0.001	0.034	<0.001	ns	-36.5	ns	-44.9	ns	57.5	ns	-46.8	-48.9	-58.7	-60.4	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.135	<0.001	-57.6	ns	-33.7	101	56.2	ns	ns	ns	ns	ns	-35.2	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.172	<0.001	ns	ns	-33.1	-23.8	-39.9	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.062	<0.001	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.074	<0.001	ns	ns	-39.7	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.024	<0.001	ns	-63.9	ns	-58.2	ns	118	ns	-70.5	-58.4	-70.4	-58.3	ns
Vanadium (V)	Fraction 3	mg/kg	lognormal	<0.001	0.002	<0.001	-17.2	-26.6	-49.8	ns	-39.3	-31.6	-46.1	-27.4	-30.2	34.6	29.4	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.067	0.004	-51.3	ns	-29.7	65.1	44.5	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.002	0.368	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Zinc (Zn)	Fraction 2	mg/kg	lognormal	<0.001	0.003	<0.001	61.8	-62.0	-61.9	-76.5	-76.4	ns	ns	-75.2	-74.7	-77.3	-76.8	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.005	<0.001	57.7	-36.1	-48.7	-59.5	-67.5	ns	ns	-52.3	-48.1	-58.1	-54.3	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.006	<0.001	ns	ns	-34.9	ns	ns	-33.6	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.011	-45.8	ns	-34.3	54.5	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.002	<0.001	59.2	-43.0	-52.3	-64.2	-70.0	ns	ns	-58.6	-55.2	-63.0	-60.0	ns

P-value <0.05.
Positive MOD (higher concentration of constituent at second biological monitoring area relative to the first).
Negative MOD (lower concentration of constituent at second biological monitoring area relative to the first).

Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.

[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. If the concentrations in one or more fractions was <LRL, the fraction sum was the sum of the LRL values. Constituents that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1} * 100$ for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.

[c] The MOD was calculated as $[EMM_{station\ 2} - EMM_{station\ 1}]/EMM_{station\ 1} * 100$ for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.22: Differences in Concentrations of Sediment Quality Constituents Among Years on Lower Greenhills and Gardine Creeks Sampling Areas, 2019 to 2022

ANOVA Model [a]							Yearly Magnitude of Difference																	
							Year Effects [b]						Year Effects by Area [c]											
													RG_GHP						RG_GHBP					
Constituent		Units	Assumed Distribution	Area	Year	Area:Year	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022
Physical Tests	Moisture	%	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	31.5	ns	ns	ns	-25.0	ns	-35.0	-37.4
	pH (1:2 soil:water)	pH units	lognormal	0.848	<0.001	<0.001	nc	nc	nc	nc	nc	nc	nc	3.72	ns	nc	nc	-2.49	nc	7.88	10.8	nc	nc	2.67
	Silt (0.0312 mm to 0.004 mm)	%	lognormal	<0.001	0.053	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Silt (0.063 mm to 0.0312 mm)	%	lognormal	0.001	0.900	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	72.7	ns	ns	ns	ns	ns	ns	ns	-47.6	-45.8
	Clay (<4 µm)	%	lognormal	<0.001	0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-33.8	ns	-29.9	ns	60.3	ns	88.8	-33.4	ns	76.8
	Sand (0.125 mm to 0.063 mm)	%	lognormal	<0.001	0.781	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	200	ns	167	144	ns	ns	ns	ns	ns	ns
	Sand (0.25 mm to 0.125 mm)	%	lognormal	<0.001	0.902	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	126	ns
	Sand (0.50 mm to 0.25 mm)	%	lognormal	<0.001	0.710	0.020	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	145	ns
	Sand (1.00 mm to 0.50 mm)	%	lognormal	<0.001	0.413	0.578	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sand (2.00 mm to 1.00 mm)	%	lognormal	<0.001	0.140	0.366	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Gravel (>2 mm)	%	lognormal	<0.001	0.565	0.708	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Organic Carbon	Total Organic Carbon	%	lognormal	<0.001	0.004	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Metals	Aluminum (Al)	mg/kg	lognormal	<0.001	<0.001	0.083	ns	-22.6	ns	-31.4	-24.8	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Antimony (Sb)	mg/kg	lognormal	<0.001	0.010	0.008	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Arsenic (As)	mg/kg	lognormal	<0.001	0.005	0.200	ns	-22.2	ns	ns	ns	21.5	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Barium (Ba)	mg/kg	lognormal	<0.001	<0.001	0.018	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	-19.5	-21.1	ns	ns	ns
	Beryllium (Be)	mg/kg	lognormal	<0.001	0.270	0.187	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Boron (B)	mg/kg	lognormal	0.006	<0.001	0.186	49.5	ns	ns	-41.1	-36.5	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Cadmium (Cd)	mg/kg	lognormal	<0.001	0.569	0.010	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	37.0	ns	ns	ns	-26.3	ns
	Calcium (Ca)	mg/kg	lognormal	<0.001	0.655	0.088	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Chromium (Cr)	mg/kg	lognormal	<0.001	<0.001	0.376	ns	-15.6	ns	-23.6	-18.9	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Cobalt (Co)	mg/kg	lognormal	<0.001	0.002	0.160	ns	-14.9	-12.7	-11.9	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Copper (Cu)	mg/kg	lognormal	<0.001	0.332	0.040	nc	nc	nc	nc	nc	nc	ns	ns	-25.9	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Iron (Fe)	mg/kg	lognormal	<0.001	0.032	0.051	ns	-20.6	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Lead (Pb)	mg/kg	lognormal	<0.001	0.111	0.080	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Lithium (Li)	mg/kg	lognormal	<0.001	0.171	0.009	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	44.0	ns	ns	57.1
	Magnesium (Mg)	mg/kg	lognormal	<0.001	<0.001	0.157	ns	-18.4	-11.9	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Manganese (Mn)	mg/kg	lognormal	0.002	0.465	0.737	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Mercury (Hg)	mg/kg	lognormal	<0.001	<0.001	0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	-32.3	ns	85.5	52.0	ns	ns	-51.1	-40.3
	Molybdenum (Mo)	mg/kg	lognormal	<0.001	0.027	0.186	ns	ns	ns	ns	ns	21.9	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Nickel (Ni)	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	52.3	ns	-26.8	ns	-52.0	-42.5
	Phosphorus (P)	mg/kg	lognormal	0.001	0.007	0.390	ns	-17.0	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Potassium (K)	mg/kg	lognormal	<0.001	<0.001	0.149	23.8	ns	ns	-30.8	-25.4	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Selenium (Se)	mg/kg	lognormal	<0.001	0.603	0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	-72.7	-68.1
	Silver (Ag)	mg/kg	lognormal	<0.001	0.626	0.162	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sodium (Na)	mg/kg	lognormal	0.002	<0.001	0.045	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	-30.5	-24.6	ns
	Strontium (Sr)	mg/kg	lognormal	<0.001	0.808	0.216	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sulphur (S)	mg/kg	lognormal	<0.001	0.474	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	97.4	ns	ns	ns	ns	ns	-59.7	ns

P-value <0.05.
Positive MOD (higher concentration of constituent at later year relative to earlier year).
Negative MOD (lower concentration of constituent at the later year relative to the earlier year).

Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.

[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. Constituents that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{Year\ 2} - EMM_{Year\ 1}]/EMM_{Year\ 1} \times 100$ for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.

[c] The MOD was calculated as $[EMM_{Year\ 2} - EMM_{Year\ 1}]/EMM_{Year\ 1} \times 100$ for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.22: Differences in Concentrations of Sediment Quality Constituents Among Years on Lower Greenhills and Gardine Creeks Sampling Areas, 2019 to 2022

ANOVA Model [a]							Yearly Magnitude of Difference																	
							Year Effects [b]						Year Effects by Area [c]											
													RG_GHP						RG_GHBP					
Constituent		Units	Assumed Distribution	Area	Year	Area:Year	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022
Metals	Thallium (Tl)	mg/kg	lognormal	<0.001	<0.001	0.081	24.2	ns	ns	-25.8	-22.5	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Tin (Sn)	mg/kg	lognormal	0.031	<0.001	<0.001	nc	nc	nc	nc	nc	nc	374	ns	ns	-80.1	-77.8	ns	203	-36.0	ns	-78.8	-64.2	69.4
	Titanium (Sn)	mg/kg	lognormal	0.031	<0.001	<0.001	nc	nc	nc	nc	nc	nc	374	ns	ns	-80.1	-77.8	ns	203	-36.0	ns	-78.8	-64.2	69.4
	Uranium (U)	mg/kg	lognormal	<0.001	0.515	0.003	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	-45.8	-37.5
	Vanadium (V)	mg/kg	lognormal	<0.001	<0.001	0.164	ns	-18.6	ns	-27.0	-18.9	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Zinc (Zn)	mg/kg	lognormal	<0.001	0.005	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-19.6	ns	ns	ns	52.8	ns	ns	-20.4	-27.6	ns
	Zirconium (Zr)	mg/kg	lognormal	0.022	<0.001	0.100	25.6	ns	ns	-25.3	-17.3	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Polycyclic Aromatic Hydrocarbons	Acenaphthylene	mg/kg	log-normal	0.002	<0.001	0.454	ns	ns	ns	ns	109	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Benz(a)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Benzo(a)pyrene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	106	127	260	ns	ns	-57.3	-73.1
	Benzo(b&j)fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	124	ns	ns	ns	122	222	ns	ns	-50.0	-65.5
	Benzo(b+j+k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	133	ns	ns	ns	124	222	ns	ns	-52.8	-67.2
	Benzo(e)pyrene	mg/kg	lognormal	<0.001	<0.001	0.003	nc	nc	nc	nc	nc	nc	ns	ns	nc	ns	nc	nc	132	228	nc	ns	nc	nc
	Benzo(g,h,i)perylene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	135	ns	ns	117	137	268	ns	ns	-51.4	-68.6
	Benzo(k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	252	ns	128	188	ns	ns	ns	ns	ns	ns
	Chrysene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	97.4	ns	ns	ns	114	ns	ns	ns	ns	ns
	Dibenz(a,h)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	88.4	ns	144	ns	ns	113	ns	ns	ns	ns	ns	-56.2
	Fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	138	201	ns	ns	ns	-59.5
	Fluorene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	103	ns	ns	ns	177	294	ns	ns	-58.8	-71.1
	Indeno(1,2,3-c,d)pyrene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	147	154	ns	ns	ns	ns	ns
	1-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	105	ns	ns	ns	146	299	ns	ns	-50.6	-69.5
	2-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	99.4	ns	ns	ns	147	306	ns	ns	-52.2	-71.0
	Naphthalene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	123	ns	ns	ns	164	347	ns	ns	-56.2	-74.2
	Perylene	mg/kg	lognormal	0.019	<0.001	0.364	ns	ns	nc	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Phenanthrene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	109	230	ns	ns	ns	-60.9
	Pyrene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	96.8	ns	ns	ns	108	176	ns	ns	-51.8	-63.7

P-value <0.05.
Positive MOD (higher concentration of constituent at later year relative to earlier year).
Negative MOD (lower concentration of constituent at the later year relative to the earlier year).
Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.
[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. Constituents that had >75% censored data were excluded from the analyses.
[b] The MOD was calculated as $[EMM_{Year\ 2} - EMM_{Year\ 1}]/EMM_{Year\ 1}*100$ for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.
[c] The MOD was calculated as $[EMM_{Year\ 2} - EMM_{Year\ 1}]/EMM_{Year\ 1}*100$ for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.22: Differences in Concentrations of Sediment Quality Constituents Among Years on Lower Greenhills and Gardine Creeks Sampling Areas, 2019 to 2022

ANOVA Model [a]							Yearly Magnitude of Difference – Year Effects by Area [c] – RG_GAUT						RG_GANF					
Constituent		Units	Assumed Distribution	Area	Year	Area:Year	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022
Physical Tests	Moisture	%	lognormal	<0.001	<0.001	<0.001	ns	36.3	-29.6	38.0	-28.8	-48.4	38.0	78.1	ns	29.0	ns	-36.9
	pH (1:2 soil:water)	pH units	lognormal	0.848	<0.001	<0.001	nc	-8.19	ns	nc	nc	9.19	nc	-5.60	2.72	nc	nc	8.81
	Silt (0.0312 mm to 0.004 mm)	%	lognormal	<0.001	0.053	<0.001	-38.8	ns	75.8	56.4	187	83.8	ns	ns	ns	ns	ns	52.2
	Silt (0.063 mm to 0.0312 mm)	%	lognormal	0.001	0.9	<0.001	-47.9	ns	ns	ns	162	ns	ns	ns	ns	ns	ns	ns
	Clay (<4 µm)	%	lognormal	<0.001	0.001	<0.001	ns	ns	ns	ns	47.7	ns	ns	ns	144	ns	165	136
	Sand (0.125 mm to 0.063 mm)	%	lognormal	<0.001	0.781	<0.001	ns	ns	ns	ns	ns	ns	96.9	ns	ns	ns	-60.8	ns
	Sand (0.25 mm to 0.125 mm)	%	lognormal	<0.001	0.902	<0.001	ns	ns	-53.4	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sand (0.50 mm to 0.25 mm)	%	lognormal	<0.001	0.71	0.02	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sand (1.00 mm to 0.50 mm)	%	lognormal	<0.001	0.413	0.578	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sand (2.00 mm to 1.00 mm)	%	lognormal	<0.001	0.14	0.366	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Gravel (>2 mm)	%	lognormal	<0.001	0.565	0.708	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Organic Carbon	Total Organic Carbon	%	lognormal	<0.001	0.003	<0.001	ns	ns	78.0	ns	115	79.2	ns	ns	82.0	ns	77.6	73.1
Metals	Aluminum (Al)	mg/kg	lognormal	<0.001	<0.001	0.083	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Antimony (Sb)	mg/kg	lognormal	<0.001	0.01	0.008	ns	61.8	ns	51.1	ns	ns	ns	70.7	ns	50.8	ns	ns
	Arsenic (As)	mg/kg	lognormal	<0.001	0.005	0.200	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Barium (Ba)	mg/kg	lognormal	<0.001	<0.001	0.018	ns	ns	ns	ns	ns	34.2	ns	-23.1	-21.8	ns	ns	ns
	Beryllium (Be)	mg/kg	lognormal	<0.001	0.27	0.187	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Boron (B)	mg/kg	lognormal	0.006	<0.001	0.186	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Cadmium (Cd)	mg/kg	lognormal	<0.001	0.569	0.01	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Calcium (Ca)	mg/kg	lognormal	<0.001	0.655	0.088	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Chromium (Cr)	mg/kg	lognormal	<0.001	<0.001	0.376	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Cobalt (Co)	mg/kg	lognormal	<0.001	0.002	0.16	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Copper (Cu)	mg/kg	lognormal	<0.001	0.332	0.04	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Iron (Fe)	mg/kg	lognormal	<0.001	0.032	0.051	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Lead (Pb)	mg/kg	lognormal	<0.001	0.111	0.08	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Lithium (Li)	mg/kg	lognormal	<0.001	0.171	0.009	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Magnesium (Mg)	mg/kg	lognormal	<0.001	<0.001	0.157	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Manganese (Mn)	mg/kg	lognormal	0.002	0.465	0.737	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Mercury (Hg)	mg/kg	lognormal	<0.001	<0.001	0.001	43.2	47.0	44.2	ns	ns	ns	ns	ns	ns	ns	ns	-31.0
	Molybdenum (Mo)	mg/kg	lognormal	<0.001	0.027	0.186	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Nickel (Ni)	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	-26.2	-38.5	ns	-22.8	ns	ns	-29.7	-27.4	ns	ns	ns
	Phosphorus (P)	mg/kg	lognormal	0.001	0.007	0.390	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Potassium (K)	mg/kg	lognormal	<0.001	<0.001	0.149	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Selenium (Se)	mg/kg	lognormal	<0.001	0.603	0.001	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Silver (Ag)	mg/kg	lognormal	<0.001	0.626	0.162	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sodium (Na)	mg/kg	lognormal	0.002	<0.001	0.045	ns	ns	ns	-22.5	-20.9	ns	ns	ns	ns	ns	ns	ns
	Strontium (Sr)	mg/kg	lognormal	<0.001	0.808	0.216	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sulphur (S)	mg/kg	lognormal	<0.001	0.474	<0.001	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

P-value <0.05.
Positive MOD (higher concentration of constituent at later year relative to earlier year).
Negative MOD (lower concentration of constituent at the later year relative to the earlier year).
Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.
[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. Constituents that had >75% censored data were excluded from the analyses.
[b] The MOD was calculated as $[EMM_{Year\ 2} - EMM_{Year\ 1}]/EMM_{Year\ 1}*100$ for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.
[c] The MOD was calculated as $[EMM_{Year\ 2} - EMM_{Year\ 1}]/EMM_{Year\ 1}*100$ for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.22: Differences in Concentrations of Sediment Quality Constituents Among Years on Lower Greenhills and Gardine Creeks Sampling Areas, 2019 to 2022

ANOVA Model [a]							Yearly Magnitude of Difference											
							Year Effects by Area [c]											
							RG_GAUT						RG_GANF					
Constituent		Units	Assumed Distribution	Area	Year	Area:Year	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022
Metals	Thallium (Tl)	mg/kg	lognormal	<0.001	<0.001	0.081	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Tin (Sn)	mg/kg	lognormal	0.031	<0.001	<0.001	86.3	ns	ns	-49.5	-49.9	ns	362	75.2	89.6	-62.1	-58.9	ns
	Titanium (Sn)	mg/kg	lognormal	0.031	<0.001	<0.001	86.3	ns	ns	-49.5	-49.9	ns	362	75.2	89.6	-62.1	-58.9	ns
	Uranium (U)	mg/kg	lognormal	<0.001	0.515	0.003	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Vanadium (V)	mg/kg	lognormal	<0.001	<0.001	0.164	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Zinc (Zn)	mg/kg	lognormal	<0.001	0.005	<0.001	ns	-18.0	ns	ns	ns	ns	ns	-22.9	ns	ns	ns	ns
	Zirconium (Zr)	mg/kg	lognormal	0.022	<0.001	0.100	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Polycyclic Aromatic Hydrocarbons	Acenaphthylene	mg/kg	log-normal	0.002	<0.001	0.454	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Benz(a)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	ns	243	233	ns	ns	121	198	ns	155	ns
	Benzo(a)pyrene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	242	314	173	231	ns	ns	ns	ns	ns	184	ns
	Benzo(b&j)fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	364	369	148	150	ns	ns	ns	119	ns	ns	ns
	Benzo(b+j+k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	353	343	153	147	ns	ns	ns	150	ns	114	ns
	Benzo(e)pyrene	mg/kg	lognormal	<0.001	<0.001	0.003	ns	335	nc	143	nc	nc	ns	ns	nc	ns	nc	nc
	Benzo(g,h,i)perylene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	364	362	162	161	ns	ns	208	185	ns	ns	ns
	Benzo(k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	ns	120	309	ns	ns	ns	780	ns	640	355
	Chrysene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	356	377	227	242	ns	ns	151	211	ns	121	ns
	Dibenz(a,h)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	ns	142	133	ns	ns	135	242	ns	113	ns
	Fluoranthene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	358	283	184	137	ns	ns	216	294	ns	137	ns
	Fluorene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	332	415	168	220	ns	ns	171	309	113	222	ns
	Indeno(1,2,3-c,d)pyrene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	ns	ns	179	ns	ns	ns	285	ns	139	ns
	1-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	299	442	139	225	ns	ns	162	330	ns	230	ns
	2-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	311	483	138	238	ns	ns	174	337	ns	225	ns
	Naphthalene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	329	613	121	267	ns	ns	195	467	ns	290	ns
	Perylene	mg/kg	lognormal	0.019	<0.001	0.364	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Phenanthrene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	324	393	140	179	ns	ns	180	273	105	173	ns
	Pyrene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	280	224	144	108	ns	ns	224	229	ns	ns	ns

P-value <0.05.
Positive MOD (higher concentration of constituent at later year relative to earlier year).
Negative MOD (lower concentration of constituent at the later year relative to the earlier year).
Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.
[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. Constituents that had >75% censored data were excluded from the analyses.
[b] The MOD was calculated as [$EMM_{Year\ 2}$- $EMM_{Year\ 1}$]/$EMM_{Year\ 1}$*100 for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.
[c] The MOD was calculated as[$EMM_{Year\ 2}$- $EMM_{Year\ 1}$]/$EMM_{Year\ 1}$*100 for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.23: Differences in Concentrations of Sediment Quality Constituents Among Years on Lower Greenhills and Gardine Creeks Sampling Areas, Based on Sequential Extraction Analysis, 2019 to 2022

ANOVA Model [a]							Yearly Magnitude of Difference: Year Effects [b]						Year Effects by Area [c]: RG_GHP						RG_GHBP						RG_GAUT						RG_GANF					
Constituent	Fraction	Units	Assumed Distribution	Area	Year	Area:Year	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022
Aluminum (Al)	Fraction 3	mg/kg	lognormal	<0.001	0.568	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	-16.9	ns	ns	22.2	ns	44.0	38.2	ns	ns	ns	ns	ns	ns	ns	-17.9	ns	ns	ns	21.5
	Fraction 4	mg/kg	lognormal	<0.001	0.071	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	73.1	-56.5	ns	162	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.131	ns	-11.8	ns	-18.4	-14.8	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Antimony (Sb)	Fraction 5	mg/kg	lognormal	<0.001	0.310	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-19.4	ns	ns	ns	ns	-35.1	ns	-31.8	ns	59.7	51.6	83.7	ns	ns	-25.6	-38.6	ns	58.4	ns	67.9	ns	-27.1
Arsenic (As)	Fraction 2	mg/kg	lognormal	0.133	0.004	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	196	ns	ns	ns	-56.9	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.121	0.127	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	0.665	0.066	0.029	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	-48.1	ns	ns	ns	ns	67.7	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.011	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	-27.5	ns	ns	ns	44.1	ns	ns	ns	ns	-26.3	ns	ns	ns	-25.9	ns	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	0.003	0.014	0.008	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Barium (Ba)	Fraction 1	mg/kg	lognormal	<0.001	0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	-38.8	87.2	ns	206	60.1	-47.7	39.9	51.0	44.7	ns	ns	ns	ns	43.7	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.001	<0.001	nc	nc	nc	nc	nc	nc	-12.5	ns	ns	ns	18.2	ns	-16.0	24.1	ns	47.6	26.3	-14.4	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	0.003	0.596	0.080	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	0.002	0.012	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	53.4	-46.5	45.6	-65.1	ns	172	ns	32.7	35.1	ns	ns	ns	ns	ns	33.1	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.500	0.105	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.042	0.002	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	21.8	30.5	24.5	ns	ns	ns	ns	21.6	ns	24.0	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.637	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	16.4	17.0	ns	21.4	17.7	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.069	0.086	ns	ns	ns	11.7	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Beryllium (Be)	Fraction 3	mg/kg	lognormal	<0.001	0.010	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	33.4	ns	ns	28.9	31.2	ns	ns	ns	ns	ns	23.0	35.3	42.4	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.002	0.005	nc	nc	nc	nc	nc	nc	ns	ns	ns	-18.9	-21.8	ns	ns	-17.9	ns	-19.9	ns	29.2	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Cadmium (Cd)	Fraction 1	mg/kg	lognormal	<0.001	0.053	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-44.8	ns	-60.1	ns	ns	ns	100	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	187	154
	Fraction 2	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	-40.0	ns	47.6	40.6	146	74.9	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	35.5	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.002	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	101	312	ns	104	-33.9	-67.7	ns	ns	79.8	ns	61.6	ns	ns	ns	ns	ns	52.7	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.204	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	83.8	74.6	ns	ns	-33.0	-29.4	ns	ns	72.8	46.2	90.1	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	0.003	<0.001	0.006	nc	nc	nc	nc	nc	nc	ns	-29.2	-46.0	ns	-39.9	-23.7	-31.1	-30.1	-23.8	ns	ns	ns	ns	ns	-33.5	ns	-29.7	ns	ns	-26.4	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	-51.2	-100.0	50.3	-100.0	208	904,103	ns	34.0	61.4	ns	46.3	ns	ns	ns	29.0	ns	64.3	27.6
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	41.9	ns	ns	ns	ns	26.1	46.4	ns	35.8	ns	ns	ns	23.3	ns	53.7	26.1
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	40.0	180	40.0	100	ns	-50.1	ns	30.2	56.7	ns	48.5	ns	ns	ns	ns	ns	44.5	ns
Calcium (Ca)	Fraction 1	mg/kg	lognormal	0.293	0.053	0.003	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	-27.2	ns	39.6	ns	56.3	48.6	ns	ns	ns	ns	ns	ns	36.5	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.002	0.015	nc	nc	nc	nc	nc	nc	ns	ns	ns	59.9	56.3	ns	ns	51.8	37.3	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.036	0.017	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	-63.9	ns	ns	ns	ns	ns	ns	ns	298	ns	196	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.003	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	39.3	ns	ns	ns	-26.5	ns	ns	ns	ns	ns	ns	ns	ns	80.0	ns	53.9	ns	-35.2
	Fraction 5	mg/kg	lognormal	<0.001	0.095	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	-46.8	ns	ns	195	ns	-58.7	ns	-52.8	-59.4	-43.7	-51.6	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.005	0.218	ns	40.6	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.008	0.200	ns	38.7	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.011	0.111	ns	38.7	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

P-value <0.05.

Positive MOD (higher concentration of constituent at later year relative to earlier year).

Negative MOD (lower concentration of constituent at the later year relative to the earlier year).

Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.

[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. If the concentrations in one or more fractions was <LRL, the fraction sum was the sum of the LRL values. Constituents that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{Year\ 2} - EMM_{Year\ 1}]/EMM_{Year\ 1}*100$ for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.

[c] The MOD was calculated as $[EMM_{Year\ 2} - EMM_{Year\ 1}]/EMM_{Year\ 1}*100$ for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.23: Differences in Concentrations of Sediment Quality Constituents Among Years on Lower Greenhills and Gardine Creeks Sampling Areas, Based on Sequential Extraction Analysis, 2019 to 2022

ANOVA Model [a]							Yearly Magnitude of Difference																													
							Year Effects [b]						Year Effects by Area [c]																							
													RG_GHP						RG_GHBP						RG_GAUT						RG_GANF					
Constituent	Fraction	Units	Assumed Distribution	Area	Year	Area:Year	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022
Chromium (Cr)	Fraction 3	mg/kg	lognormal	<0.001	0.005	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	-28.6	73.8	ns	143	35.0	-44.5	ns	ns	ns	ns	ns	ns	ns	-20.3	ns	ns	33.4	40.4
	Fraction 4	mg/kg	lognormal	0.061	0.126	0.013	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	62.2	ns	ns	64.3	ns	52.8	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.011	0.216	ns	-11.1	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Cobalt (Co)	Fraction 1	mg/kg	lognormal	0.776	<0.001	0.012	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	172	179	158	ns	ns	ns	145	209	186	ns	ns	ns
	Fraction 2	mg/kg	lognormal	0.046	0.025	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	79.5	221	133	86.5	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	124	91.8	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	-23.6	ns	-48.5	-65.7	ns	-33.5	54.9	133	ns	-23.6	-51.0	ns	-46.9	-35.8	-29.9	-45.3	ns	ns	ns	41.2
	Fraction 4	mg/kg	lognormal	<0.001	0.263	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	-47.6	ns	-57.2	ns	89.3	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-38.6	ns	-36.2	-23.1	ns	-37.1	ns	-27.1	ns	58.0	ns	-23.4	-30.5	-22.7	-29.9	ns	ns	-24.5	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.013	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	-40.4	ns	69.7	ns	ns	-37.2	ns	-39.1	-31.2	ns	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-18.4	ns	ns	ns	ns	ns	ns	-36.7	ns	65.1	ns	ns	-34.0	-15.1	-36.6	-25.2	ns	ns	ns	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	-24.8	-48.3	ns	-31.2	20.1	74.5	ns	-20.7	-47.6	ns	-44.2	-33.9	-20.4	-33.2	ns	-16.1	ns	28.0
Copper (Cu)	Fraction 4	mg/kg	lognormal	<0.001	0.011	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	58.1	ns	ns	-52.5	ns	57.6	ns	85.0	174	ns	82.2	ns	ns	ns	55.3	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-34.4	ns	-34.2	-24.0	ns	-35.6	ns	-33.8	ns	69.2	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Iron (Fe)	Fraction 3	mg/kg	lognormal	<0.001	0.298	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	50.0	33.8	65.7	47.8	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	30.9
	Fraction 4	mg/kg	lognormal	0.013	0.779	0.036	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	-43.1	ns	68.8	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.018	nc	nc	nc	nc	nc	nc	ns	ns	-35.4	ns	-34.6	ns	ns	ns	ns	ns	ns	ns	ns	-32.3	-45.8	-31.0	-44.7	ns	ns	-31.2	-31.8	ns	ns	ns
Lead (Pb)	Fraction 3	mg/kg	lognormal	<0.001	<0.001	0.007	nc	nc	nc	nc	nc	nc	ns	-15.6	ns	ns	ns	29.4	ns	ns	22.6	ns	ns	15.9	ns	-18.3	ns	-15.6	ns	18.0	ns	ns	27.9	ns	21.9	27.2
	Fraction 4	mg/kg	lognormal	<0.001	0.124	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-51.4	ns	-54.4	-45.3	77.9	ns	ns	ns	ns	ns	ns	103	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.002	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-39.5	ns	-37.7	-32.9	ns	-45.1	ns	ns	ns	73.5	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Lithium (Li)	Fraction 5	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	28.0	ns	39.3	ns	-27.4	ns	-19.9	-34.9	-27.6	-41.1	ns	ns	-21.0	-22.5	ns	ns	ns
Manganese (Mn)	Fraction 1	mg/kg	lognormal	0.493	<0.001	0.007	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	2,004	1,480	504	ns	ns	ns	782	787	1,121	ns	ns	ns	349	682	430	ns	ns	ns
	Fraction 2	mg/kg	lognormal	0.190	<0.001	0.188	45.7	59.5	32.1	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 3	mg/kg	lognormal	<0.001	0.012	0.005	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	-59.6	ns	ns	101	ns	ns	ns	ns	ns	ns	-47.7	ns	-51.0	-57.4	ns	ns	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.019	0.038	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	-39.8	ns	ns	-40.0	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.002	nc	nc	nc	nc	nc	nc	ns	ns	-40.4	ns	-38.2	ns	ns	ns	ns	ns	ns	ns	ns	-33.4	-44.6	-34.6	-45.7	ns	ns	-29.0	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.036	0.781	ns	ns	ns	ns	ns	-21.5	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.025	0.718	ns	ns	ns	ns	ns	-20.9	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.065	0.178	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Molybdenum (Mo)	Fraction 5	mg/kg	lognormal	<0.001	0.294	0.010	nc	nc	nc	nc	nc	nc	ns	ns	-32.2	ns	-30.1	ns	ns	ns	ns	53.4	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Nickel (Ni)	Fraction 1	mg/kg	lognormal	<0.001	0.180	<0.001	nc	nc	nc	nc	nc	nc	ns	53.1	ns	65.6	49.1	ns	92.6	-35.1	ns	-66.3	ns	107	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	26.8	38.1	42.5	55.3	ns	60.7	-55.1	ns	-72.1	-45.1	96.5	ns	-40.7	ns	-24.9	ns	ns	ns	ns	-37.3	ns	-32.9	-24.2
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	23.0	19.7	25.5	22.1	ns	22.3	-70.5	ns	-75.9	ns	247	ns	-23.1	-46.8	ns	-37.5	-30.8	-27.7	-33.6	-19.1	ns	ns	21.8
	Fraction 4	mg/kg	lognormal	<0.001	0.104	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	103	-68.1	ns	-84.3	-42.6	266	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.004	nc	nc	nc	nc	nc	nc	ns	-23.6	-40.9	ns	-38.9	-22.7	ns	-30.8	ns	-22.8	ns	36.1	ns	ns	-30.5	ns	-29.7	ns	ns	-27.1	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.009	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	53.1	-66.4	ns	-78.0	-32.2	209	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	43.3	-61.9	ns	-73.4	-29.0	167	ns	ns	ns	ns	ns	ns	ns	-20.3	-23.2	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	23.8	24.2	29.2	29.6	ns	32.6	-66.3	ns	-74.6	-25.5	193	ns	-26.4	ns	ns	ns	ns	-23.6	-30.4	-27.6	ns	ns	ns

P-value <0.05.
Positive MOD (higher concentration of constituent at later year relative to earlier year).
Negative MOD (lower concentration of constituent at the later year relative to the earlier year).

Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.

[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. If the concentrations in one or more fractions was <LRL, the fraction sum was the sum of the LRL values. Constituents that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{Year\ 2} - EMM_{Year\ 1}]/EMM_{Year\ 1} \times 100$ for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.

[c] The MOD was calculated as $[EMM_{Year\ 2} - EMM_{Year\ 1}]/EMM_{Year\ 1} \times 100$ for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.23: Differences in Concentrations of Sediment Quality Constituents Among Years on Lower Greenhills and Gardine Creeks Sampling Areas, Based on Sequential Extraction Analysis, 2019 to 2022

ANOVA Model [a]							Yearly Magnitude of Difference																													
							Year Effects [b]						Year Effects by Area [c]																							
													RG_GHP						RG_GHBP						RG_GAUT						RG_GANF					
Constituent	Fraction	Units	Assumed Distribution	Area	Year	Area:Year	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2020 vs 2021	2020 vs 2022	2021 vs 2022
Phosphorus (P)	Fraction 3	mg/kg	lognormal	<0.001	0.182	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-38.0	ns	ns	-36.7	ns	ns	ns	ns	ns	ns	ns	ns	65.1	ns	ns	ns	-56.6	-50.4	ns	ns	61.4	ns
Potassium (K)	Fraction 1	mg/kg	lognormal	0.987	<0.001	<0.001	nc	nc	nc	nc	nc	nc	31.6	ns	47.5	ns	ns	34.8	ns	ns	ns	-26.3	ns	33.8	ns	70.7	59.6	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	0.987	<0.001	<0.001	nc	nc	nc	nc	nc	nc	31.6	ns	47.5	ns	ns	34.8	ns	ns	ns	-26.3	ns	33.8	ns	70.7	59.6	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	0.987	<0.001	<0.001	nc	nc	nc	nc	nc	nc	31.6	ns	47.5	ns	ns	34.8	ns	ns	ns	-26.3	ns	33.8	ns	70.7	59.6	ns	ns	ns	ns	ns	ns	ns	ns	ns
Selenium (Se)	Fraction 1	mg/kg	lognormal	<0.001	0.510	0.028	nc	nc	nc	nc	nc	nc	ns	140	ns	197	ns	ns	ns	ns	ns	-61.0	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.392	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	169	ns	171	ns	ns	-57.4	ns	-72.6	ns	115	-98.8	ns	-98.9	11,746	ns	-99.2	3,056	7,717	ns	ns	-97.0	-98.8
	Fraction 4	mg/kg	lognormal	<0.001	0.120	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	109	ns	ns	-69.3	ns	-82.8	ns	280	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.011	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	81.6	-67.8	ns	-82.3	ns	290	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Silver (Ag)	Fraction 5	mg/kg	lognormal	<0.001	0.979	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	-44.2	ns	-48.6	ns	97.4	ns	70.2	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Strontium (Sr)	Fraction 1	mg/kg	lognormal	<0.001	0.001	0.210	ns	29.5	ns	20.5	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 2	mg/kg	lognormal	<0.001	0.007	0.002	nc	nc	nc	nc	nc	nc	ns	ns	49.3	42.8	83.5	ns	ns	73.4	ns	45.4	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.025	0.022	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	139	ns	ns	ns	-65.8	ns	ns	ns	ns	ns	ns	ns	132	ns	ns	ns	ns
	Fraction 4	mg/kg	lognormal	0.049	0.021	0.005	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	25.8	ns	ns	-29.3	ns	36.1	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.035	0.031	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	-21.4	ns	-24.4	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	28.2
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.004	0.043	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	56.1	ns	ns	64.0	ns	ns	ns	-39.0	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.033	0.013	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	34.2	ns	-28.2	ns	ns	ns	ns	ns	ns	ns	28.4	ns	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.016	0.024	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	81.6	ns	ns	95.8	ns	ns	ns	-47.4	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Thallium (Tl)	Fraction 5	mg/kg	lognormal	0.007	0.030	0.059	ns	ns	-12.5	ns	-12.6	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Titanium (Sn)	Fraction 4	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	-69.5	-90.1	-67.8	-89.6	-67.6	ns	ns	ns	ns	ns	ns	ns	-93.0	-83.1	-93.0	-83.0	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.015	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	102	ns	119	ns	-54.4	99.7	ns	47.5	-38.7	-26.2	ns	ns	ns	ns	ns	ns	ns
Uranium (U)	Fraction 1	mg/kg	lognormal	<0.001	0.020	0.001	nc	nc	nc	nc	nc	nc	ns	ns	132	ns	137	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.021	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	102	ns	163	ns	91.1	ns	ns	-64.2	ns	83.3	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.034	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	61.1	ns	-49.4	ns	-60.4	ns	80.2	ns	ns	ns	ns	67.0	ns	ns	ns	ns	ns	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.135	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	-47.2	ns	-60.3	ns	146	ns	ns	58.9	ns	52.9	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.172	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	-25.8	ns	-27.5	ns	ns	65.4	ns	-24.1	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.062	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.074	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.024	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	64.8	ns	93.2	ns	ns	-43.3	ns	-62.1	ns	81.3	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Vanadium (V)	Fraction 3	mg/kg	lognormal	<0.001	0.002	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	-15.1	83.4	26.0	116	48.4	-31.3	ns	ns	ns	ns	ns	ns	ns	ns	40.6	ns	43.1	46.5
	Fraction 4	mg/kg	lognormal	<0.001	0.067	0.004	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	-36.8	ns	-40.0	ns	95.2	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.002	0.368	ns	-11.6	ns	-15.4	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Zinc (Zn)	Fraction 2	mg/kg	lognormal	<0.001	0.003	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	36.5	ns	36.3	ns	57.1	67.5	ns	ns	ns	-24.0	ns	ns	-24.1	ns	-28.4	-26.5	ns	ns	ns	ns	ns	-25.3
	Fraction 3	mg/kg	lognormal	<0.001	0.005	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	80.0	64.3	32.6	ns	-26.3	ns	ns	ns	ns	ns	ns	ns	ns	ns	28.0	ns	35.0	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.006	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns	110	ns	56.8	-42.4	ns	ns	ns	82.2	100.0	55.5	70.7	ns	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.011	nc	nc	nc	nc	nc	nc	ns	ns	-39.1	ns	-37.4	-25.0	ns	-25.3	ns	ns	ns	37.2	ns	-25.5	-32.3	ns	-26.5	ns	ns	-27.4	ns	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.002	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	22.8	ns	74.0	65.6	31.0	ns	-24.7	-20.9	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	25.2	ns

P-value <0.05.

Positive MOD (higher concentration of constituent at later year relative to earlier year).

Negative MOD (lower concentration of constituent at the later year relative to the earlier year).

Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; ns = not significant; nc = no comparison; HSD = Honestly Significant Difference.

[a] Censored regression Analysis of Variance (ANOVA) with factor Area, Year and Area:Year. Post-hoc contrasts were corrected using a Tukey's HSD Test. If the concentrations in one or more fractions was <LRL, the fraction sum was the sum of the LRL values. Constituents that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{Year\ 2} - EMM_{Year\ 1}]/EMM_{Year\ 1} * 100$ for all years combined when the Area:Year term was insignificant (α = 0.05) . The EMM is the estimated marginal mean from the censored regression model.

[c] The MOD was calculated as $[EMM_{Year\ 2} - EMM_{Year\ 1}]/EMM_{Year\ 1} * 100$ for each year when the Area:Year term was significant (α = 0.05). The EMM is the estimated marginal mean from the censored regression model.

Table F.24: **Sediment Quality Indices (SQI) for Biological Monitoring Areas on Greenhills and Gardine Creeks, 2013 to 2022**

Biological Monitoring Area	Year	SQI [a]	F1 (Scope) [b]	F2 (Area Frequency) [c]	F3 (Amplitude) [d]	Sample Size [e]
RG_GAUT	2019	30.2	70.0	49.5	85.3	99
	2020	35.5	50.0	46.0	88.7	100
	2021	24.5	75.0	49.0	95.2	100
	2022	27.0	65.0	50.5	95.9	97
RG_GANF	2019	33.9	55.0	45.0	89.8	100
	2020	37.2	45.0	38.0	91.4	100
	2021	33.1	50.0	43.0	95.3	100
	2022	30.0	55.0	46.9	97.2	98
RG_GHP	2013	24.9	70.0	50.9	97.2	163
	2017	24.6	70.0	55.0	95.6	120
	2019	20.7	75.0	62.5	96.6	120
	2020	20.8	70.0	66.0	97.8	100
	2021	24.1	65.0	59.2	97.8	98
	2022	21.6	70.0	62.5	98.1	120
RG_GHBP	2017	31.6	60.0	46.0	91.2	100
	2018	26.6	65.0	54.0	95.0	100
	2019	26.8	70.0	51.0	92.7	100
	2020	25.4	65.0	57.0	96.1	100
	2021	24.1	65.0	59.6	97.5	99
	2022	27.1	65.0	54.7	93.4	95

Notes: Non-detect data were replaced with the LRL to support calculation of the SQI. Calculations were derived using a total of 20 BC WSQG, including the alert concentration for selenium (BCMOECCS 2021a,b). SQI = Sediment Quality Index; LRL = Laboratory Reporting Limit; BC WSQG = British Columbia Working Sediment Quality Guidelines; no. = number.

[a] $SQI = 100 - (sqr(F1^2+F2^2+F3^2)/1.732)$.

[b] Percentage of constituents that did not meet their respective guidelines (i.e., no. of constituents with failed samples/total no. of constituents*100).

[c] Percentage of samples that did not meet their respective guidelines (i.e., no. of failed samples/total no. of samples*100).

[d] Normalized sum of extent above guidelines scaled between 0 and 100.

[e] Sample sizes reported in 2022 were smaller relative to 2021 due to higher scrutiny over PAH concentrations and exclusion of PAHs with LRLs that were raised due to potential evaporation-related effects associated with the drying process.

Table F.25: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHBP-1 on Lower Greenhills Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	453	2,160	6,660	<2,713	<9,373	<503	9,390
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.720	<0.4	<1.12	<0.2	0.830
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.0530	0.414	0.718	<5	<1.24	<6.24	0.467	6.95
Barium (Ba)	mg/kg	-	-	9.20	33.2	35.7	30.5	133	109	242	68.9	196
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.270	<0.2	0.320	<0.87	<1.19	<0.47	0.790
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	10.0
Cadmium (Cd)	mg/kg	0.600	3.50	0.168	0.596	0.756	0.127	0.0690	1.65	1.72	1.35	1.01
Calcium (Ca)	mg/kg	-	-	5,800	35,300	8,090	1,630	239	50,820	51,059	43,390	41,500
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.570	5.19	9.90	<11.3	<21.2	<5.57	14.1
Cobalt (Co)	mg/kg	-	-	0.140	0.640	3.39	1.98	2.18	6.15	8.33	4.03	8.55
Copper (Cu)	mg/kg	35.7	197	0.920	<0.5	0.530	11.4	11.7	<13.4	<25	<1.03	17.0
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,150	3,350	7,770	<6,600	<14,370	<3,200	20,400
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.29	2.05	5.91	<6.34	<12.2	<3.79	13.2
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	<20	<25	<10	13.9
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	6,020
Manganese (Mn)	mg/kg	460	1,100	20.6	113	172	18.1	31.7	324	355	285	520
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0408
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.890	<2	<2.89	<1	1.66
Nickel (Ni)	mg/kg	16.0	75.0	2.45	12.6	45.7	35.6	9.60	96.3	106	58.3	63.5
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	150	-	-	<250	<250	<200	1,290
Potassium (K)	mg/kg	-	-	140	-	-	-	-	140	140	-	2,050
Selenium (Se) [b]	mg/kg	2.00		0.450	0.260	2.13	20.3	3.09	23.1	26.2	2.39	6.85
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.240	<0.4	<0.64	<0.2	0.200
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	76.0
Strontium (Sr)	mg/kg	-	-	7.02	15.6	6.44	4.82	19.4	33.9	53.3	22.0	49.4
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	<1,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.174	<0.2	<0.374	<0.1	0.237
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	8.70	14.9	<15.7	<30.6	<6	15.8
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.0580	0.281	0.434	0.545	0.277	1.32	1.60	0.715	1.04
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.04	6.84	22.9	<9.28	<32.2	<2.24	30.4
Zinc (Zn)	mg/kg	123	315	<1	19.8	64.2	17.8	50.9	<103	<154	84.0	132

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021B).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.26: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHBP-2 on Lower Greenhills Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	446	1,670	8,330	<2,216	<10,546	<496	6,480
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.700	<0.4	<1.1	<0.2	0.830
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.372	0.416	5.16	<0.888	<6.05	<0.422	6.26
Barium (Ba)	mg/kg	-	-	12.3	38.0	33.3	23.2	134	107	241	71.3	173
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.260	<0.2	0.380	<0.86	<1.24	<0.46	0.680
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	5.80
Cadmium (Cd)	mg/kg	0.600	3.50	0.250	0.625	0.590	0.0820	0.0990	1.55	1.65	1.22	1.20
Calcium (Ca)	mg/kg	-	-	4,290	40,700	8,500	1,500	732	54,990	55,722	49,200	50,400
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.710	4.00	12.1	<10.2	<22.3	<5.71	10.8
Cobalt (Co)	mg/kg	-	-	0.200	0.770	3.09	1.33	2.89	5.39	8.28	3.86	7.62
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	6.79	14.4	<8.29	<22.7	<1	16.7
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,760	2,280	12,200	<5,140	<17,340	<2,810	17,900
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.44	1.00	6.82	<5.44	<12.3	<3.94	12.6
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	6.70	<20	<26.7	<10	11.7
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	5,310
Manganese (Mn)	mg/kg	460	1,100	61.8	108	208	16.2	46.6	394	441	316	433
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0491
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	1.12	<2	<3.12	<1	1.84
Nickel (Ni)	mg/kg	16.0	75.0	1.96	9.80	29.2	16.6	12.0	57.6	69.6	39.0	51.6
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	141	-	-	<241	<241	<191	1,240
Potassium (K)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	1,300
Selenium (Se) [b]	mg/kg	2.00		0.270	<0.2	1.17	8.53	1.80	<10.2	<12	<1.37	5.54
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.160	<0.4	<0.56	<0.2	0.240
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	59.0
Strontium (Sr)	mg/kg	-	-	5.07	17.8	7.23	4.90	22.0	35.0	57.0	25.0	50.4
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	<1,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.185	<0.2	<0.385	<0.1	0.192
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	18.7	13.3	<25.7	<39	<6	10.3
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.358	0.410	0.395	0.348	<1.21	<1.56	0.768	1.13
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.24	5.56	27.3	<8.2	<35.5	<2.44	23.0
Zinc (Zn)	mg/kg	123	315	<1	22.7	57.0	9.10	69.2	<89.8	<159	79.7	136

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.27: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHBP-3 on Lower Greenhills Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	410	1,850	6,440	<2,360	<8,800	<460	7,440
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.680	<0.4	<1.08	<0.2	0.780
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.326	0.642	<5	<1.07	<6.07	<0.376	7.36
Barium (Ba)	mg/kg	-	-	10.9	38.5	30.5	38.0	143	118	261	69.0	223
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.230	<0.2	0.280	<0.83	<1.11	<0.43	0.680
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	5.80
Cadmium (Cd)	mg/kg	0.600	3.50	0.185	0.681	0.710	0.117	0.0630	1.69	1.76	1.39	1.40
Calcium (Ca)	mg/kg	-	-	5,030	42,500	15,800	2,020	321	65,350	65,671	58,300	62,700
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.640	4.20	9.40	<10.3	<19.7	<5.64	12.4
Cobalt (Co)	mg/kg	-	-	0.280	0.900	3.08	1.78	2.21	6.04	8.25	3.98	9.61
Copper (Cu)	mg/kg	35.7	197	1.23	<0.5	<0.5	9.62	11.0	<11.8	<22.8	<1	19.0
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,610	2,800	7,930	<5,510	<13,440	<2,660	21,800
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.45	1.67	5.40	<6.12	<11.5	<3.95	11.7
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	<20	<25	<10	12.0
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	6,010
Manganese (Mn)	mg/kg	460	1,100	85.7	136	161	13.9	31.0	397	428	297	701
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0422
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.790	<2	<2.79	<1	1.52
Nickel (Ni)	mg/kg	16.0	75.0	3.36	12.2	42.1	30.0	9.40	87.7	97.1	54.3	68.9
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	122	-	-	<222	<222	<172	1,190
Potassium (K)	mg/kg	-	-	150	-	-	-	-	150	150	-	1,990
Selenium (Se) [b]	mg/kg	2.00		0.280	0.220	1.56	12.9	2.03	15.0	17.0	1.78	6.14
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.200	<0.4	<0.6	<0.2	0.200
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	104
Strontium (Sr)	mg/kg	-	-	6.25	18.4	9.06	5.61	18.8	39.3	58.1	27.5	55.6
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	<1,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.153	<0.2	<0.353	<0.1	0.192
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	23.4	11.1	<30.4	<41.5	<6	11.4
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.0590	0.347	0.408	0.407	0.256	1.22	1.48	0.755	1.06
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.03	6.02	22.0	<8.45	<30.4	<2.23	26.2
Zinc (Zn)	mg/kg	123	315	<1	24.3	74.5	14.3	52.7	<114	<167	98.8	149

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.28: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHBP-4 on Lower Greenhills Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	342	1,400	6,640	<1,842	<8,482	<392	6,190
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.640	<0.4	<1.04	<0.2	0.620
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.260	0.450	<5	<0.81	<5.81	<0.31	4.45
Barium (Ba)	mg/kg	-	-	17.6	46.1	36.1	30.5	140	130	270	82.2	232
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.270	<0.2	0.320	<0.87	<1.19	<0.47	0.580
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	6.30
Cadmium (Cd)	mg/kg	0.600	3.50	0.175	0.529	0.491	0.0810	0.0910	1.28	1.37	1.02	1.23
Calcium (Ca)	mg/kg	-	-	4,320	45,900	24,300	2,110	730	76,630	77,360	70,200	71,300
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.600	3.55	9.70	<9.65	<19.4	<5.6	9.85
Cobalt (Co)	mg/kg	-	-	<0.1	0.380	3.62	1.47	2.58	<5.57	<8.15	4.00	7.51
Copper (Cu)	mg/kg	35.7	197	1.29	<0.5	<0.5	7.14	11.9	<9.43	<21.3	<1	16.0
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,260	2,080	9,990	<4,440	<14,430	<2,310	12,900
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.91	0.740	5.64	<5.65	<11.3	<4.41	10.3
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	5.50	<20	<25.5	<10	9.20
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	5,530
Manganese (Mn)	mg/kg	460	1,100	10.5	80.7	261	14.3	38.5	366	405	342	435
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0545
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.880	<2	<2.88	<1	1.22
Nickel (Ni)	mg/kg	16.0	75.0	1.82	9.20	30.9	21.3	10.4	63.2	73.6	40.1	65.3
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	68.0	-	-	<168	<168	<118	1,080
Potassium (K)	mg/kg	-	-	130	-	-	-	-	130	130	-	1,390
Selenium (Se) [b]	mg/kg	2.00		<0.2	0.210	1.21	8.40	1.36	<10	<11.4	1.42	8.40
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.150	<0.4	<0.55	<0.2	0.240
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	72.0
Strontium (Sr)	mg/kg	-	-	5.82	20.4	11.9	5.42	20.5	43.5	64.0	32.3	58.7
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,400
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.157	<0.2	<0.357	<0.1	0.180
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	17.7	11.2	<24.7	<35.9	<6	9.80
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.0500	0.376	0.448	0.324	0.336	1.20	1.53	0.824	1.36
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.00	5.10	22.4	<7.5	<29.9	<2.2	21.8
Zinc (Zn)	mg/kg	123	315	<1	17.5	50.2	8.00	58.0	<76.7	<135	67.7	124

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.29: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHBP-5 on Lower Greenhills Creek, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	252	872	5,550	<1,224	<6,774	<302	4,100
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.560	<0.4	<0.96	<0.2	0.330
Arsenic (As)	mg/kg	5.90	17.0	0.0600	0.0700	0.329	0.322	<5	0.781	<5.78	0.399	2.86
Barium (Ba)	mg/kg	-	-	10.8	34.4	51.9	26.1	86.7	123	210	86.3	136
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.210	<0.2	0.240	<0.81	<1.05	<0.41	0.360
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	6.20
Cadmium (Cd)	mg/kg	0.600	3.50	<0.05	0.491	0.956	0.0840	0.0690	<1.58	<1.65	1.45	1.10
Calcium (Ca)	mg/kg	-	-	3,270	45,300	90,200	2,530	721	141,300	142,021	135,500	107,000
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.510	2.33	7.80	<8.34	<16.1	<5.51	6.25
Cobalt (Co)	mg/kg	-	-	0.230	0.810	1.95	1.28	1.99	4.27	6.26	2.76	5.08
Copper (Cu)	mg/kg	35.7	197	1.35	<0.5	<0.5	6.92	8.60	<9.27	<17.9	<1	10.1
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	1,550	1,440	7,510	<3,090	<10,600	<1,600	9,010
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.82	<0.5	3.21	<5.32	<8.53	<4.32	6.32
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	<20	<25	<10	6.40
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	5,010
Manganese (Mn)	mg/kg	460	1,100	51.3	116	128	6.70	31.8	302	334	244	281
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0305
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.640	<2	<2.64	<1	0.720
Nickel (Ni)	mg/kg	16.0	75.0	2.76	11.5	27.8	17.5	8.00	59.6	67.6	39.3	46.3
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	136	-	-	<236	<236	<186	725
Potassium (K)	mg/kg	-	-	160	-	-	-	-	160	160	-	1,020
Selenium (Se) [b]	mg/kg	2.00		0.460	0.370	2.68	11.9	2.01	15.4	17.4	3.05	7.66
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.110	<0.4	<0.51	<0.2	0.130
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	69.0
Strontium (Sr)	mg/kg	-	-	4.60	19.4	37.2	4.05	17.0	65.2	82.2	56.6	60.8
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,700
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.123	<0.2	<0.323	<0.1	0.107
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	13.8	10.2	<20.8	<31	<6	9.10
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.0630	0.377	0.586	0.192	0.251	1.22	1.47	0.963	0.959
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	1.65	3.35	17.9	<5.4	<23.3	<1.85	14.0
Zinc (Zn)	mg/kg	123	315	<1	23.2	67.2	7.00	44.7	<98.4	<143	90.4	103

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.30: Annual Differences in Sediment Quality in Lower Greenhills Creek (RG_GHBP) for Years Before (2017) and After (2018 to 2022) Initiation of Antiscalant Treatment

ANOVA Model Testing for Difference Among Treatment and Year						*Post hoc* Contrasts and MODs (%) Relative to Pre-Treatment Year (2017)					
Constituent		Units	% Censored	Treatment	Year (Treatment)	Treatment Effects [a]	Treatment Effects by Years [b]				
							2018	2019	2020	2021	2022
Physical Tests	Moisture	%	0	0.056	<0.001	nc	45.2	ns	34.4	39.6	ns
	Sand (0.125 to 0.063 mm)	%	0	0.409	0.381	ns	nc	nc	nc	nc	nc
	Sand (0.25 to 0.125 mm)	%	0	0.340	0.431	ns	nc	nc	nc	nc	nc
	Sand (0.50 to 0.25 mm)	%	6.7	0.483	0.922	ns	nc	nc	nc	nc	nc
	Sand (1.00 to 0.50 mm)	%	10	0.656	0.996	ns	nc	nc	nc	nc	nc
	Sand (2.00 to 1.00 mm)	%	20	0.129	1.000	ns	nc	nc	nc	nc	nc
	Silt (0.0312 to 0.004 mm)	%	0	0.196	0.854	ns	nc	nc	nc	nc	nc
	Silt (0.063 to 0.0312 mm)	%	0	0.114	0.442	ns	nc	nc	nc	nc	nc
	Clay (<4 µm)	%	0	0.362	0.040	nc	ns	ns	ns	ns	75.6
	Gravel (>2 mm)	%	50	0.300	0.995	ns	nc	nc	nc	nc	nc
Organic Carbon	Total Organic Carbon	%	0	0.192	0.950	ns	nc	nc	nc	nc	nc
Metals	Aluminum (Al)	mg/kg	0	0.446	0.761	ns	nc	nc	nc	nc	nc
	Antimony (Sb)	mg/kg	0	0.460	0.937	ns	nc	nc	nc	nc	nc
	Arsenic (As)	mg/kg	0	0.551	0.880	ns	nc	nc	nc	nc	nc
	Barium (Ba)	mg/kg	0	0.572	0.204	ns	nc	nc	nc	nc	nc
	Beryllium (Be)	mg/kg	0	0.421	0.972	ns	nc	nc	nc	nc	nc
	Boron (B)	mg/kg	10	0.926	0.002	nc	ns	ns	63.5	ns	ns
	Cadmium (Cd)	mg/kg	0	0.880	0.113	ns	nc	nc	nc	nc	nc
	Calcium (Ca)	mg/kg	0	0.697	0.997	ns	nc	nc	nc	nc	nc
	Chromium (Cr)	mg/kg	0	0.092	0.993	ns	nc	nc	nc	nc	nc
	Cobalt (Co)	mg/kg	0	0.727	0.320	ns	nc	nc	nc	nc	nc
	Copper (Cu)	mg/kg	0	0.677	0.972	ns	nc	nc	nc	nc	nc
	Iron (Fe)	mg/kg	0	0.714	0.908	ns	nc	nc	nc	nc	nc
	Lead (Pb)	mg/kg	0	0.333	0.968	ns	nc	nc	nc	nc	nc
	Lithium (Li)	mg/kg	0	0.393	0.726	ns	nc	nc	nc	nc	nc
	Magnesium (Mg)	mg/kg	0	0.936	0.035	nc	ns	ns	ns	ns	ns
	Manganese (Mn)	mg/kg	0	0.027	0.924	27.1	nc	nc	nc	nc	nc
	Mercury (Hg)	mg/kg	0	0.664	0.037	nc	ns	ns	63.7	ns	ns
	Molybdenum (Mo)	mg/kg	0	0.297	0.956	ns	nc	nc	nc	nc	nc
	Nickel (Ni)	mg/kg	0	0.869	0.006	nc	ns	ns	ns	ns	-34.2
	Phosphorus (P)	mg/kg	0	0.612	0.957	ns	nc	nc	nc	nc	nc
	Potassium (K)	mg/kg	0	0.386	0.578	ns	nc	nc	nc	nc	nc
	Selenium (Se)	mg/kg	0	0.084	<0.001	nc	ns	ns	169	130	ns
	Silver (Ag)	mg/kg	3.3	0.799	0.968	ns	nc	nc	nc	nc	nc
	Sodium (Na)	mg/kg	0	0.438	0.024	nc	38.9	ns	ns	ns	ns
	Strontium (Sr)	mg/kg	0	0.613	0.937	ns	nc	nc	nc	nc	nc
	Sulfur (S)	mg/kg	27	0.411	0.443	ns	nc	nc	nc	nc	nc
	Thallium (Tl)	mg/kg	0	0.139	0.198	ns	nc	nc	nc	nc	nc
	Titanium (Ti)	mg/kg	0	0.014	<0.001	nc	128	ns	411	ns	ns
	Uranium (U)	mg/kg	0	0.302	0.010	nc	ns	ns	51.4	ns	ns
	Vanadium (V)	mg/kg	0	0.349	0.943	ns	nc	nc	nc	nc	nc
	Zinc (Zn)	mg/kg	0	0.255	<0.001	nc	ns	ns	42.7	ns	ns
	Zirconium (Zr)	mg/kg	43	0.700	0.339	ns	nc	nc	nc	nc	nc
Polycyclic Aromatic Hydrocarbons	Acenaphthylene	mg/kg	63	0.595	0.312	ns	nc	nc	nc	nc	nc
	B(a)P Total Potency Equivalent	mg/kg	0	0.042	0.047	nc	ns	ns	181	259	ns
	Benz(a)anthracene	mg/kg	40	0.172	0.059	ns	nc	nc	nc	nc	nc
	Benzo(a)pyrene	mg/kg	13	0.039	0.078	109	nc	nc	nc	nc	nc
	Benzo(b&j)fluoranthene	mg/kg	0	0.041	0.079	87.7	nc	nc	nc	nc	nc
	Benzo(e)pyrene	mg/kg	0	0.009	0.122	136	nc	nc	nc	nc	nc
	Benzo(g,h,i)perylene	mg/kg	3.3	0.007	0.054	152	nc	nc	nc	nc	nc
	Benzo(k)fluoranthene	mg/kg	73	0.243	0.266	ns	nc	nc	nc	nc	nc
	Chrysene	mg/kg	13	0.053	0.731	ns	nc	nc	nc	nc	nc
	d10-Acenaphthene	mg/kg	0	0.196	<0.001	nc	ns	ns	22.9	33.7	nc
	d12-Chrysene	mg/kg	0	0.737	<0.001	nc	ns	-14.5	18.4	13.8	nc
	d8-Naphthalene	mg/kg	0	0.211	<0.001	nc	ns	ns	23.0	32.9	nc
	Dibenz(a,h)anthracene	mg/kg	43	0.202	0.015	nc	ns	ns	168	210	ns
	Fluoranthene	mg/kg	3.3	0.029	0.145	97.3	nc	nc	nc	nc	nc
	Fluorene	mg/kg	0	0.007	0.078	176	nc	nc	nc	nc	nc
	IACR (CCME)	mg/kg	0	0.034	0.085	89.6	nc	nc	nc	nc	nc
	Indeno(1,2,3-c,d)pyrene	mg/kg	43	0.030	0.652	32.3	nc	nc	nc	nc	nc
	1-Methylnaphthalene	mg/kg	0	0.012	0.078	145	nc	nc	nc	nc	nc
	2-Methylnaphthalene	mg/kg	0	0.018	0.093	138	nc	nc	nc	nc	nc
	Naphthalene	mg/kg	0	0.013	0.075	168	nc	nc	nc	nc	nc
	Phenanthrene	mg/kg	0	0.012	0.195	125	nc	nc	nc	nc	nc
	Phenanthrene d10	mg/kg	0	0.180	<0.001	nc	ns	ns	11.4	22.9	nc
	Pyrene	mg/kg	0	0.002	0.120	164	nc	nc	nc	nc	nc

Main effect p-value <0.05; interaction p-value <0.05.

Positive MOD (higher concentration of constituent after initation of treatment (i.e., in 2018, 2019, 2020, 2021, and/or 2022) relative to before (2017) treatment.

Negative MOD (lower concentration of constituent after initation of treatment (i.e., in 2018, 2019, 2020, 2021, and/or 2022) relative to before (2017) treatment.

Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; % = percent; < = less than; nc = not calculated; ns = not significant; mm = millimetres; µm = micrometre; > = greater than; mg/kg = milligrams per kilogram; LRL = Laboratory Reporting Limit; MCT = Measure of Central Tendency.

Constituents with >75% of reported values <LRL were excluded from the analysis. When year (treatment) was insignificant, the *post hoc* test was conducted as a Dunnett's test comparing all post-treatment years (i.e., 2018 to 2022) to the pre-treatment year (2017).

[a] MOD = $(MCT_{\text{After Treatment}} - MCT_{\text{Before Treatment}})/MCT_{\text{Before Treatment}} \times 100$, in which After Treatment combined all years (2018 to 2022), when Year (Treatment) was insignificant.

[b] MOD = $(MCT_{\text{after year}} - MCT_{2017})/MCT_{2017} \times 100$ when Year (Treatment) was significant. MCT is the estimated marginal mean from the censored regression model.

Table F.31: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHP-1 on Greenhills Creek Sedimentation Pond, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	435	1,510	6,560	<2,045	<8,605	<485	7,280
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	0.110	<0.1	0.760	<0.41	<1.17	<0.21	1.23
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.0870	1.45	0.823	<5	<2.41	<7.41	1.54	4.94
Barium (Ba)	mg/kg	-	-	21.4	68.4	42.3	15.5	208	148	356	111	400
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.290	<0.2	0.280	<0.89	<1.17	<0.49	0.630
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	5.70
Cadmium (Cd)	mg/kg	0.600	3.50	<0.05	0.442	0.858	0.126	<0.05	<1.48	<1.53	1.30	1.46
Calcium (Ca)	mg/kg	-	-	3,910	44,000	39,400	2,220	250	89,530	89,780	83,400	104,000
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	1.39	3.23	9.20	<10.1	<19.3	<6.39	11.4
Cobalt (Co)	mg/kg	-	-	0.250	1.81	3.58	1.39	1.50	7.03	8.53	5.39	8.92
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.680	12.6	9.93	<14.3	<24.2	<1.18	22.2
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	5,310	2,250	4,940	<7,660	<12,600	<5,360	11,500
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	5.64	0.720	3.90	<7.36	<11.3	<6.14	10.7
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	<20	<25	<10	7.20
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	5,900
Manganese (Mn)	mg/kg	460	1,100	17.4	80.3	67.9	7.40	18.8	173	192	148	216
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0822
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	0.500	0.580	<2	<2.58	<1	1.54
Nickel (Ni)	mg/kg	16.0	75.0	1.63	13.4	29.9	11.8	6.40	56.7	63.1	43.3	64.5
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	52.0	-	-	<152	<152	<102	847
Potassium (K)	mg/kg	-	-	110	-	-	-	-	110	110	-	1,730
Selenium (Se) [b]	mg/kg	2.00		0.610	0.200	5.36	49.8	16.6	56	72.6	5.56	80.9
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.300	<0.4	<0.7	<0.2	0.350
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	81.0
Strontium (Sr)	mg/kg	-	-	6.16	26.2	18.5	6.13	17.9	57	74.9	44.7	83.7
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	6,600
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.123	<0.2	<0.323	<0.1	0.181
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	<1	15.9	<8	<23.9	<6	9.00
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.517	0.979	0.582	0.324	0.244	2.40	2.65	1.56	2.87
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	4.64	4.61	23.8	<9.65	<33.4	<4.84	26.6
Zinc (Zn)	mg/kg	123	315	<1	29.3	66.6	12.8	31.8	<110	<142	95.9	128

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.32: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHP-2 on Greenhills Creek Sedimentation Pond, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	334	876	5,670	<1,310	<6,980	<384	5,120
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	0.13	<0.1	0.84	<0.43	<1.27	<0.23	1.11
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.121	0.626	0.365	<5	<1.16	<6.16	0.747	3.37
Barium (Ba)	mg/kg	-	-	9.14	49.8	60.9	22.3	105	142	247	111	259
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.22	<0.2	0.28	<0.82	<1.1	<0.42	0.46
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	<5
Cadmium (Cd)	mg/kg	0.600	3.50	<0.05	0.335	0.797	0.11	<0.05	<1.29	<1.34	1.13	1.32
Calcium (Ca)	mg/kg	-	-	3,360	47,200	104,000	2,570	322	157,130	157,452	151,200	180,000
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.97	2.22	7.7	<8.69	<16.4	<5.97	8.18
Cobalt (Co)	mg/kg	-	-	0.18	1.09	2.74	0.98	1.64	4.99	6.63	3.83	6.85
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	9.69	7.62	<11.2	<18.8	<1	17
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,300	1,210	5,030	<3,610	<8,640	<2,350	7,860
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	4.41	<0.5	2.76	<5.91	<8.67	<4.91	8.13
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	<20	<25	<10	5.3
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	5,620
Manganese (Mn)	mg/kg	460	1,100	13.2	63.2	59.4	6	20.6	142	162	123	176
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0628
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	<0.5	<2	<2.5	<1	1.15
Nickel (Ni)	mg/kg	16.0	75.0	1.96	11.9	30.5	10.9	6.5	55.3	61.8	42.4	64.4
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	68	-	-	<168	<168	<118	697
Potassium (K)	mg/kg	-	-	130	-	-	-	-	130	130	-	1,260
Selenium (Se) [b]	mg/kg	2.00		1.66	0.8	9.58	51.9	12	63.9	75.9	10.4	76.2
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.24	<0.4	<0.64	<0.2	0.26
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	95
Strontium (Sr)	mg/kg	-	-	5.45	55.2	59.1	4.72	15.8	124	140	114	152
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,400
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.126	<0.2	<0.326	<0.1	0.113
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	14.4	13.3	<21.4	<34.7	<6	7.4
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.426	1.6	1.4	0.288	0.221	3.71	3.94	3	4.16
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.71	3.41	20.4	<6.52	<26.9	<2.91	19.5
Zinc (Zn)	mg/kg	123	315	<1	17.6	59.4	7.6	34.5	<85.6	<120	77	106

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.33: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHP-3 on Greenhills Creek Sedimentation Pond, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	660	1,830	8,690	<2,590	<11,280	<710	8,320
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.970	<0.4	<1.37	<0.2	1.25
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.496	0.420	5.36	<1.02	<6.38	<0.546	6.30
Barium (Ba)	mg/kg	-	-	22.6	56.1	51.7	28.1	172	158	330	108	343
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.350	<0.2	0.430	<0.95	<1.38	<0.55	0.830
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	0.200
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	5.90
Cadmium (Cd)	mg/kg	0.600	3.50	0.180	0.531	0.530	0.101	0.0970	1.34	1.44	1.06	1.40
Calcium (Ca)	mg/kg	-	-	3,600	30,500	6,140	1,400	109	41,640	41,749	36,640	48,300
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.970	4.10	12.5	<10.6	<23.1	<5.97	13.5
Cobalt (Co)	mg/kg	-	-	0.390	1.32	5.73	1.12	3.39	8.56	12.0	7.05	11.3
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.930	9.69	18.4	<11.6	<30	<1.43	26.7
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,810	1,530	11,300	<5,440	<16,740	<3,860	14,500
Lead (Pb)	mg/kg	35.0	91.3	<0.5	0.590	4.59	1.04	7.98	<6.72	<14.7	5.18	13.7
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	5.80	<20	<25.8	<10	8.90
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	4,920
Manganese (Mn)	mg/kg	460	1,100	124	146	198	15.4	44.2	483	528	344	530
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.117
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	1.24	<2	<3.24	<1	1.68
Nickel (Ni)	mg/kg	16.0	75.0	1.99	10.9	31.7	10.4	14.3	55	69.3	42.6	66.6
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	114	-	-	<214	<214	<164	1,040
Potassium (K)	mg/kg	-	-	140	-	-	-	-	140	140	-	1,910
Selenium (Se) [b]	mg/kg	2.00		0.310	<0.2	1.20	12.1	3.18	<13.8	<17	<1.4	16.8
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	0.140	<0.1	0.250	<0.44	<0.69	<0.24	0.450
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	66.0
Strontium (Sr)	mg/kg	-	-	5.61	15.8	6.54	4.86	23.4	32.8	56.2	22.3	59.0
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,200
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.152	<0.2	<0.352	<0.1	0.146
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	1.00	16.3	<8	<24.3	<6	10.5
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.0910	0.214	0.254	0.356	0.380	0.915	1.30	0.468	1.24
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	3.88	5.54	33.5	<9.82	<43.3	<4.08	31.5
Zinc (Zn)	mg/kg	123	315	<1	17.7	55.3	11.6	77.6	<85.6	<163	73.0	138

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.34: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHP-4 on Greenhills Creek Sedimentation Pond, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	645	1,570	6,220	<2,315	<8,535	<695	7,180
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.820	<0.4	<1.22	<0.2	1.02
Arsenic (As)	mg/kg	5.90	17.0	0.0670	0.119	0.888	0.370	<5	1.44	<6.44	1.01	5.28
Barium (Ba)	mg/kg	-	-	22.9	52.6	40.1	22.3	136	138	274	92.7	294
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.380	<0.2	0.350	<0.98	<1.33	<0.58	0.700
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	5.60
Cadmium (Cd)	mg/kg	0.600	3.50	0.0920	0.536	0.500	0.0940	0.0700	1.22	1.29	1.04	1.16
Calcium (Ca)	mg/kg	-	-	3,160	37,400	5,700	1,040	85.0	47,300	47,385	43,100	55,700
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	1.03	3.59	9.30	<10.1	<19.4	<6.03	10.9
Cobalt (Co)	mg/kg	-	-	0.320	1.37	3.59	0.860	2.79	6.14	8.93	4.96	8.58
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.860	8.58	16.5	<10.4	<26.9	<1.36	23.5
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,870	1,360	8,520	<5,330	<13,850	<3,920	11,400
Lead (Pb)	mg/kg	35.0	91.3	<0.5	1.12	4.02	0.940	6.55	<6.58	<13.1	5.14	11.6
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	<20	<25	<10	7.80
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	4,440
Manganese (Mn)	mg/kg	460	1,100	37.3	70.1	56.2	7.30	36.9	171	208	126	215
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0933
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	1.02	<2	<3.02	<1	1.36
Nickel (Ni)	mg/kg	16.0	75.0	1.83	11.6	27.1	8.87	11.3	49.4	60.7	38.7	59.0
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	125	-	-	<225	<225	<175	964
Potassium (K)	mg/kg	-	-	160	-	-	-	-	160	160	-	1,730
Selenium (Se) [b]	mg/kg	2.00		0.540	0.220	1.12	19.8	6.05	21.7	27.7	1.34	28.6
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.300	<0.4	<0.7	<0.2	0.390
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	65.0
Strontium (Sr)	mg/kg	-	-	4.60	17.8	6.52	3.86	19.9	32.8	52.7	24.3	58.8
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,800
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.100	<0.2	<0.3	<0.1	0.102
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	1.50	14.6	<8.5	<23.1	<6	8.60
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.173	0.364	0.256	0.307	0.320	1.10	1.42	0.620	1.42
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	3.87	5.00	25.9	<9.27	<35.2	<4.07	28.0
Zinc (Zn)	mg/kg	123	315	<1	23.9	43.9	9.20	61.1	<78.0	<139	67.8	117

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.35: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHP-5 on Greenhills Creek Sedimentation Pond, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	589	1,640	8,420	<2,329	<10,749	<639	8,840
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	1.05	<0.4	<1.45	<0.2	1.21
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.0520	0.388	0.421	5.38	<0.911	<6.29	0.440	6.71
Barium (Ba)	mg/kg	-	-	18.8	57.4	45.4	32.1	164	154	318	103	346
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.360	<0.2	0.440	<0.96	<1.4	<0.56	0.860
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	0.200
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	<5
Cadmium (Cd)	mg/kg	0.600	3.50	0.179	0.623	0.527	0.116	0.101	1.44	1.55	1.15	1.52
Calcium (Ca)	mg/kg	-	-	3,340	40,800	6,820	1,460	97.0	52,420	52,517	47,620	60,300
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.970	3.61	12.5	<10.1	<22.6	<5.97	13.7
Cobalt (Co)	mg/kg	-	-	0.300	1.03	5.74	1.05	3.61	8.12	11.7	6.77	12.2
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.900	9.15	20.2	<11	<31.2	<1.4	29.9
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,460	1,330	11,100	<4,890	<15,990	<3,510	14,600
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	5.06	1.10	8.58	<7.16	<15.7	<5.56	14.7
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	5.30	<20	<25.3	<10	8.30
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	4,880
Manganese (Mn)	mg/kg	460	1,100	134	177	250	18.9	47.5	580	627	427	671
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.111
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	1.41	<2	<3.41	<1	1.83
Nickel (Ni)	mg/kg	16.0	75.0	1.94	11.0	30.3	9.83	15.4	53.1	68.5	41.3	70.6
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	72.0	-	-	<172	<172	<122	1,040
Potassium (K)	mg/kg	-	-	130	-	-	-	-	130	130	-	2,140
Selenium (Se) [b]	mg/kg	2.00		0.330	0.200	0.910	11.7	3.01	13.1	16.2	1.11	14.2
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	0.130	<0.1	0.270	<0.43	<0.7	<0.23	0.440
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	70.0
Strontium (Sr)	mg/kg	-	-	5.04	20.0	7.17	4.87	27.0	37.1	64.1	27.2	65.7
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,200
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.157	<0.2	<0.357	<0.1	0.118
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	<1	15.3	<8	<23.3	<6	5.90
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.109	0.265	0.209	0.310	0.394	0.893	1.29	0.474	1.25
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	3.69	5.67	33.5	<9.76	<43.3	<3.89	34.4
Zinc (Zn)	mg/kg	123	315	<1	15.4	53.3	11.6	80.8	<81.3	<162	68.7	148

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

Fraction 2 - metals bound to carbonate that are released due to changes in pH.

Fraction 3 - easily reducible metals and iron oxides that are released under reducing conditions.

Fraction 4 - organic or mineral bound fractions that are released under oxidizing conditions.

Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

Table F.36: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHP-6 on Greenhills Creek Sedimentation Pond, September 2022

Metal	Units	BC WSQG [a]		SEA Results								Conventional Bulk Metals Analysis
		Lower	Upper	Fraction 1: Exchangeable and Adsorbed Metals	Fraction 2: Metals Bound to Carbonates	Fraction 3: Reducible Metals and Iron Oxides	Fraction 4: Metals Bound to Organic Material	Fraction 5: Residual Metals	Sum of Fractions 1 to 4	Sum of Fractions 1 to 5	Sum of Fractions 2 and 3	
Aluminum (Al)	mg/kg	-	-	<50.0	<50.0	584	1,420	6,970	<2,104	<9,074	<634	7,720
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.790	<0.4	<1.19	<0.2	1.11
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.438	0.434	<5	<0.972	<5.97	<0.488	5.77
Barium (Ba)	mg/kg	-	-	16.4	51.4	33.4	30.3	124	132	256	84.8	285
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.320	<0.2	0.390	<0.92	<1.31	<0.52	0.810
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.8	<1	<0.4	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	<5
Cadmium (Cd)	mg/kg	0.600	3.50	0.111	0.570	0.425	0.105	0.0720	1.21	1.28	0.995	1.30
Calcium (Ca)	mg/kg	-	-	2,960	44,200	8,950	1,280	90.0	57,390	57,480	53,150	72,000
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.940	3.07	10.2	<9.51	<19.7	<5.94	12.0
Cobalt (Co)	mg/kg	-	-	0.240	0.780	4.76	0.760	2.85	6.54	9.39	5.54	9.74
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.720	7.79	17.0	<9.51	<26.5	<1.22	25.0
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,450	1,140	8,550	<4,690	<13,240	<3,500	11,800
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	4.62	0.950	6.35	<6.57	<12.9	<5.12	12.3
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	<20	<25	<10	7.80
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	4,500
Manganese (Mn)	mg/kg	460	1,100	124	141	228	13.4	39.0	506	545	369	585
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0930
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	1.00	<2	<3	<1	1.59
Nickel (Ni)	mg/kg	16.0	75.0	2.31	12.0	30.8	8.24	11.7	53.4	65.0	42.8	67.4
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	100	-	-	<200	<200	<150	874
Potassium (K)	mg/kg	-	-	140	-	-	-	-	140	140	-	1,880
Selenium (Se) [b]	mg/kg	2.00		0.250	<0.2	0.620	6.80	1.67	<7.87	<9.54	<0.82	9.02
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	0.110	<0.1	0.200	<0.41	<0.61	<0.21	0.400
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	<100	<100	-	69.0
Strontium (Sr)	mg/kg	-	-	4.20	19.6	8.17	4.23	23.7	36.2	59.9	27.8	67.7
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,400
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.0910	<0.2	<0.291	<0.1	0.0960
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	<8	<10	<4	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	10.1	12.1	<17.1	<29.2	<6	6.70
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.0780	0.246	0.170	0.246	0.300	0.740	1.04	0.416	1.08
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	3.54	5.12	27.8	<9.06	<36.9	<3.74	29.9
Zinc (Zn)	mg/kg	123	315	<1	16.7	51.6	9.80	65.4	<79.1	<144	68.3	128

Concentration exceeds the lower BC WSQG.

Concentration exceeds the upper BC WSQG or alert concentration for selenium.

Notes: BC WSQG = British Columbia Working Sediment Quality Guidelines; SEA = Sequential Extraction Analysis; mg/kg = milligrams per kilogram; - = no data/not applicable; < = less than; LRL = Laboratory Reporting Limit; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

Values <LRL were replaced with the LRL in the calculation of the sum of fractions.

Fraction 1 - exchangeable and adsorbed metals that are released due to changes in ionic strength.

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Fraction 5 - residual metals resistant to the first four digestions that are mobilized with a strong acid. Representative of "total" or "bulk" metals in sediment.

[a] BC WSQG for the protection of freshwater aquatic life (BCMOECCS 2021b).

[b] The 2 mg/kg alert concentration from BCMOECCS (2021a) was applied; there is currently no BC WSQG for selenium.

APPENDIX G
BENTHIC INVERTEBRATE
COMMUNITY

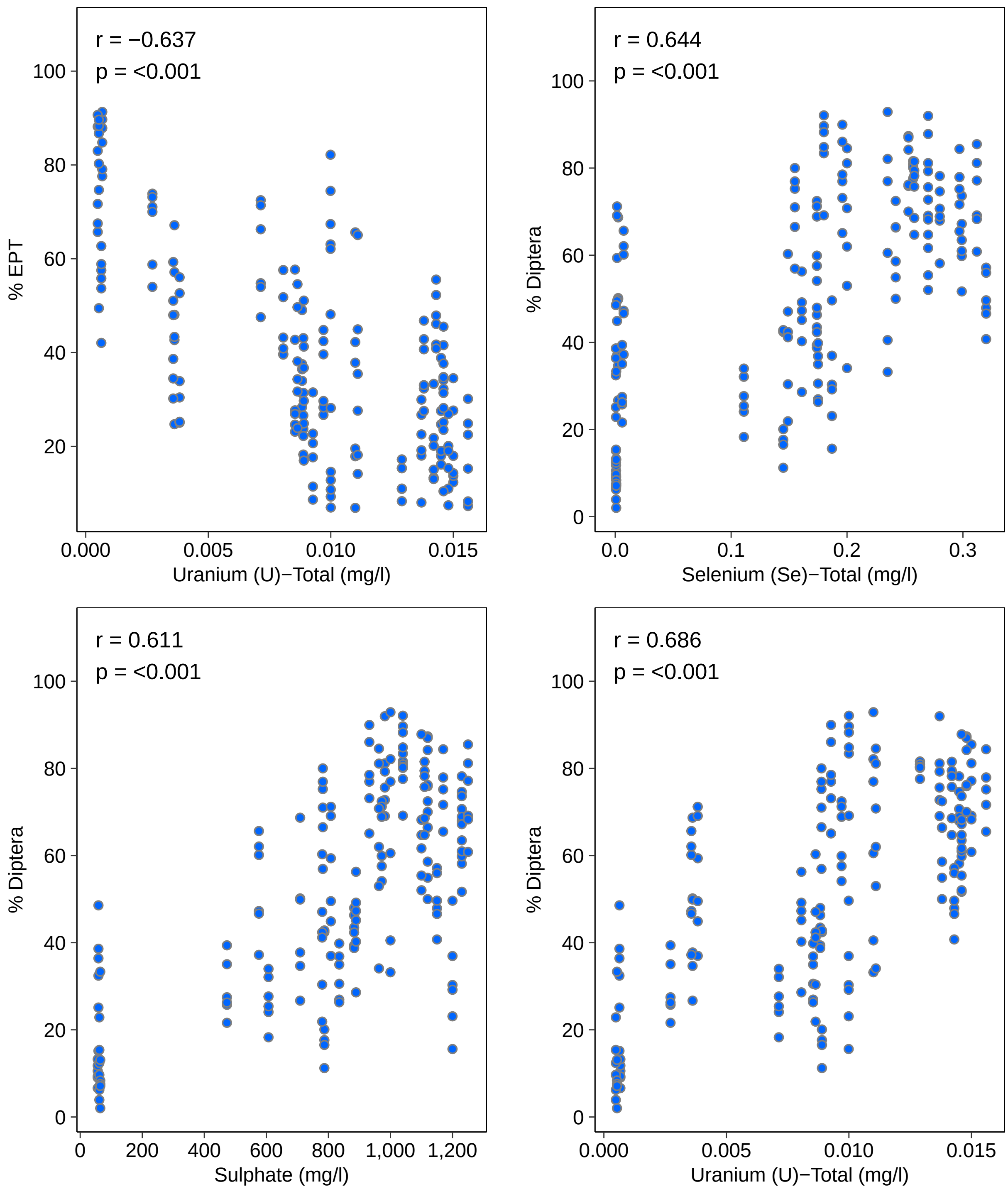

Figure G.1: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Water Chemistry Constituents with Early Warning Triggers, Greenhills and Gardine Creeks, 2017 to 2022

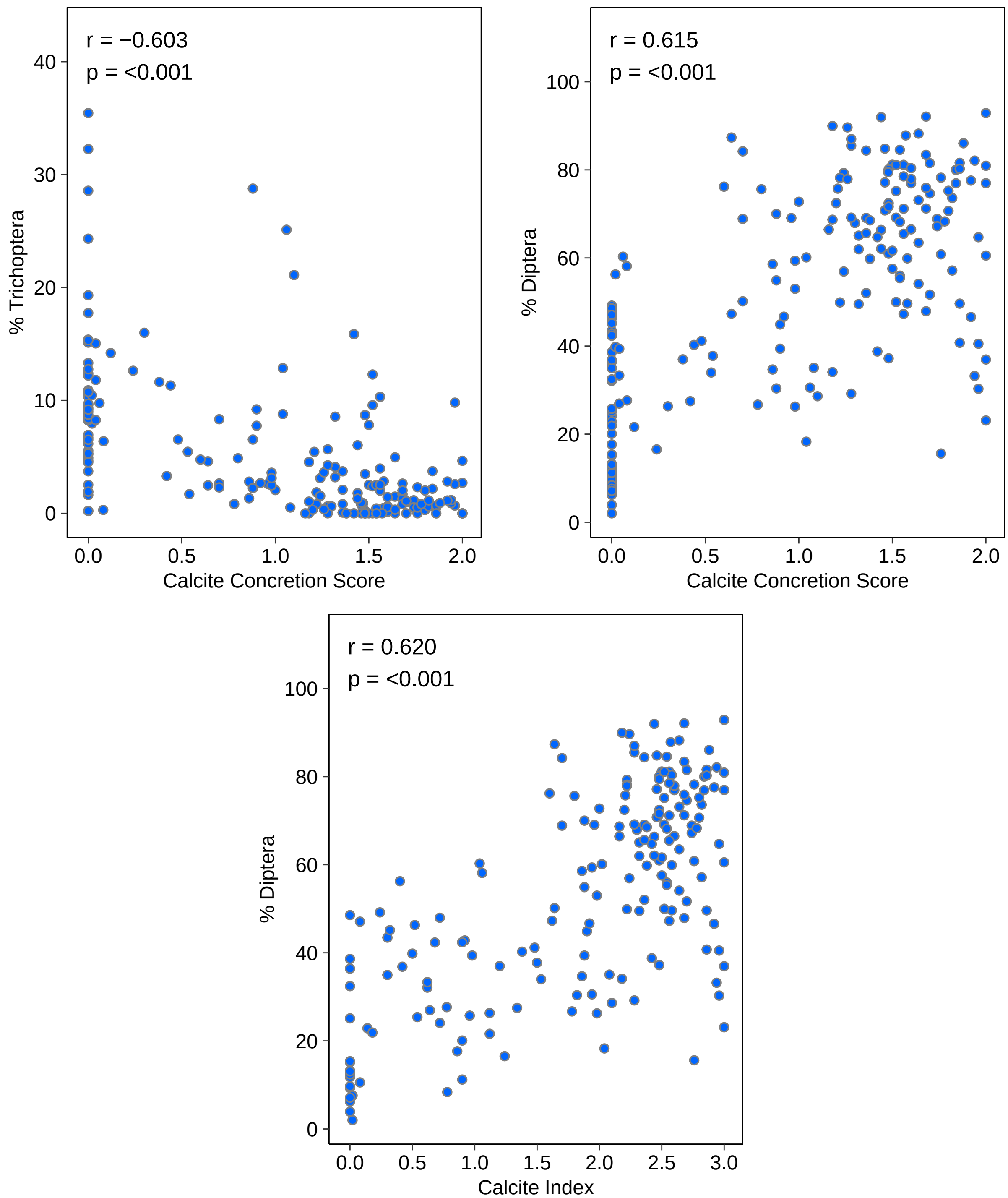

Figure G.2: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Calcite Index and Concretion Scores, Greenhills and Gardine Creeks, 2017 to 2022

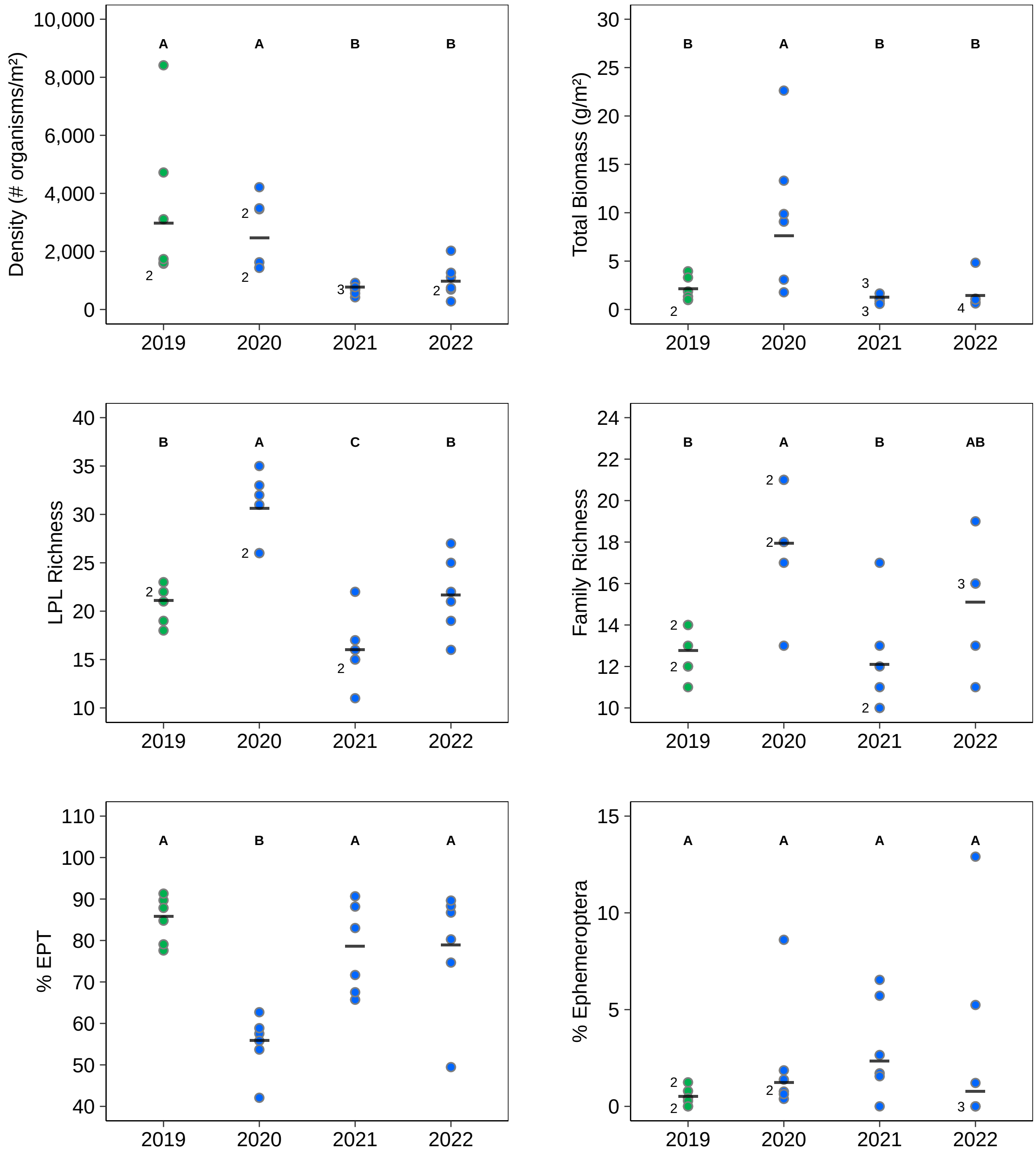

Figure G.3: Benthic Invertebrate Community Endpoint Comparisons for Upper Gardine Creek (RG_GAUT), September 2019 to 2022

Notes: Areas that share a letter are not significantly different (p−value = 0.1). Bars indicate measures of central tendency. Numbers indicate the number of overlapping points.

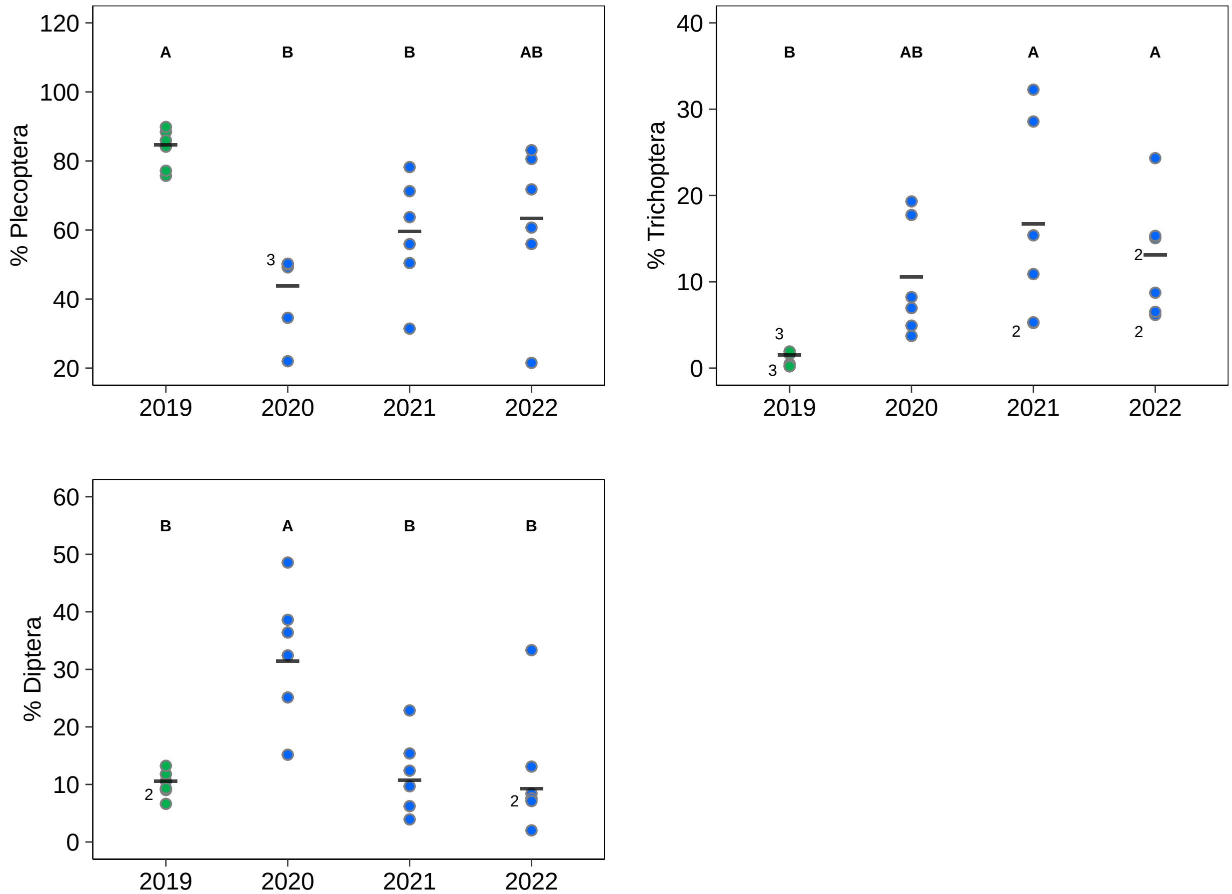

Figure G.3: Benthic Invertebrate Community Endpoint Comparisons for Upper Gardine Creek (RG_GAUT), September 2019 to 2022

Notes: Areas that share a letter are not significantly different (p−value = 0.1). Bars indicate measures of central tendency. Numbers indicate the number of overlapping points.

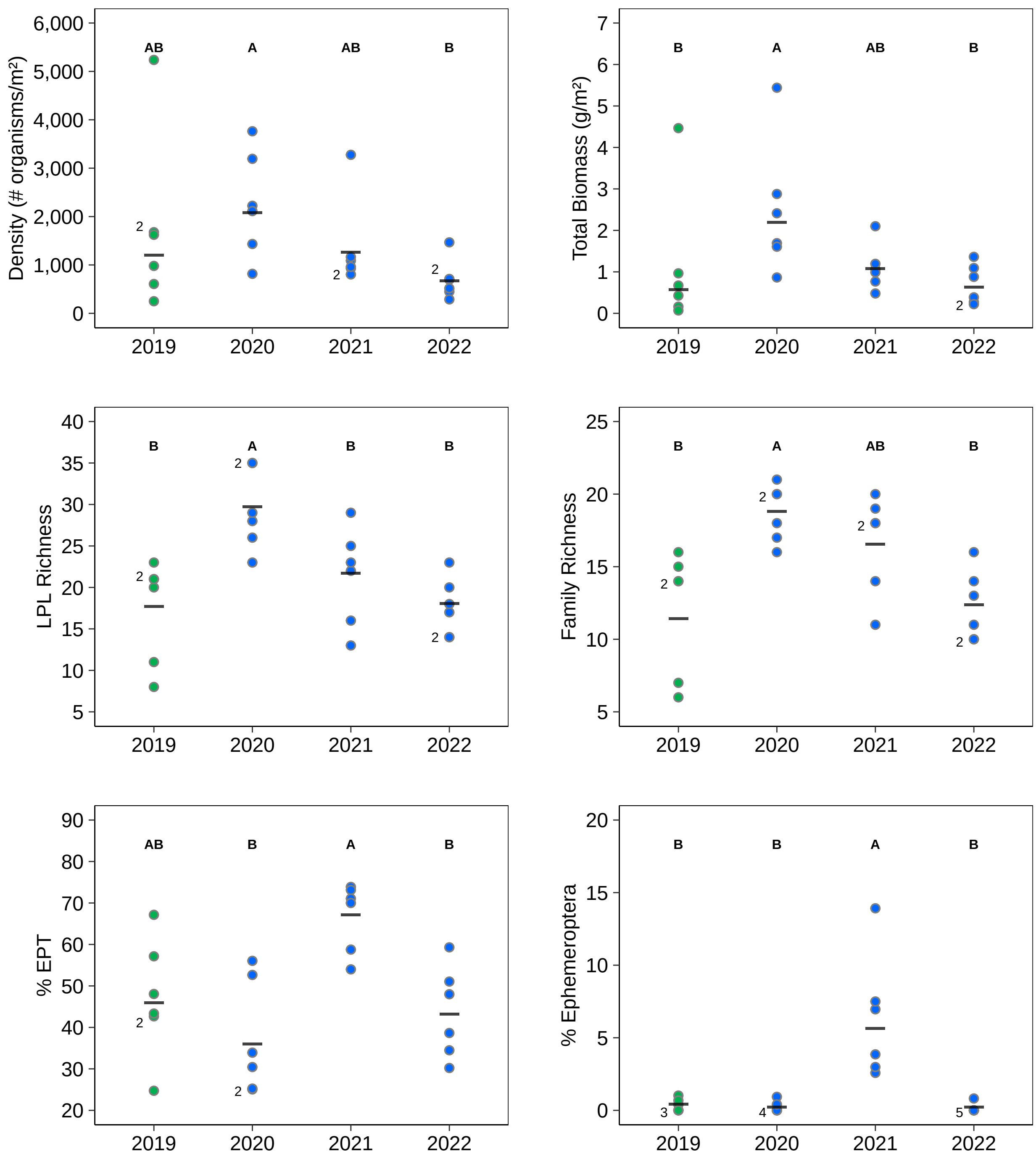

Figure G.4: Benthic Invertebrate Community Endpoint Comparisons for Lower Gardine Creek (RG_GANF), September 2019 to 2022

Notes: Areas that share a letter are not significantly different (p−value = 0.1). Bars indicate measures of central tendency. Numbers indicate the number of overlapping points.

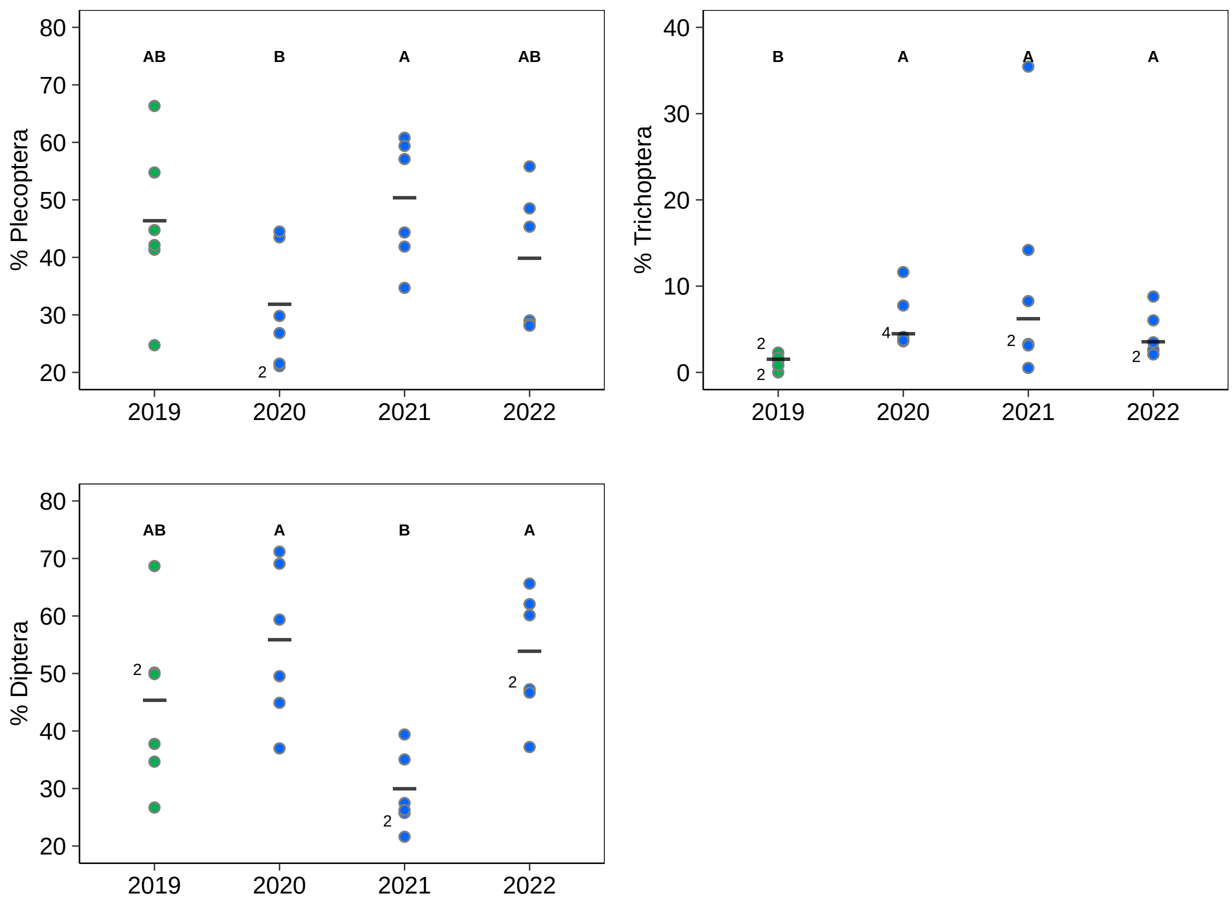

Figure G.4: Benthic Invertebrate Community Endpoint Comparisons for Lower Gardine Creek (RG_GANF), September 2019 to 2022

Notes: Areas that share a letter are not significantly different (p−value = 0.1). Bars indicate measures of central tendency. Numbers indicate the number of overlapping points.

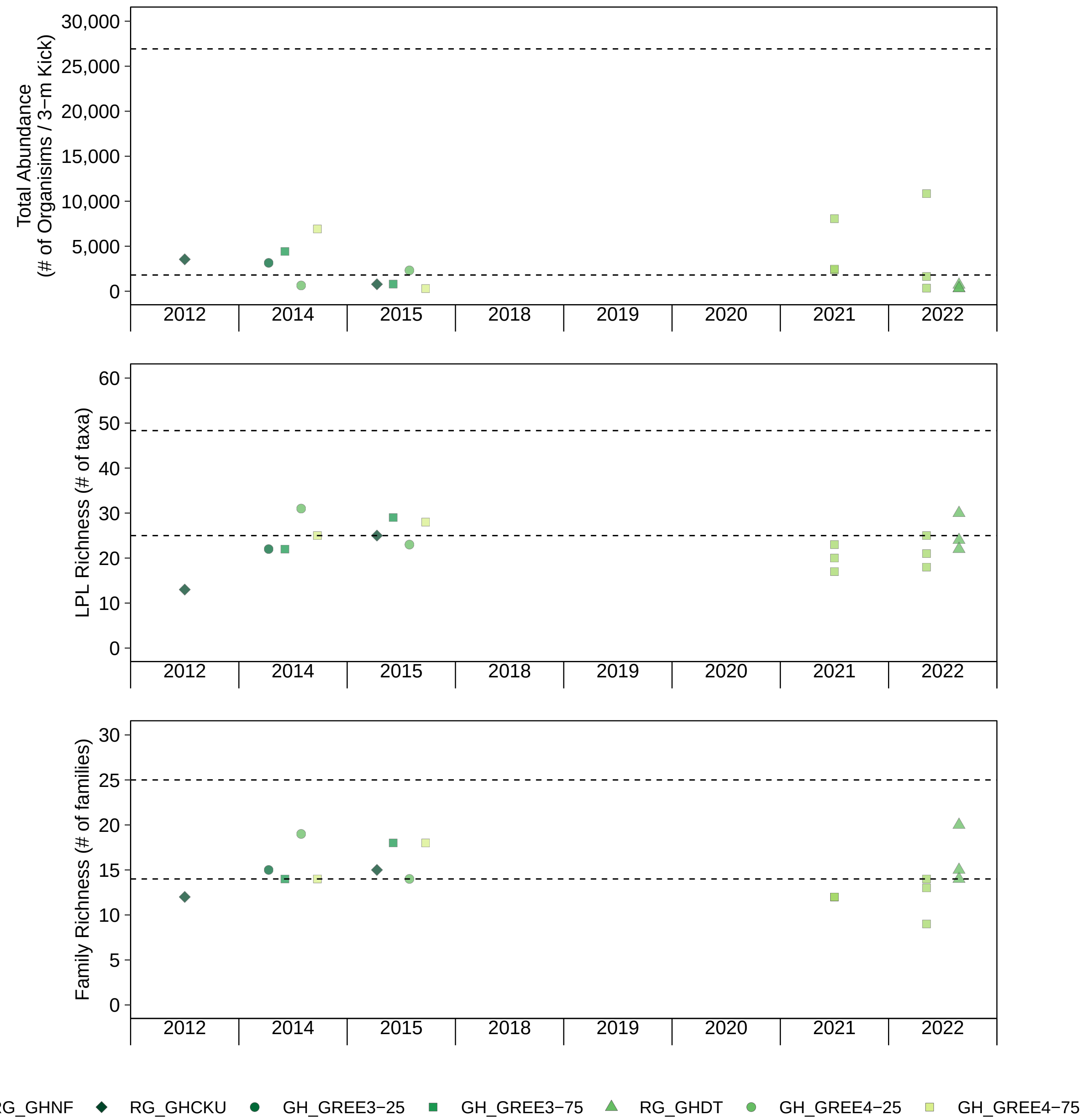

Figure G.5: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Upper Greenhills Creek, September 2012 to 2022

Notes: Samples were collected using timed kicks, consistent with Canadian Aquatic Biomonitoring Network (CABIN) protocols. Normal ranges representing the 2.5th to 97.5th percentiles of reference area data (2012 to 2019) from the Regional Aquatic Environmental Monitoring Program (RAEMP) are shown as dashed horizontal lines (as available).

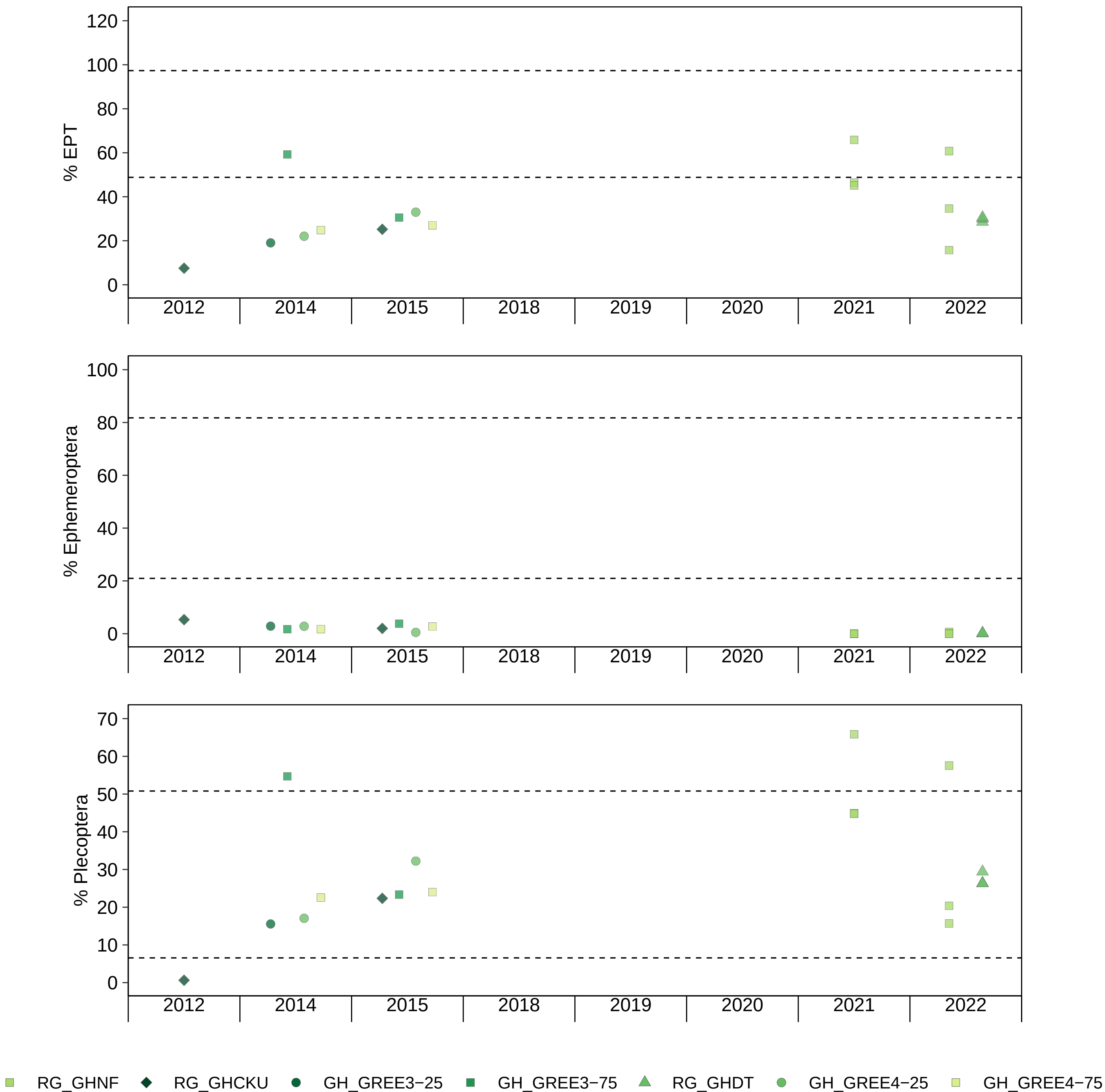

Figure G.5: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Upper Greenhills Creek, September 2012 to 2022

Notes: Samples were collected using timed kicks, consistent with Canadian Aquatic Biomonitoring Network (CABIN) protocols. Normal ranges representing the 2.5th to 97.5th percentiles of reference area data (2012 to 2019) from the Regional Aquatic Environmental Monitoring Program (RAEMP) are shown as dashed horizontal lines (as available).

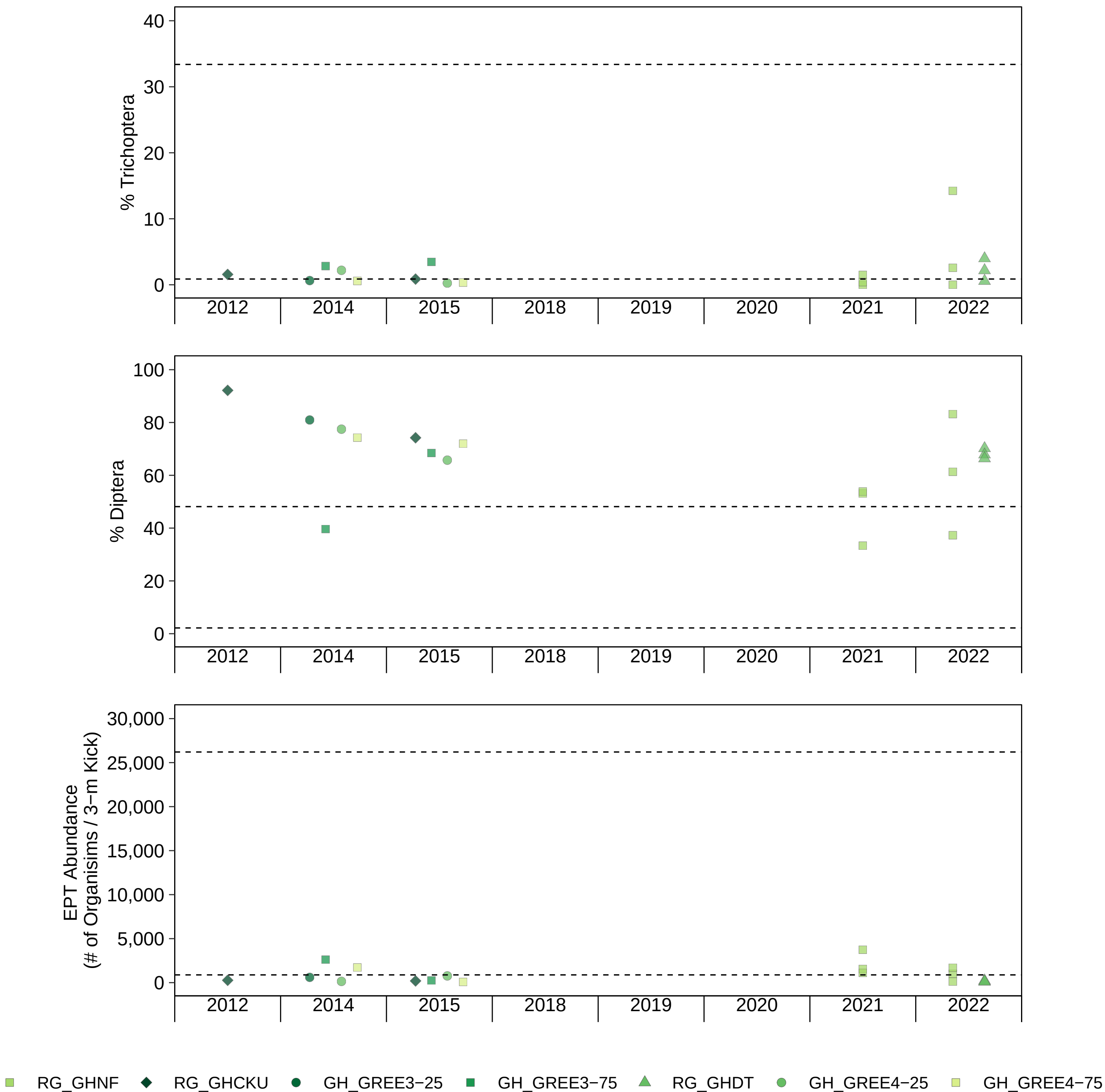

Figure G.5: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Upper Greenhills Creek, September 2012 to 2022

Notes: Samples were collected using timed kicks, consistent with Canadian Aquatic Biomonitoring Network (CABIN) protocols. Normal ranges representing the 2.5th to 97.5th percentiles of reference area data (2012 to 2019) from the Regional Aquatic Environmental Monitoring Program (RAEMP) are shown as dashed horizontal lines (as available).

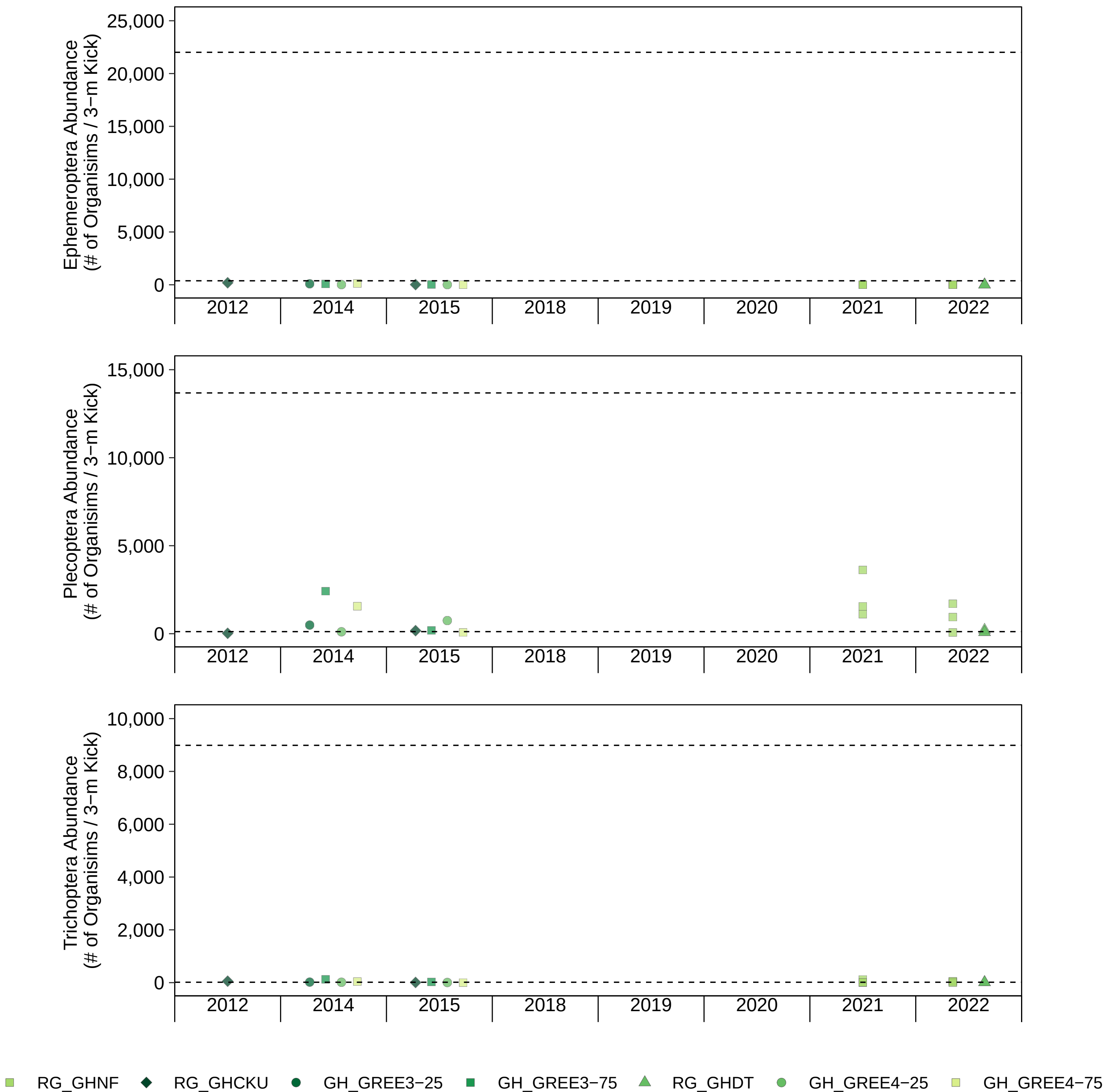

Figure G.5: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Upper Greenhills Creek, September 2012 to 2022

Notes: Samples were collected using timed kicks, consistent with Canadian Aquatic Biomonitoring Network (CABIN) protocols. Normal ranges representing the 2.5th to 97.5th percentiles of reference area data (2012 to 2019) from the Regional Aquatic Environmental Monitoring Program (RAEMP) are shown as dashed horizontal lines (as available).

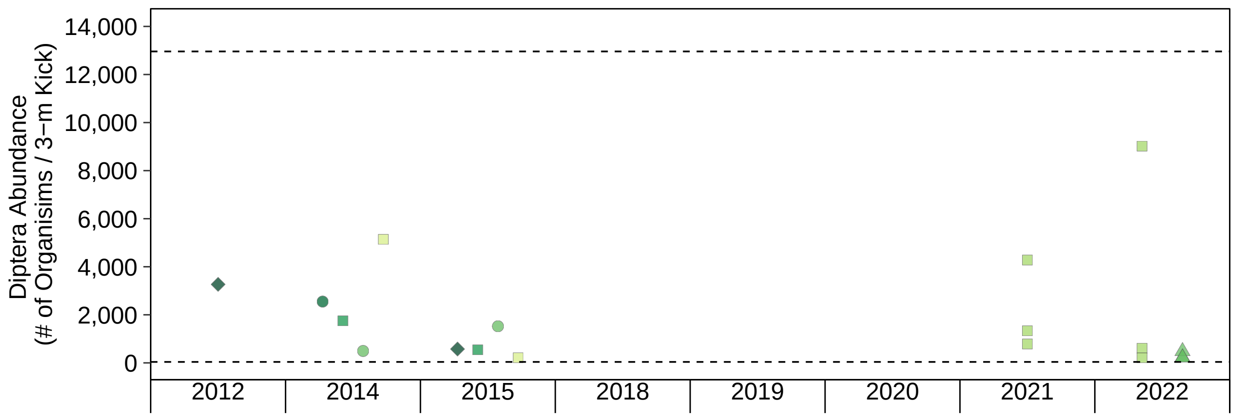

Figure G.5: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Upper Greenhills Creek, September 2012 to 2022

Notes: Samples were collected using timed kicks, consistent with Canadian Aquatic Biomonitoring Network (CABIN) protocols. Normal ranges representing the 2.5th to 97.5th percentiles of reference area data (2012 to 2019) from the Regional Aquatic Environmental Monitoring Program (RAEMP) are shown as dashed horizontal lines (as available).

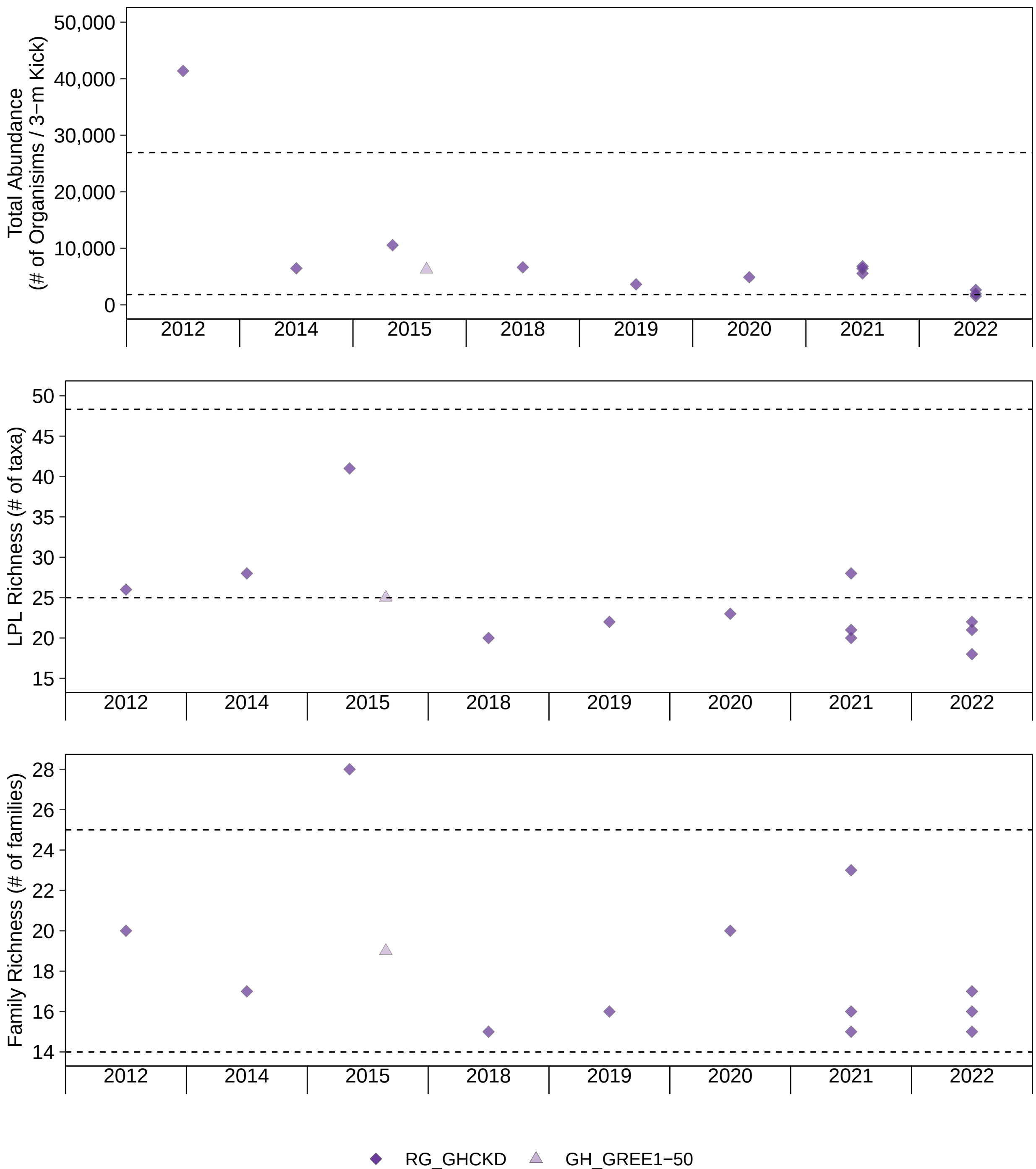

Figure G.6: **Benthic Invertebrate Community Endpoints for Timed Kick Samples on Lower Greenhills Creek, September 2012 to 2022**

Notes: Samples were collected using timed kicks, consistent with Canadian Aquatic Biomonitoring Network (CABIN) protocols. Normal ranges representing the 2.5th to 97.5th percentiles of reference area data (2012 to 2019) from the Regional Aquatic Environmental Monitoring Program (RAEMP) are shown as dashed horizontal lines (as available).

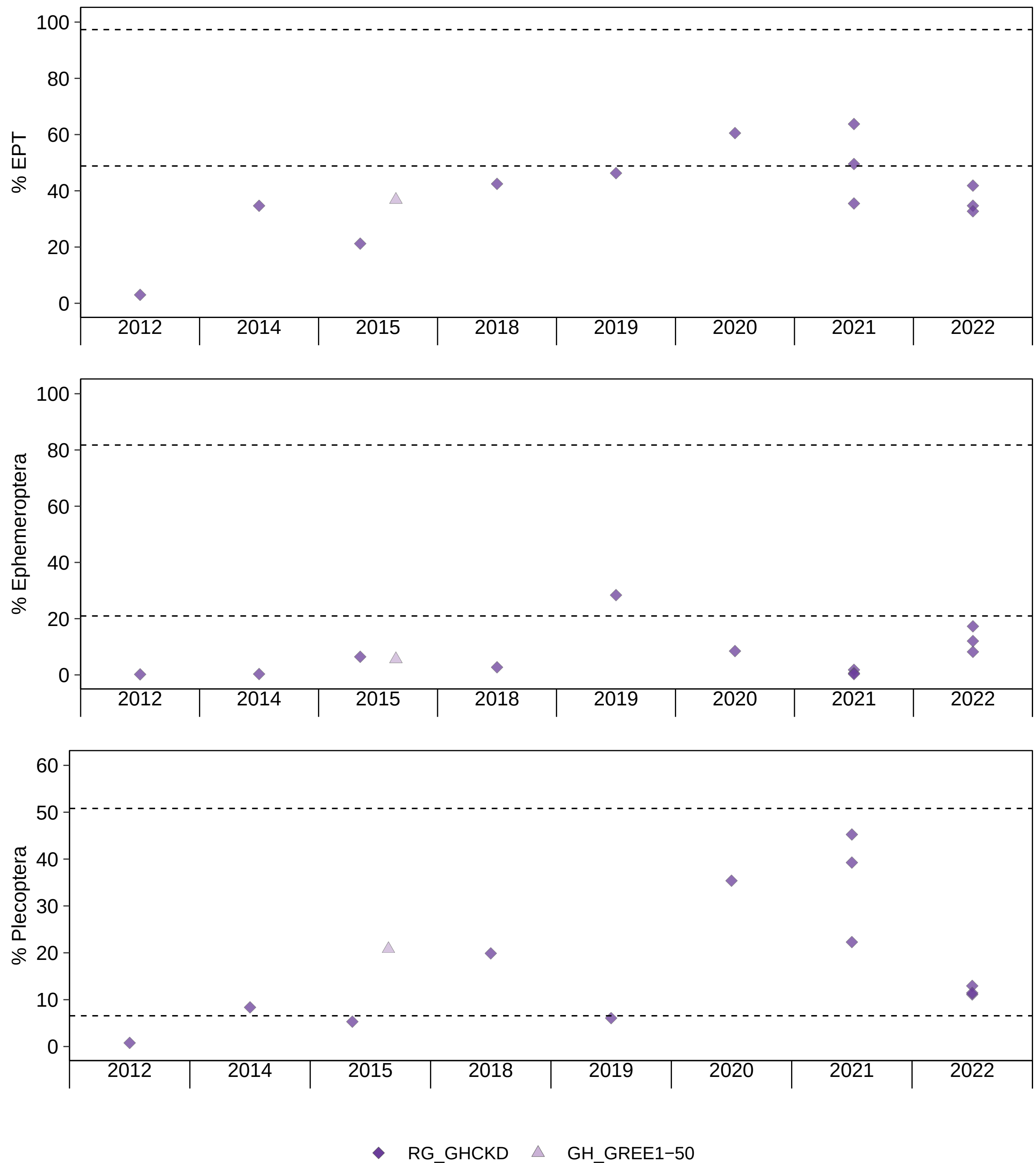

Figure G.6: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Lower Greenhills Creek, September 2012 to 2022

Notes: Samples were collected using timed kicks, consistent with Canadian Aquatic Biomonitoring Network (CABIN) protocols. Normal ranges representing the 2.5th to 97.5th percentiles of reference area data (2012 to 2019) from the Regional Aquatic Environmental Monitoring Program (RAEMP) are shown as dashed horizontal lines (as available).

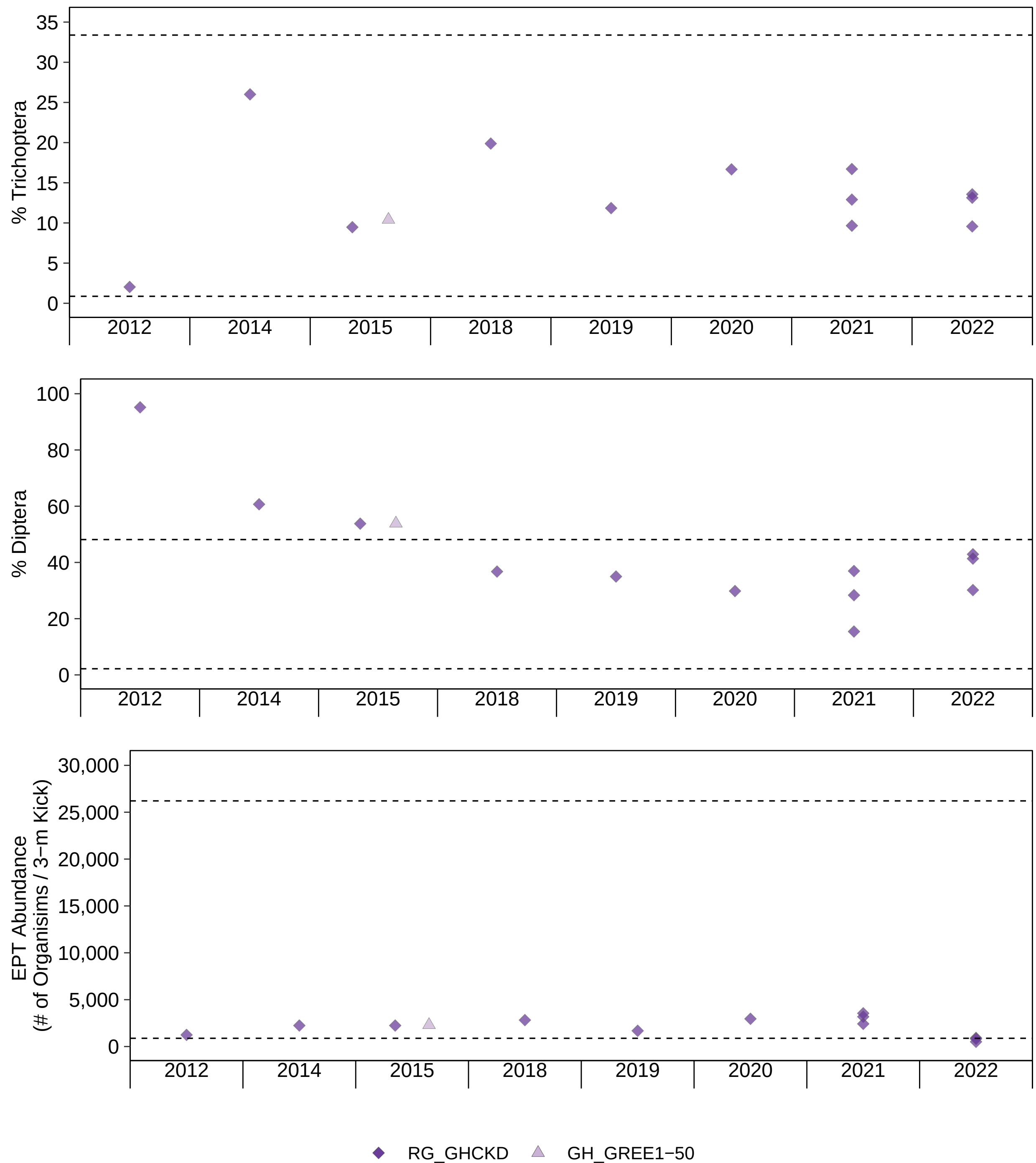

Figure G.6: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Lower Greenhills Creek, September 2012 to 2022

Notes: Samples were collected using timed kicks, consistent with Canadian Aquatic Biomonitoring Network (CABIN) protocols. Normal ranges representing the 2.5th to 97.5th percentiles of reference area data (2012 to 2019) from the Regional Aquatic Environmental Monitoring Program (RAEMP) are shown as dashed horizontal lines (as available).

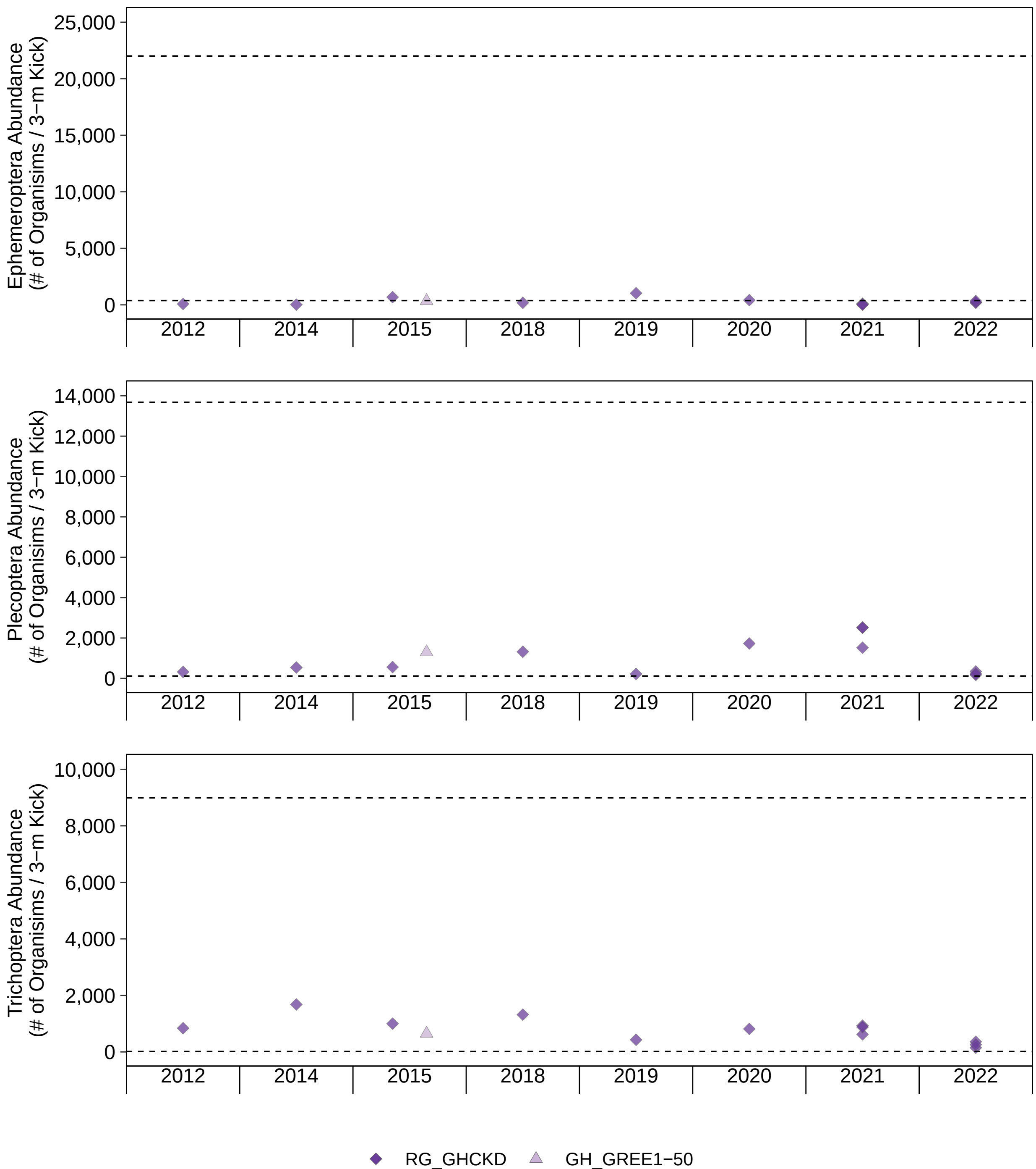

Figure G.6: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Lower Greenhills Creek, September 2012 to 2022

Notes: Samples were collected using timed kicks, consistent with Canadian Aquatic Biomonitoring Network (CABIN) protocols. Normal ranges representing the 2.5th to 97.5th percentiles of reference area data (2012 to 2019) from the Regional Aquatic Environmental Monitoring Program (RAEMP) are shown as dashed horizontal lines (as available).

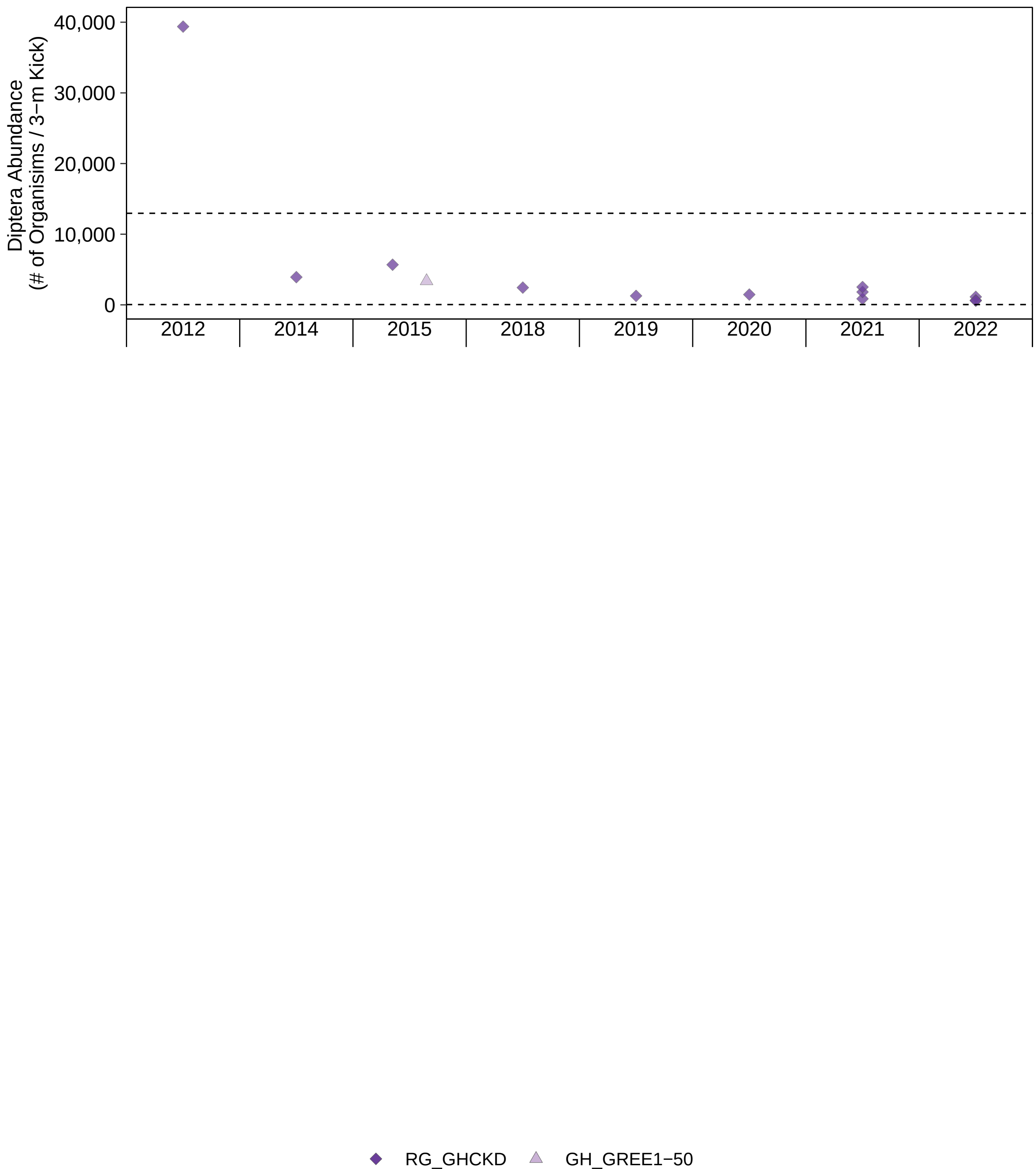

Figure G.6: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Lower Greenhills Creek, September 2012 to 2022

Notes: Samples were collected using timed kicks, consistent with Canadian Aquatic Biomonitoring Network (CABIN) protocols. Normal ranges representing the 2.5th to 97.5th percentiles of reference area data (2012 to 2019) from the Regional Aquatic Environmental Monitoring Program (RAEMP) are shown as dashed horizontal lines (as available).

Table G.1: Supporting Measures Associated with Area-based and Timed Kick and Sweep Benthic Invertebrate Community Sampling, September 2022

Watercourse		**Gardine Creek**					
Biological Area Code		**RG_GAUT**					
Station ID		**RG_GAUT-1**	**RG_GAUT-2**	**RG_GAUT-3**	**RG_GAUT-4**	**RG_GAUT-5**	**RG_GAUT-6**
Date Sampled		14-Sep-22	14-Sep-22	14-Sep-22	14-Sep-22	14-Sep-22	14-Sep-22
Weather		Hazy (smoke)					
Air Temperature (°C)		-					
UTMs (NAD83, Zone 11U)	Easting	653457	653435	653402	653384	653347	653320
	Northing	5548920	5548949	5548985	5548987	5549025	5549046
Habitat Characteristics							
Surrounding Land Use		Mining; logged historically					
Length of Reach Assessed (m)		100					
Water Temperature (°C)		6.3	7.0	7.5	8.5	8.8	9.1
pH		7.79	7.79	7.98	8.06	8.04	8.24
Dissolved Oxygen	% sat	78.2	80.1	79.2	79.6	78.3	80.4
	mg/L	9.64	9.71	9.48	9.30	9.09	9.25
Specific Conductance (µS/cm)		485	491	488	484	490	488
Water Clarity		Clear					
Water Colour		Colourless					
Wetted width (m)		0.90	0.84	0.78	0.63	0.55	0.37
Bankfull width (m)		3.1	2.2	1.8	2.5	3.3	2.1
Average Water Depth (m)		0.3					
Average Water Velocity (m/s)		0.019	0.058	0.026	0.040	0.042	0.094
Substrate	% Bedrock	0					
	% Boulder	10					
	% Cobble	30					
	% Gravel	20					
	% Sand	40					
	% Fines	0					
Vegetation	Canopy Coverage (%)	76 to 100					
	Streamside Vegetation	-					
	Dominant Vegetation	Deciduous trees					
	Macrophyte Coverage (%)	0					
	Dominant Macrophyte	-					
	Periphyton Coverage (1 to 5)	1 - Rocks not slippery, no obvious colour (<0.5 mm thick)					
Benthic Invertebrate Sampling [a]							
Number of Jars		1	1	1	1	1	1
Macrophytes (in sampler)		N	N	N	N	N	N
Algae (in sampler)		N	N	N	N	N	N
Comments		-					

Notes: ID = identifier; - = no data/not recorded; °C = degrees Celsius; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; m = metre; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; m/s = metres per second; < = less than; mm = millimetres; > = greater than; N = none; C = common; SP = sparse; µm = micrometre; m^2 = square metre; CABIN = Canadian Aquatic Biomonitoring Network.

[a] Data are for area-based kicks unless otherwise indicated. A kick net with a 400 µm mesh was used to kick an estimated sampling area of 1/3 m^2 at each station listed in the table. A kick net with a 400 µm mesh was also used to collect the timed CABIN samples from RG_GHNF (n = 3) and RG_GHDT (n = 3).

Table G.1: Supporting Measures Associated with Area-based and Timed Kick and Sweep Benthic Invertebrate Community Sampling, September 2022

Watercourse		**Gardine Creek**					
Biological Area Code		**RG_GANF**					
Station ID		**RG_GANF-1**	**RG_GANF-2**	**RG_GANF-3**	**RG_GANF-4**	**RG_GANF-5**	**RG_GANF-6**
Date Sampled		13-Sep-22	13-Sep-22	13-Sep-22	13-Sep-22	13-Sep-22	13-Sep-22
Weather		-					
Air Temperature (°C)		-					
UTMs (NAD83, Zone 11U)	Easting	654273	654256	654235	654200	654184	654130
	Northing	5547738	5547799	5547802	5547815	5547836	5547824
Habitat Characteristics							
Surrounding Land Use		Mining					
Length of Reach Assessed (m)		100					
Water Temperature (°C)		6.9	8.0	8.4	8.8	9.0	9.3
pH		7.94	8.01	8.04	8.06	8.01	8.01
Dissolved Oxygen	% sat	83.0	82.5	83.9	83.9	83.9	84.0
	mg/L	10.07	9.79	9.79	9.69	9.64	9.60
Specific Conductance (µS/cm)		1,339	1,720	1,747	1,745	1,747	1,751
Water Clarity		-					
Water Colour		-					
Wetted width (m)		2.4	1.6	1.4	1.6	1.9	2.3
Bankfull width (m)		3.2	3.6	4.6	5.6	3.5	3.4
Average Water Depth (m)		-					
Average Water Velocity (m/s)		0.124	0.108	0.046	0.202	0.127	0.207
Substrate	% Bedrock	-					
	% Boulder	-					
	% Cobble	-					
	% Gravel	-					
	% Sand	-					
	% Fines	-					
Vegetation	Canopy Coverage (%)	-					
	Streamside Vegetation	-					
	Dominant Vegetation	-					
	Macrophyte Coverage (%)	-					
	Dominant Macrophyte	-					
	Periphyton Coverage (1 to 5)	-					
Benthic Invertebrate Sampling [a]							
Number of Jars		1	1	1	1	1	1
Macrophytes (in sampler)		N	N	N	N	N	N
Algae (in sampler)		N	N	N	N	N	N
Comments		-					

Notes: ID = identifier; - = no data/not recorded; °C = degrees Celsius; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; m = metre; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; m/s = metres per second; < = less than; mm = millimetres; > = greater than; N = none; C = common; SP = sparse; µm = micrometre; m^2 = square metre; CABIN = Canadian Aquatic Biomonitoring Network.

[a] Data are for area-based kicks unless otherwise indicated. A kick net with a 400 µm mesh was used to kick an estimated sampling area of 1/3 m^2 at each station listed in the table. A kick net with a 400 µm mesh was also used to collect the timed CABIN samples from RG_GHNF (n = 3) and RG_GHDT (n = 3).

Table G.1: Supporting Measures Associated with Area-based and Timed Kick and Sweep Benthic Invertebrate Community Sampling, September 2022

Watercourse		**Upper Greenhills Creek**					
Biological Area Code		**RG_GHUT**					
Station ID		**RG_GHUT-1**	**RG_GHUT-2**	**RG_GHUT-3**	**RG_GHUT-4**	**RG_GHUT-5**	**RG_GHUT-6**
Date Sampled		15-Sep-22	15-Sep-22	15-Sep-22	15-Sep-22	15-Sep-22	15-Sep-22
Weather		Partly cloudy					
Air Temperature (°C)		17					
UTMs (NAD83, Zone 11U)	Easting	654147	654144	654128	654136	654131	654136
	Northing	5549851	5549894	5549931	5549960	5549994	5550024
Habitat Characteristics							
Surrounding Land Use		Mining; logged historically					
Length of Reach Assessed (m)		100					
Water Temperature (°C)		4.8	4.9	5.0	5.3	5.5	5.8
pH		7.89	7.92	7.94	7.91	7.90	7.92
Dissolved Oxygen	% sat	81.6	82.2	82.8	83.6	84.6	86.6
	mg/L	10.41	10.45	10.49	10.51	10.59	10.75
Specific Conductance (µS/cm)		2,203	2,290	2,299	2,300	2,315	2,324
Water Clarity		Turbid from overnight rainfall					
Water Colour		Brown					
Wetted width (m)		2.1	2.6	2.2	1.7	2.9	1.4
Bankfull width (m)		9.1	10.2	3.4	3.9	6.3	4.4
Average Water Depth (m)		0.3					
Average Water Velocity (m/s)		0.150	0.316	0.315	0.204	0.215	0.303
Substrate	% Bedrock	-					
	% Boulder	-					
	% Cobble	-					
	% Gravel	-					
	% Sand	-					
	% Fines	-					
Vegetation	Canopy Coverage (%)	1 to 25					
	Streamside Vegetation	Ferns/grass equally dominant as shrubs.					
	Dominant Vegetation	Ferns/grass					
	Macrophyte Coverage (%)	0					
	Dominant Macrophyte	-					
	Periphyton Coverage (1 to 5)	4 - Rocks are very slippery, numerous clumps (5 to 20 mm thick)					
Benthic Invertebrate Sampling [a]							
Number of Jars		1	1	1	1	2	2
Macrophytes (in sampler)		N	N	N	N	N	N
Algae (in sampler)		C	C	C	SP	SP	N
Comments		Mostly pavement. Can't discern substrate. Large algae strands.					

Notes: ID = identifier; - = no data/not recorded; °C = degrees Celsius; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; m = metre; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; m/s = metres per second; < = less than; mm = millimetres; > = greater than; N = none; C = common; SP = sparse; µm = micrometre; m^2 = square metre; CABIN = Canadian Aquatic Biomonitoring Network.

[a] Data are for area-based kicks unless otherwise indicated. A kick net with a 400 µm mesh was used to kick an estimated sampling area of 1/3 m^2 at each station listed in the table. A kick net with a 400 µm mesh was also used to collect the timed CABIN samples from RG_GHNF (n = 3) and RG_GHDT (n = 3).

Table G.1: Supporting Measures Associated with Area-based and Timed Kick and Sweep Benthic Invertebrate Community Sampling, September 2022

Watercourse		**Upper Greenhills Creek**					
Biological Area Code		**RG_GHNF**					
Station ID		**RG_GHNF-1**	**RG_GHNF-2**	**RG_GHNF-3**	**RG_GHNF-4**	**RG_GHNF-5**	**RG_GHNF-6**
Date Sampled		9-Sep-22	9-Sep-22	10-Sep-22	10-Sep-22	10-Sep-22	10-Sep-22
Weather		Sunny					
Air Temperature (°C)		16					
UTMs (NAD83, Zone 11U)	Easting	654388	654374	654367	654344	654337	654306
	Northing	5548985	5549036	5549044	5549094	5549155	5549188
Habitat Characteristics							
Surrounding Land Use		Mining; logged historically					
Length of Reach Assessed (m)		100					
Water Temperature (°C)		5.6	6.8	3.3	3.7	4.5	6.6
pH		7.53	7.84	-	-	-	-
Dissolved Oxygen	% sat	81.2	81.2	83.0	83.9	83.4	84.3
	mg/L	10.14	9.84	11.02	11.00	10.72	10.27
Specific Conductance (µS/cm)		1,936	1,932	1,983	1,986	1,977	1,980
Water Clarity		Clear					
Water Colour		Colourless					
Wetted width (m)		2.7	1.9	2.8	5.7	10.0	4.2
Bankfull width (m)		4.5	4.2	4.6	8.1	12.8	6.5
Average Water Depth (m)		0.3					
Average Water Velocity (m/s)		0.078	0.063	0.046	0.206	0.099	0.291
Substrate	% Bedrock	0					
	% Boulder	70					
	% Cobble	20					
	% Gravel	0					
	% Sand	0					
	% Fines	10					
Vegetation	Canopy Coverage (%)	51 to 75					
	Streamside Vegetation	Equal mixture of coniferous, deciduous, and shrubs					
	Dominant Vegetation	-					
	Macrophyte Coverage (%)	0					
	Dominant Macrophyte	-					
	Periphyton Coverage (1 to 5)	5 - Rocks mostly obscured by algae mat, may have long strands (>20mm thick)					
Benthic Invertebrate Sampling [a]							
Number of Jars		1	1	1	2	2	3
Macrophytes (in sampler)		N	N	N	N	N	N
Algae (in sampler)		C	N	N	C	C	C
Comments		pH probe malfunctioned.					

Notes: ID = identifier; - = no data/not recorded; °C = degrees Celsius; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; m = metre; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; m/s = metres per second; < = less than; mm = millimetres; > = greater than; N = none; C = common; SP = sparse; µm = micrometre; m^2 = square metre; CABIN = Canadian Aquatic Biomonitoring Network.

[a] Data are for area-based kicks unless otherwise indicated. A kick net with a 400 µm mesh was used to kick an estimated sampling area of 1/3 m^2 at each station listed in the table. A kick net with a 400 µm mesh was also used to collect the timed CABIN samples from RG_GHNF (n = 3) and RG_GHDT (n = 3).

Table G.1: Supporting Measures Associated with Area-based and Timed Kick and Sweep Benthic Invertebrate Community Sampling, September 2022

Watercourse		**Upper Greenhills Creek**					
Biological Area Code		**RG_GHDT**					
Station ID		**RG_GHDT-1**	**RG_GHDT-2**	**RG_GHDT-3**	**RG_GHDT-4**	**RG_GHDT-5**	**RG_GHDT-6**
Date Sampled		16-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22	16-Sep-22
Weather		Light cloud, smoke					
Air Temperature (°C)		16					
UTMs (NAD83, Zone 11U)	Easting	654288	654310	654342	654356	654359	654357
	Northing	5547720	5547725	5547758	5547815	5547831	5547848
Habitat Characteristics							
Surrounding Land Use		Mining					
Length of Reach Assessed (m)		100					
Water Temperature (°C)		5.2	5.4	5.5	5.6	5.7	6.0
pH		8.20	8.19	8.21	8.15	8.16	8.16
Dissolved Oxygen	% sat	84.1	84.7	84.5	84.5	84.8	84.8
	mg/L	10.60	10.63	10.59	10.57	10.57	10.49
Specific Conductance (µS/cm)		2,034	2,044	2,047	2,049	2,051	2,048
Water Clarity		Clear					
Water Colour		Colourless					
Wetted width (m)		3.8	4.5	3.3	3.8	2.3	3.8
Bankfull width (m)		6.7	8.8	8.2	7.7	6.0	10.3
Average Water Depth (m)		0.3					
Average Water Velocity (m/s)		0.053	0.214	0.043	0.142	0.219	0.191
Substrate	% Bedrock	0					
	% Boulder	10					
	% Cobble	5					
	% Gravel	5					
	% Sand	-					
	% Fines	-					
Vegetation	Canopy Coverage (%)	51 to 75					
	Streamside Vegetation	-					
	Dominant Vegetation	Shrubs					
	Macrophyte Coverage (%)	0					
	Dominant Macrophyte	-					
	Periphyton Coverage (1 to 5)	2 - Rocks slightly slippery, yellow-brown to light green colour (0.5-1mm thick)					
Benthic Invertebrate Sampling [a]							
Number of Jars		1	1	1	1	1	1
Macrophytes (in sampler)		N	N	N	N	N	N
Algae (in sampler)		N	N	N	N	N	N
Comments		Mostly calcite terraces (hence why substrate proportions do not add up to 100%).					

Notes: ID = identifier; - = no data/not recorded; °C = degrees Celsius; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; m = metre; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; m/s = metres per second; < = less than; mm = millimetres; > = greater than; N = none; C = common; SP = sparse; µm = micrometre; m^2 = square metre; CABIN = Canadian Aquatic Biomonitoring Network.

[a] Data are for area-based kicks unless otherwise indicated. A kick net with a 400 µm mesh was used to kick an estimated sampling area of 1/3 m^2 at each station listed in the table. A kick net with a 400 µm mesh was also used to collect the timed CABIN samples from RG_GHNF (n = 3) and RG_GHDT (n = 3).

Table G.1: Supporting Measures Associated with Area-based and Timed Kick and Sweep Benthic Invertebrate Community Sampling, September 2022

Watercourse		**Upper Greenhills Creek**					
Biological Area Code		**RG_GHFF**					
Station ID		**RG_GHFF-1**	**RG_GHFF-2**	**RG_GHFF-3**	**RG_GHFF-4**	**RG_GHFF-5**	**RG_GHFF-6**
Date Sampled		8-Sep-22	8-Sep-22	9-Sep-22	9-Sep-22	9-Sep-22	9-Sep-22
Weather		Overcast, snow overnight					
Air Temperature (°C)		10					
UTMs (NAD83, Zone 11U)	Easting	654115	654111	654143	654161	654183	654184
	Northing	5547122	5547139	5547195	5547200	5547260	5547288
Habitat Characteristics							
Surrounding Land Use		Mining					
Length of Reach Assessed (m)		100					
Water Temperature (°C)		6.7	7.2	7.1	5.0	5.0	5.2
pH		7.51	7.55	7.56	7.66	7.58	7.60
Dissolved Oxygen	% sat	83.1	84.0	84.4	83.7	84.5	84.3
	mg/L	10.12	10.10	10.15	10.63	10.73	10.67
Specific Conductance (µS/cm)		1,592	1,601	1,614	1,593	1,594	1,593
Water Clarity		Clear					
Water Colour		Colourless					
Wetted width (m)		5.3	4.1	2.9	3.1	3.6	8.0
Bankfull width (m)		6.9	6.1	7.7	4.0	4.2	9.3
Average Water Depth (m)		0.3					
Average Water Velocity (m/s)		0.221	0.224	0.121	0.279	0.296	0.282
Substrate	% Bedrock	0					
	% Boulder	70					
	% Cobble	25					
	% Gravel	0					
	% Sand	0					
	% Fines	5					
Vegetation	Canopy Coverage (%)	26 to 50					
	Streamside Vegetation	-					
	Dominant Vegetation	Ferns/grass					
	Macrophyte Coverage (%)	0					
	Dominant Macrophyte	-					
	Periphyton Coverage (1 to 5)	1 - Rocks not slippery, no obvious colour (<0.5 mm thick)					
Benthic Invertebrate Sampling [a]							
Number of Jars		1	1	1	1	1	1
Macrophytes (in sampler)		N	N	N	N	N	N
Algae (in sampler)		N	N	N	N	N	N
Comments		Heavily calcified.					

Notes: ID = identifier; - = no data/not recorded; °C = degrees Celsius; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; m = metre; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; m/s = metres per second; < = less than; mm = millimetres; > = greater than; N = none; C = common; SP = sparse; µm = micrometre; m^2 = square metre; CABIN = Canadian Aquatic Biomonitoring Network.

[a] Data are for area-based kicks unless otherwise indicated. A kick net with a 400 µm mesh was used to kick an estimated sampling area of 1/3 m^2 at each station listed in the table. A kick net with a 400 µm mesh was also used to collect the timed CABIN samples from RG_GHNF (n = 3) and RG_GHDT (n = 3).

Table G.1: Supporting Measures Associated with Area-based and Timed Kick and Sweep Benthic Invertebrate Community Sampling, September 2022

Watercourse		**Lower Greenhills Creek**					
Biological Area Code		**RG_GHBP**					
Station ID		**RG_GHBP-1**	**RG_GHBP-2**	**RG_GHBP-3**	**RG_GHBP-4**	**RG_GHBP-5**	**RG_GHBP-6**
Date Sampled		10-Sep-22	12-Sep-22	12-Sep-22	12-Sep-22	12-Sep-22	12-Sep-22
Weather		Light cloud					
Air Temperature (°C)		18					
UTMs (NAD83, Zone 11U)	Easting	653505	653515	653524	653534	653554	653527
	Northing	5545599	5545625	5545635	5545655	5545676	5545693
Habitat Characteristics							
Surrounding Land Use		Mining					
Length of Reach Assessed (m)		100					
Water Temperature (°C)		12.4	12.6	12.8	13.1	13.4	13.6
pH		7.92	8.34	8.23	-	-	-
Dissolved Oxygen	% sat	82.9	84.1	84.4	84.0	85.3	84.9
	mg/L	8.82	8.91	8.89	8.80	8.86	8.78
Specific Conductance (µS/cm)		1,482	1,482	1,482	1,482	1,480	1,478
Water Clarity		Clear					
Water Colour		Colourless					
Wetted width (m)		5.1	2.3	2.7	6.5	3.7	2.8
Bankfull width (m)		10.5	3.6	5.3	9.6	8.6	5.9
Average Water Depth (m)		0.3					
Average Water Velocity (m/s)		0.339	0.306	0.141	0.051	0.227	0.202
Substrate	% Bedrock	0					
	% Boulder	10					
	% Cobble	55					
	% Gravel	20					
	% Sand	10					
	% Fines	5					
Vegetation	Canopy Coverage (%)	1 to 25					
	Streamside Vegetation	Equal mixture of deciduous, shrubs, and ferns/grass					
	Dominant Vegetation	Deciduous trees					
	Macrophyte Coverage (%)	0					
	Dominant Macrophyte	-					
	Periphyton Coverage (1 to 5)	2 - Rocks slightly slippery, yellow-brown to light green colour (0.5 to 1 mm thick)					
Benthic Invertebrate Sampling [a]							
Number of Jars		1	1	1	1	1	1
Macrophytes (in sampler)		N	N	N	N	N	N
Algae (in sampler)		N	N	N	N	N	N
Comments		pH probe malfunctioned.					

Notes: ID = identifier; - = no data/not recorded; °C = degrees Celsius; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; m = metre; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; m/s = metres per second; < = less than; mm = millimetres; > = greater than; N = none; C = common; SP = sparse; µm = micrometre; m^2 = square metre; CABIN = Canadian Aquatic Biomonitoring Network.

[a] Data are for area-based kicks unless otherwise indicated. A kick net with a 400 µm mesh was used to kick an estimated sampling area of 1/3 m^2 at each station listed in the table. A kick net with a 400 µm mesh was also used to collect the timed CABIN samples from RG_GHNF (n = 3) and RG_GHDT (n = 3).

Table G.2: Summary of Benthic Invertebrate Endpoints Collected by Area-based (1/3 m^2) Kick and Sweep Sampling at Greenhills and Gardine Creeks, September 2022

Watercourse	Biological Area Code	Replicate	Density (No. org/m^2)	Biomass (g/m^2)	LPL Richness (No. of taxa)	Family Richness	%EPT	%Ephemeroptera	%Plecoptera	%Trichoptera	%Diptera
Gardine Creek	RG_GAUT	1	279	0.75	19	11	50	13	22	15	33
		2	1,110	0.77	25	16	80	0	56	24	8.4
		3	1,266	0.63	22	16	87	0	81	6.2	7.6
		4	687	1.1	27	19	75	5.2	61	8.7	13
		5	744	1.0	16	13	88	1.2	72	15	2.0
		6	2,025	4.8	21	16	90	0	83	6.5	7.1
	RG_GANF	1	1,467	1.4	23	16	39	0.82	29	8.8	60
		2	696	0.88	14	10	34	0	28	6.0	62
		3	711	1.1	17	11	51	0	48	2.5	47
		4	450	0.27	14	10	48	0	45	2.7	47
		5	516	0.39	18	13	59	0	56	3.5	37
		6	288	0.22	20	14	30	0	28	2.1	66
Upper Greenhills Creek	RG_GHUT	1	4,044	1.6	17	11	13	0	13	0	68
		2	1,197	0.78	19	11	15	0	15	0	79
		3	306	0.48	15	12	33	0	24	9.8	65
		4	552	0.33	16	10	13	0	12	1.1	82
		5	2,424	1.1	19	10	22	0	16	5.4	76
		6	7,272	4.2	22	12	20	0	18	2.3	78
	RG_GHNF	1	5,544	3.4	22	13	38	0	37	0.43	55
		2	1,533	1.7	20	14	28	0	20	7.8	62
		3	369	0.49	18	12	46	0	45	0.81	52
		4	8,307	3.9	15	8.0	35	0	35	0	65
		5	11,040	2.8	13	9.0	10	0	10	0	88
		6	11,628	7.5	15	9.0	31	0	31	0	68
	RG_GHDT	1	840	0.89	19	12	33	0	26	7.1	64
		2	1,215	0.53	16	10	19	0	18	0.99	80
		3	543	0.9	13	9.0	10	0	9.9	0.55	90
		4	321	0.25	22	14	29	0.93	24	3.7	67
		5	768	1.5	19	13	29	0	18	11	70
		6	363	0.30	19	13	23	0	20	3.3	75
	RG_GHFF	1	885	0.47	21	14	21	0.68	16	3.7	77
		2	876	2.3	20	15	32	2.4	20	8.6	65
		3	867	0.26	14	11	8.7	0	7.6	1.0	90
		4	726	1.8	29	19	23	0.83	17	5.0	73
		5	1,494	0.67	21	16	18	1.6	14	2.0	78
		6	5,244	3.0	22	14	11	0	10	0.92	86
Lower Greenhills Creek	RG_GHBP	1	2,742	4.6	25	18	50	15	26	9.2	22
		2	2,205	3.5	18	14	32	8.7	12	11	47
		3	3,879	6.3	20	15	38	14	11	13	42
		4	6,021	8.4	20	16	24	6.0	8.2	9.8	60
		5	1,836	1.8	20	17	34	22	5.2	6.5	41
		6	1,116	0.94	22	19	55	20	5.4	29	30

Notes: No. org/m^2 = number of organisms per square metre; g/m^2 = grams per square metre; LPL = lowest practical level; % = percent; EPT = Ephemeroptera, Plecoptera, and Trichoptera.

Table G.3: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on the Lowest Practical Level of Taxonomy, 2019 to 2022

Taxon				Density															
Higher Level Classification		Family	Lowest Practical Level Identification	2019												2020			
				RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6	RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4
Bivalvia	Veneroida	Pisidiidae	Pisidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	13	7	0	0	0	0	0	23	27	13	0	0	27	0
Collembola	Collembola	-	Collembola	67	153	60	13	67	117	53	37	57	87	23	63	133	57	40	333
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	13	0	0	0	0	13	0	0	0	3	0	0	27	10	33	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	7	0	0	0	0	0	0	0	0	0	0	13	17	27	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	7	13	0	0	0	0	0	0	0	27	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	7	20	7	0	0	40	3	0	0	0	20	80	7	13	20
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	13	3	13	0
Insecta	Coleoptera	Elmidae	Heterlimnius	27	20	13	0	40	3	0	0	0	0	0	3	53	47	147	7
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	3	27	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	215	28	77	21	96	127	0	0	0	0	0	0	447	135	585	20
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	7
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	7
Insecta	Diptera	Chironomidae	Corynoneura	29	14	14	0	14	3	0	0	0	0	5	0	28	3	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	7	0	0	3	115	31	18	79	25	29	28	3	7	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	14	0	0	0	0	0	0	0	0	21	14	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	0	0	7	10	0	0	0	0	0
Insecta	Diptera	Chironomidae	Krenosmittia	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	43	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	57	28	139	7	83	21	0	0	0	0	0	0	56	63	178	33
Insecta	Diptera	Chironomidae	Micropsectra	57	21	21	14	69	14	0	4	0	0	0	0	126	17	114	0
Insecta	Diptera	Chironomidae	Orthocladius complex	29	21	28	14	14	14	317	39	14	41	85	87	0	10	43	13
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	1,914	335	55	682	174	130	14	3	0	7
Insecta	Diptera	Chironomidae	Paraphaenocladius	29	7	0	0	14	0	0	0	0	0	0	0	42	28	36	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	230	14	14	29	110	24	0	0	0	4	0	10	0	3	7	13
Insecta	Diptera	Chironomidae	Zalutschia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	57	21	7	14	0	7	14	4	0	0	5	58	98	94	471	73
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Insecta	Diptera	Dixidae	Meringodixa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	7	7	0	3	53	0	0	0	20	57	0	0	14	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	0	0	7	3	0	0	0	0	0
Insecta	Diptera	Empididae	Oreogeton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0

Note: - = not applicable.

Table G.3: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on the Lowest Practical Level of Taxonomy, 2019 to 2022

Taxon				Density															
Higher Level Classification		Family	Lowest Practical Level Identification	2019												2020			
				RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6	RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	14	0	0	0	0	0	40	0	0	0	7	0	13	0	0	7
Insecta	Diptera	Psychodidae	Pericoma	0	0	0	0	0	0	0	3	0	10	0	3	0	0	0	13
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	7	13	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0	13	40	0	13	7	173	0	0	7	17	47	120	83	123	40
Insecta	Diptera	Tipulidae	Helius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0
Insecta	Diptera	Tipulidae	Tipula	0	0	13	0	0	3	0	0	0	0	3	0	93	48	89	7
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	7
Insecta	Ephemeroptera	Baetidae	Baetis	67	0	13	7	13	0	40	0	0	7	7	0	0	0	7	120
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	7
Insecta	Ephemeroptera	Heptageniidae	Cinygma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	7	0	0	0	0	0	0	0	0	13	20	20	7
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	6,493	1,007	2,273	1,307	3,693	1,150	587	37	50	167	290	517	1,400	357	560	673
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	7	7	0	0	0	0	0	0	0	0	0	0	0	67	7
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0	13	0	7	7
Insecta	Plecoptera	Nemouridae	Malenka	13	7	0	0	0	7	13	0	0	7	3	3	35	29	27	17
Insecta	Plecoptera	Nemouridae	Zapada	800	150	283	127	293	167	1,640	107	40	463	223	493	259	58	20	69
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	27	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0	0	0	0	0	0	0	27	13	47	7
Insecta	Plecoptera	Perlodidae	Megarcys	27	10	47	13	70	13	37	0	0	3	3	10	0	43	40	20
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	107	13	7	0	0	3	40	7	13	67	17	53	0	0	0	0
Insecta	Trichoptera	Apataniidae	Allomyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Apataniidae	Apatania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	40	0	0	0	0	0	27	33	7	20
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Chyranda	0	0	0	0	0	13	0	0	0	0	0	0	107	103	473	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	13	0	0	3	0	3	0	7	0	0
Insecta	Trichoptera	Limnephilidae	Hesperophylax	0	0	0	0	0	0	0	0	0	0	0	0	40	100	160	7
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	27	7	7	3	0	3	27	0	0	3	13	7	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	13	10	0	0	77	17	40	0	3	7	3	3	53	13	33	47
Insecta	Trichoptera	Uenoidae	Neothremma	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.3: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on the Lowest Practical Level of Taxonomy, 2019 to 2022

Taxon				Density															
Higher Level Classification		Family	Lowest Practical Level Identification	2020								2021							
				RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6	RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2
Bivalvia	Veneroida	Pisidiidae	Pisidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	13	67	47	33	27	80	3	0	0	6	12	0	0	6	0
Collembola	Collembola	-	Collembola	53	200	20	60	160	310	53	3	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	7	0	0	0	0	0	3	0	0	12	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	13	0	0	0	0	27	0	36	24	42	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	13	0	0	0	0	0	0	0	0	0	0	0	0	18	0
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	27	20	7	13	13	7	0	3	0	0	18	0	0	6	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	7	0	0	0	0	0	0	0	12	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	27	0	7	0	0	3	40	3	12	84	30	108	12	18	12	9
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	7	3	13	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	140	90	0	0	0	0	0	3	0	0	0	12	12	7	0	7
Insecta	Diptera	Chironomidae	Brundiniella	0	21	7	0	0	0	0	7	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	28	0	7	34	8	0	0	0	0	0	9	0	0	14	0	0
Insecta	Diptera	Chironomidae	Corynoneura	28	7	0	0	0	0	0	0	0	0	0	0	6	0	0	4
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0	0	8	7	55	3	0	0	0	0	0	0	0	7
Insecta	Diptera	Chironomidae	Heleniella	28	14	0	0	16	10	28	0	0	0	0	0	6	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Krenosmittia	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	112	35	13	0	0	0	14	7	0	12	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	560	0	0	14	28	71	344	88	24	0	0	0	0	0	12	18
Insecta	Diptera	Chironomidae	Orthocladius complex	196	0	7	75	79	51	151	14	0	0	0	12	0	7	12	11
Insecta	Diptera	Chironomidae	Pagastia	53	0	360	1,871	873	748	1,362	57	0	0	0	0	0	0	60	90
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	27	0	7	7	7	7	28	10	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	28	21	7	0	0	0	41	3	0	12	0	0	0	7	0	4
Insecta	Diptera	Chironomidae	Zalutschia	0	0	0	0	0	0	0	51	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	53	104	0	7	55	17	28	0	0	12	9	36	6	14	18	18
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	13	0	13	0	0	0	0	0	12	0	0	0
Insecta	Diptera	Dixidae	Meringodixa	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	20	85	107	70	161	23	0	0	12	12	0	0	30	18
Insecta	Diptera	Empididae	Clinocera	0	0	0	35	7	10	67	10	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Oreogeton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.3: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on the Lowest Practical Level of Taxonomy, 2019 to 2022

Taxon				Density															
Higher Level Classification		Family	Lowest Practical Level Identification	2020								2021							
				RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6	RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	7	50	20	40	3	134	33	0	0	0	0	0	0	51	12
Insecta	Diptera	Psychodidae	Pericoma	0	0	7	27	27	7	67	10	0	0	6	0	0	0	12	3
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	7	13	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	267	48	47	100	53	40	67	27	60	0	36	24	6	0	6	15
Insecta	Diptera	Tipulidae	Helius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	27	0	0	0	0	0	0	3	0	0	6	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	53	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	27	20	0	0	0	0	0	0	12	24	18	12	0	0	24	15
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	7	13	0	0	0	0	3	0	0	0	0	0	0	0	6
Insecta	Ephemeroptera	Heptageniidae	Cinygma	0	0	0	0	0	0	0	0	12	36	0	0	0	12	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	103	25	0	98	50	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	1,707	613	193	200	127	100	147	160	120	461	353	300	148	413	180	72
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	53	0	13	0	7	3	80	20	0	0	12	0	0	0	0	18
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	7	0	0	0	0	0	0	0	0	0	12	18	3
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	240	80	367	300	353	420	317	133	12	24	18	24	42	96	306	162
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	3	0	0	0	0	0	0	0	0	6	3
Insecta	Plecoptera	Perlodidae	Isoperla	0	7	47	100	20	47	133	27	0	24	12	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	107	20	3	0	17	7	77	10	0	6	12	18	12	33	3	12
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	67	73	50	40	13	0	36	0	12	12	0	18	9
Insecta	Trichoptera	Apataniidae	Allomyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Apataniidae	Apatania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	96	12	24	96	168	66	12	201
Insecta	Trichoptera	Glossosomatidae	Glossosoma	133	0	67	20	0	0	13	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	3	13	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Insecta	Trichoptera	Limnephilidae	Chyranda	27	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	47	60	20	20	40	10	24	24	0	12	6	0	0	3
Insecta	Trichoptera	Limnephilidae	Hesperophylax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	33	27	7	33	13	47	0	0	6	0	0	0	18	12
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	3
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	187	20	13	20	53	30	60	7	0	12	6	0	6	18	102	60
Insecta	Trichoptera	Uenoidae	Neothremma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.3: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on the Lowest Practical Level of Taxonomy, 2019 to 2022

Taxon				Density															
Higher Level Classification		Family	Lowest Practical Level Identification	2021				2022											
				RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6	RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	12	0	0	0	0	6	0	0	0	0	0	6	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	30	0	0	12	0	12	0	0	0	0	6	18	6	24	12	0
Collembola	Collembola	-	Collembola	42	24	72	18	0	12	0	0	0	0	0	6	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	6	0	0	18	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	6	0	6	6	6	0	0	0	0	0	6
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	6	0	6	0	6	0	6	6	0	0	0	6	3
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	6	6	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	12	0	0	42	78	60	48	66	48	6	0	0	0	0	3
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	7	14	0	0	0	0	6	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	6	6	0	0	7	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	34	14	0	32	6	0	0	0	0	0	397	21	7	8	16	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	6	6	0	0	0	0	0	0	4
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	6	0	0	0	0	7	0	8	0
Insecta	Diptera	Chironomidae	Krenosmittia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	7	0	0	0	6	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	18	7	0	0	0	0	0	0	0	0	0	4
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	21	0	12	0	0	7	0	6	0	0	27	0	20	0	0	4
Insecta	Diptera	Chironomidae	Orthocladius complex	34	27	0	0	12	0	6	6	0	0	61	72	20	16	16	23
Insecta	Diptera	Chironomidae	Pagastia	254	619	294	123	6	0	0	0	0	0	249	138	89	101	57	45
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	6	7	0	6	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	14	0	0	24	20	0	0	0	6	34	0	7	0	8	0
Insecta	Diptera	Chironomidae	Zalutschia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	27	69	0	6	0	0	18	12	3	6	7	9	0	8	8	8
Insecta	Diptera	Dixidae	Dixa	0	12	0	0	0	0	0	0	0	12	0	0	0	0	6	0
Insecta	Diptera	Dixidae	Meringodixa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	6	72	60	66	0	6	6	6	3	0	48	174	144	36	36	39
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Oreogeton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.3: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on the Lowest Practical Level of Taxonomy, 2019 to 2022

Taxon				Density															
Higher Level Classification		Family	Lowest Practical Level Identification	2021				2022											
				RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6	RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	12	36	18	0	102	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	15	12	0	0	0	0	0	12	3	0	42	6	6	0	24	18
Insecta	Diptera	Psychodidae	Pericoma	18	24	18	18	0	0	0	0	0	0	6	12	30	24	12	39
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	6	24	18	6	0	0	0	0	0	0	0	0	6	12	0	3
Insecta	Diptera	Tipulidae	Helius	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	12	6	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	9	3	6	6	0	0	0	0	0	6	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	36	228	162	72	0	0	0	0	0	0	12	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygma	0	0	0	0	0	0	0	30	9	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	36	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	42	202	0	26	120	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	54	336	42	84	24	372	590	330	385	1,104	0	0	18	12	24	9
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	12	12	0	0	0	0	24	24	6	6	0	12	0	0	18	3
Insecta	Plecoptera	Leuctridae	Leuctridae	6	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	282	1,320	336	390	16	180	174	36	93	324	318	72	180	78	102	48
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	11	84	30	36	12	18	12	18	12	18	84	96	144	84	126	21
Insecta	Plecoptera	Perlodidae	Megarcys	32	0	0	0	0	9	18	9	12	93	6	18	3	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	60	240	108	60	0	0	0	0	0	0	12	0	0	30	18	0
Insecta	Trichoptera	Apataniidae	Allomyia	0	0	0	0	0	0	6	6	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Apataniidae	Apatania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	36	24	0	0	6	240	54	24	42	60	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Chyranda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	12	6	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Hesperophylax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	6	24	0	24	6	0	6	6	3	6	0	0	0	0	0	3
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	48	60	6	6	18	24	6	24	69	51	93	42	18	12	18	3
Insecta	Trichoptera	Uenoidae	Neothremma	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.4: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on the Lowest Practical Level of Taxonomy, 2019 to 2022

Taxon				Area-based Kicks						Area-based Kicks						Area-based Kicks			
Higher Level Classification		Family	Lowest Practical Level Identification	2019						2019						2020			
				RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6	RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4
Bivalvia	Veneroida	Pisidiidae	Pisidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0.429	0.414	0	0	0	0	0	1.39	2.72	0.821	0	0	0.765	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0.792	9.73	1.93	0.828	1.41	6.72	1.02	6.04	22.7	5.17	2.38	3.90	3.86	3.92	1.15	20.5
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0.158	0	0	0	0	0.768	0	0	0	0.199	0	0	0.772	0.691	0.956	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0.423	0	0	0	0	0	0	0	0	0	0	0.386	1.15	0.765	0
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0.414	0.282	0	0	0	0	0	0	0	0.772	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0.423	0.643	0.414	0	0	0.764	0.549	0	0	0	1.23	2.32	0.461	0.382	1.23
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0	0	0	0	0	0	0.386	0.230	0.382	0
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0.317	1.27	0.429	0	0.847	0.192	0	0	0	0	0	0.205	1.54	3.23	4.21	0.410
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0.230	0.765	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0.282	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	2.56	1.77	2.47	1.33	2.04	7.32	0	0	0	0	0	0	12.9	9.36	16.8	1.23
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	0	0.808	0	0	0.447
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0.720	0	0.410
Insecta	Diptera	Chironomidae	Diplocladius	0.341	0.884	0.448	0	0.292	0.198	0	0	0	0	0.508	0	0.808	0.240	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0	0	0	0	0	0	0	0	0	0	0.404	0	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0.224	0	0	0.198	2.20	5.14	7.30	4.69	2.54	1.78	0.808	0.240	0.204	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0.292	0	0	0	0	0	0	0	0	1.44	0.409	0
Insecta	Diptera	Chironomidae	Krenosmittia	0	0	0	0	0	0	0	0	0	0.447	1.02	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0	0.404	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0.512	0	0	0	0.292	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0.198	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0.682	1.77	4.48	0.444	1.75	1.19	0	0	0	0	0	0	1.62	4.32	5.11	2.05
Insecta	Diptera	Chironomidae	Orthocladius complex	0.682	1.33	0.672	0.887	1.46	0.791	0	0.643	0	0	0	0	3.64	1.20	3.27	0
Insecta	Diptera	Chironomidae	Pagastia	0.341	1.33	0.896	0.887	0.292	0.791	6.05	6.43	5.47	2.46	8.63	5.35	0	0.720	1.23	0.820
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	36.5	55.3	21.9	40.7	17.8	8.02	0.404	0.240	0	0.410
Insecta	Diptera	Chironomidae	Pentaneura	0.341	0.442	0	0	0.292	0	0	0	0	0	0	0	1.21	1.92	1.02	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	0	0	0	0	0	0	0	0	1.02	0	0	0	0	0
Insecta	Diptera	Chironomidae	Zalutschia	2.73	0.884	0.448	1.77	2.33	1.38	0	0	0	0.224	0	0.594	0	0.240	0.204	0.820
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0.682	1.33	0.224	0.887	0	0.396	0.275	0.643	0	0	0.508	3.56	2.83	6.48	13.5	4.47
Insecta	Diptera	Dixidae	Meringodixa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.410
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	0.214	0.414	0	0.195	1.02	0	0	0	2.04	3.49	0	0	0.392	0

Note: - = not applicable.

Table G.4: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on the Lowest Practical Level of Taxonomy, 2019 to 2022

Taxon				Area-based Kicks						Area-based Kicks						Area-based Kicks			
Higher Level Classification		Family	Lowest Practical Level Identification	2019						2019						2020			
				RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6	RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4
Insecta	Diptera	Empididae	Oreogeton	0	0	0	0	0	0	0	0	0	0.398	0.340	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.196	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	0	0	0	0	0	0	0	0	0.232	0	0
Insecta	Diptera	Psychodidae	Pericoma	0.164	0	0	0	0	0	0.764	0	0	0	0.680	0	0.386	0	0	0.410
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0.549	0	0.596	0	0.205	0	0	0	0.820
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0	0	0	0	0	0	0	0	0	0	0.680	0.821	0	0	0	0
Insecta	Diptera	Tipulidae	Helius	0	0.846	1.29	0	0.282	0.390	3.31	0	0	0.398	1.70	2.87	3.47	5.71	3.52	2.46
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.196	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0.429	0	0	0.195	0	0	0	0	0.340	0	2.70	3.33	2.55	0.410
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0.414	0	0	0	0	0	0	0	0	0	0	0	0.410
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0.792	0	0.429	0.414	0.282	0	0.764	0	0	0.398	0.680	0	0	0	0.191	7.38
Insecta	Ephemeroptera	Heptageniidae	Cinygma	0	0	0	0	0	0	0.255	0	0	0	0	0	0	0	0	0.410
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0.414	0	0	0	0	0	0	0	0	0.386	1.38	0.574	0.410
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	77.2	63.9	73.1	81.2	78.2	66.2	11.2	6.04	20.0	9.94	29.6	31.8	40.5	24.6	16.1	41.4
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0.423	0.214	0	0	0	0	0	0	0	0	0	0	0	1.91	0.410
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0	0	0	0	0	0	0	0.386	0	0.191	0.410
Insecta	Plecoptera	Nemouridae	Zapada	0.158	0.423	0	0	0	0.384	0.255	0	0	0.398	0.340	0.205	0.999	2.00	0.765	1.07
Insecta	Plecoptera	Peltoperlidae	Yoraperla	9.51	9.51	9.11	7.87	6.21	9.60	31.3	17.6	16.0	27.6	22.8	30.4	7.49	3.99	0.574	4.26
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0	0.509	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0	0	0	0	0	0	0	0	0	0.772	0.922	1.34	0.410
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0.317	0.634	1.50	0.828	1.48	0.768	0.700	0	0	0.199	0.340	0.616	0	3.00	1.15	1.23
Insecta	Trichoptera	Apataniidae	Allomyia	1.27	0.846	0.214	0	0	0.192	0.764	1.10	5.33	3.98	1.70	3.29	0	0	0	0
Insecta	Trichoptera	Apataniidae	Apatania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.410
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0.764	0	0	0	0	0	0.772	2.30	0.191	1.23
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Chyranda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0.768	0	0	0	0	0	0	3.09	7.14	13.6	0
Insecta	Trichoptera	Limnephilidae	Hesperophylax	0	0	0	0	0	0	0.255	0	0	0.199	0	0.205	0	0.461	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	1.16	6.91	4.59	0.410
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0.386	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0.317	0.423	0.214	0.207	0	0.192	0.509	0	0	0.199	1.36	0.411	0	0	0	0
Insecta	Trichoptera	Uenoidae	Neothremma	0.158	0.634	0	0	1.62	0.960	0.764	0	1.33	0.398	0.340	0.205	1.54	0.922	0.956	2.87

Note: - = not applicable.

Table G.4: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on the Lowest Practical Level of Taxonomy, 2019 to 2022

Taxon				Area-based Kicks		Area-based Kicks						Area-based Kicks						Area-based Kicks	
Higher Level Classification		Family	Lowest Practical Level Identification	2020		2020						2021						2021	
				RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6	RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2
Bivalvia	Veneroida	Pisidiidae	Pisidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.645	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0.930	4.65	1.46	1.50	1.26	2.13	0.408	0	0	0.885	1.71	0	0	0.645	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	1.27	13.9	1.40	1.88	7.20	14.7	1.42	0.408	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0.465	0	0	0	0	0	0.408	0	0	1.77	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0.930	0	0	0	0	0.709	0	8.57	2.61	6.19	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0.930	0	0	0	0	0	0	0	0	0	0	0	0	1.94	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0.408	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0.633	1.40	0.465	0.418	0.600	0.315	0	0.408	0	0	2.65	0	0	0.778	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0.465	0	0	0	0	0	0	0	1.31	0	0	0	0	0	0
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0.633	0	0.465	0	0	0.158	1.06	0.408	2.86	9.15	4.42	15.4	2.15	2.33	1.29	1.12
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0.600	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0.300	0.158	0.354	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	0	0	0	0	0	0	0	0.408	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0.474	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	3.32	6.31	0	0	0	0	0	0.414	0	0	0	1.71	2.15	0.889	0	0.899
Insecta	Diptera	Chironomidae	Chaetocladius	0	1.46	0.465	0	0	0	0	0.827	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0.663	0	0.465	1.07	0.356	0	0	0	0	0	1.33	0	0	1.78	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0.663	0.485	0	0	0	0	0	0	0	0	0	0	1.08	0	0	0.449
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0.356	0.319	1.46	0.414	0	0	0	0	0	0	0	0.899
Insecta	Diptera	Chironomidae	Hydrobaenus	0.663	0.970	0	0	0.712	0.478	0.731	0	0	0	0	0	1.08	0	0	0
Insecta	Diptera	Chironomidae	Krenosmittia	0	0	0	0	0	0	0	1.24	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0.414	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0.663	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	2.65	2.43	0.930	0	0	0	0.366	0.827	0	1.31	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	13.3	0	0	0.426	1.25	3.35	9.14	10.8	5.71	0	0	0	0	0	1.29	2.25
Insecta	Diptera	Chironomidae	Pagastia	4.64	0	0.465	2.34	3.56	2.39	4.02	1.65	0	0	0	1.71	0	0.889	1.29	1.35
Insecta	Diptera	Chironomidae	Paraphaenocladius	1.27	0	25.1	58.6	39.2	35.4	36.2	7.03	0	0	0	0	0	0	6.45	11.2
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0.366	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0	0	0	2.86	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0.633	0	0.465	0.213	0.311	0.319	0.731	1.24	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Zalutschia	0.663	1.46	0.465	0	0	0	1.10	0.414	0	1.31	0	0	0	0.889	0	0.449
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	6.20	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	1.27	7.28	0	0.213	2.49	0.797	0.731	0	0	1.31	1.33	5.13	1.08	1.78	1.94	2.25
Insecta	Diptera	Dixidae	Meringodixa	0	0	0	0	0.600	0	0.356	0	0	0	0	0	2.15	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0	0	0	0	0	0	0	0	0	0	1.08	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	1.40	2.65	4.80	3.29	4.27	2.86	0	0	1.77	1.71	0	0	3.23	2.24

Note: - = not applicable.

Table G.4: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on the Lowest Practical Level of Taxonomy, 2019 to 2022

Taxon				Area-based Kicks		Area-based Kicks						Area-based Kicks						Area-based Kicks	
Higher Level Classification		Family	Lowest Practical Level Identification	2020		2020						2021						2021	
				RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6	RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2
Insecta	Diptera	Empididae	Oreogeton	0	0	0	1.11	0.300	0.494	1.78	1.22	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	0	0	0	0	0	0.885	0	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	0	0.474	3.49	0.626	1.80	0.158	3.56	4.08	0	0	0	0	0	0	5.48	1.49
Insecta	Diptera	Psychodidae	Psychoda	0	0	0.465	0.835	1.20	0.315	1.78	1.22	0	0	0.885	0	0	0	1.29	0.373
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0.356	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0	0	0	0	0	0.315	0.356	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Helius	6.33	3.32	3.26	3.13	2.40	1.89	1.78	3.27	14.3	0	5.31	3.42	1.08	0	0.645	1.87
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	0.633	0	0	0	0	0	0	0.408	0	0	0.885	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	1.71	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	1.27	0.474	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0.633	1.40	0	0	0	0	0	0	2.86	2.61	2.65	1.71	0	0	2.58	1.87
Insecta	Ephemeroptera	Heptageniidae	Cinygma	0	0.465	0.930	0	0	0	0	0.408	0	0	0	0	0	0	0	0.746
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	2.86	3.92	0	0	0	1.56	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.373
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0	0	0	0	0	0	0	11.2	3.64	0	17.6	6.42	0	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	40.5	42.8	13.5	6.26	5.70	4.73	3.90	19.6	28.6	50.3	52.1	42.7	26.4	53.5	19.4	8.96
Insecta	Plecoptera	Leuctridae	Leuctridae	1.27	0	0.930	0	0.300	0.158	2.13	2.45	0	0	1.77	0	0	0	0	2.24
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0.209	0	0	0	0	0	0	0	0	0	1.56	1.94	0.373
Insecta	Plecoptera	Nemouridae	Zapada	0	0	0	0	0	0	0.443	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Yoraperla	5.70	5.58	25.6	9.39	15.9	19.9	8.41	16.3	2.86	2.61	2.65	3.42	7.53	12.4	32.9	20.1
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0.158	0	0	0	0	0	0	0	0	0.645	0.373
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.465	3.26	3.13	0.900	2.21	3.54	3.27	0	2.61	1.77	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	2.53	1.40	0.233	0	0.750	0.315	2.04	1.22	0	0.654	1.77	2.56	2.15	4.28	0.323	1.49
Insecta	Trichoptera	Apataniidae	Allomyia	0	0	0	2.09	3.30	2.37	1.06	1.63	0	3.92	0	1.71	2.15	0	1.94	1.12
Insecta	Trichoptera	Apataniidae	Apatania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	22.9	1.31	3.54	13.7	30.1	8.56	1.29	25.0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	3.16	0	4.65	0.626	0	0	0.354	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0.158	0.354	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Chyranda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.746
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0.633	2.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Hesperophylax	0	0	3.26	1.88	0.900	0.946	1.06	1.22	5.71	2.61	0	1.71	1.08	0	0	0.373
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	2.33	0.835	0.300	1.58	0.354	5.71	0	0	0.885	0	0	0	1.94	1.49
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0.465	0	0	0	0	0	0	0	0	0	0	0	0	0.373
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Uenoidae	Neothremma	4.43	1.40	0.930	0.626	2.40	1.42	1.59	0.816	0	1.31	0.885	0	1.08	2.33	11.0	7.46

Note: - = not applicable.

Table G.4: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on the Lowest Practical Level of Taxonomy, 2019 to 2022

Taxon				Area-based Kicks				Area-based Kicks						Area-based Kicks					
Higher Level Classification		Family	Lowest Practical Level Identification	2021				2022						2022					
				RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6	RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	1.08	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0.366	0	0	0	0	0.474	0	0	0	0	0	0.844	0	0	0
Collembola	Collembola	-	Collembola	2.75	0	0	1.25	0	1.08	0	0	0	0	0.409	2.59	0.844	5.33	2.33	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	3.86	0.733	6.19	1.88	0	1.08	0	0	0	0	0	0.862	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	2.15	0	0	2.62	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0	0	0.541	0	0.873	0.806	0.296	0	0	0	0	0	2.08
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0.625	0	0.541	0	0.873	0	0.296	0.409	0	0	0	1.16	1.04
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0.474	0.873	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0	0.366	0	0	15.1	7.03	4.74	6.99	8.87	2.37	0.409	0	0	0	0	1.04
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0	0	0	0	0	0.296	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	0	0	0	0	0	0	0	0	0	0	0.409	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0.948	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	1.08	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0	0	0	0.593	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0.631	0.420	0	0	0	0	0.474	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0.474	0.873	0	0	0.458	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Heleniella	3.16	0.420	0	3.38	2.15	0	0	0	0	0	27.0	2.95	0.959	1.73	3.16	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	0.873	0.806	0	0	0	0	0	0	1.31
Insecta	Diptera	Chironomidae	Krenosmittia	0	0	0	0	0	0	0	0.873	0	0	0	0	0.959	0	1.58	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0.608	0	0	0	0.296	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	6.45	0.608	0	0	0	0	0	0	0	0	0	1.31
Insecta	Diptera	Chironomidae	Micropsectra	0	0	0	0	0	0.608	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	1.89	0	1.05	0	0	0.608	0	0.873	0	0	1.83	0	2.88	0	0	1.31
Insecta	Diptera	Chironomidae	Pagastia	3.16	0.839	0	0	4.30	0	0.474	0.873	0	0	4.13	10.3	2.88	3.45	3.16	7.88
Insecta	Diptera	Chironomidae	Paraphaenocladius	23.4	18.9	25.2	12.8	2.15	0	0	0	0	0	17.0	19.9	12.5	22.4	11.1	15.8
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	2.15	0.608	0	0.873	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Zalutschia	0	0.420	0	0	8.60	1.82	0	0	0	0.296	2.29	0	0.959	0	1.58	0
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	2.52	2.10	0	0.675	0	0	1.42	1.75	0.403	0.296	0.458	1.33	0	1.73	1.58	2.63
Insecta	Diptera	Dixidae	Meringodixa	0	0.366	0	0	0	0	0	0	0	0.593	0	0	0	0	1.16	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Clinocera	0.551	2.20	5.15	6.88	0	0.541	0.474	0.873	0.403	0	3.27	25.0	20.2	8.00	6.98	13.5

Note: - = not applicable.

Table G.4: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on the Lowest Practical Level of Taxonomy, 2019 to 2022

Taxon				Area-based Kicks				Area-based Kicks						Area-based Kicks					
Higher Level Classification		Family	Lowest Practical Level Identification	2021				2022						2022					
				RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6	RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6
Insecta	Diptera	Empididae	Oreogeton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	1.08	2.84	2.62	0	5.04	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	1.38	0.366	0	0	0	0	0	1.75	0.403	0	2.86	0.862	0.844	0	4.65	6.25
Insecta	Diptera	Psychodidae	Psychoda	1.65	0.733	1.55	1.88	0	0	0	0	0	0	0.409	1.72	4.22	5.33	2.33	13.5
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Helius	0.551	0.733	1.55	0.625	0	0	0	0	0	0	0	0	0.844	2.67	0	1.04
Insecta	Diptera	Tipulidae	Limnophila	0	0	0.515	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	0	0	0	0	4.30	0.541	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0.551	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.04
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	3.23	0.270	0.474	0.873	0	0	0	0	0	1.33	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0.873	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	3.31	6.96	13.9	7.50	0	0	0	0	0	0	0.818	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygma	0.551	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	4.37	1.21	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	12.9	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0	0	0	3.83	15.9	0	3.45	5.93	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	4.96	10.3	3.61	8.75	8.60	33.5	46.6	48.0	51.8	54.5	0	0	2.53	2.67	4.65	3.12
Insecta	Plecoptera	Leuctridae	Leuctridae	1.10	0.366	0	0	0	0	1.90	3.49	0.806	0.296	0	1.72	0	0	3.49	1.04
Insecta	Plecoptera	Nemouridae	Malenka	0.551	0	0	0	0	0	0	0	0	0.889	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	0	0	0	0	2.87	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Yoraperla	25.9	40.3	28.9	40.6	5.73	16.2	13.7	5.24	12.5	16.0	21.7	10.3	25.3	17.3	19.8	16.7
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0	0	0	0	0	0.409	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0.964	2.56	2.58	3.75	4.30	1.62	0.948	2.62	1.61	0.889	5.73	13.8	20.2	18.7	24.4	7.29
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	2.89	0	0	0	0	0.811	1.42	1.31	1.61	4.59	0.409	2.59	0.422	0	0	0
Insecta	Trichoptera	Apataniidae	Allomyia	5.51	7.33	9.28	6.25	0	0	0	0	0	0	0.818	0	0	6.67	3.49	0
Insecta	Trichoptera	Apataniidae	Apatania	0	0	0	0	0	0	0.474	0.873	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	2.04	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	3.31	0.733	0	0	2.15	21.6	4.27	3.49	5.65	2.96	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0.409	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Chyranda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Hesperophylax	0	0	0	0	4.30	0.541	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0.551	0.733	0	2.50	2.15	0	0.474	0.873	0.403	0.296	0	0	0	0	0	1.04
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	0	0	0	0	0	0	0	0.741	0	0	0	0	0	0
Insecta	Trichoptera	Uenoidae	Neothremma	4.41	1.83	0.515	0.625	6.45	2.16	0.474	3.49	9.27	2.52	6.34	6.03	2.53	2.67	3.49	1.04

Note: - = not applicable.

Table G.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on Family Level of Taxonomy, 2019 to 2022

Taxon			Density											
Higher Level Classification		Family	2019											
			RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6
Bivalvia	Veneroida	Pisidiidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	0	13	7	0	0	0	0	0	23	27	13
Euchelicerata	Trombidiformes	Hydryphantidae	13	0	0	0	0	13	0	0	0	3	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	7	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	7	13	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	7	20	7	0	0	40	3	0	0	0	20
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	27	20	13	0	40	3	0	0	0	0	0	3
Insecta	Coleoptera	Hydrophilidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	13	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	746	153	307	100	427	216	2,360	413	87	813	313	313
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	0	0	7	7	0	3	53	0	0	7	23	57
Insecta	Diptera	Pelecorhynchidae	14	0	0	0	0	0	40	0	0	0	7	0
Insecta	Diptera	Psychodidae	0	0	0	0	0	0	0	3	0	10	0	3
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	7	13
Insecta	Diptera	Tipulidae	0	13	53	0	13	10	173	0	0	7	20	47
Insecta	Ephemeroptera	Ameletidae	0	0	0	7	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	67	0	13	7	13	0	40	0	0	7	7	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	13	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	7	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	6,493	1,007	2,273	1,307	3,693	1,150	587	37	50	167	290	517
Insecta	Plecoptera	Chloroperlidae	0	7	7	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	813	157	283	127	293	173	1,653	107	40	470	227	497
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	27	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	27	10	47	13	70	13	37	0	0	3	3	10
Insecta	Plecoptera	Taeniopterygidae	107	13	7	0	0	3	40	7	13	67	17	53
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	40	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	27	7	7	3	0	17	40	0	0	7	13	10
Insecta	Trichoptera	Rhyacophilidae	13	10	0	0	77	17	40	0	3	7	3	3
Insecta	Trichoptera	Uenoidae	0	13	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	67	153	60	13	67	117	53	37	57	87	23	63

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.5: **Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on Family Level of Taxonomy, 2019 to 2022**

Taxon			Density											
Higher Level Classification		Family	2020											
			RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6
Bivalvia	Veneroida	Pisidiidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	0	27	0	0	13	67	47	33	27	80	3
Euchelicerata	Trombidiformes	Hydryphantidae	27	10	33	0	0	7	0	0	0	0	0	3
Euchelicerata	Trombidiformes	Hygrobatidae	13	17	27	0	0	13	0	0	0	0	27	0
Euchelicerata	Trombidiformes	Lebertiidae	27	0	0	0	0	13	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	0	0	0	0	0	0	0	0	0	0	0	3
Euchelicerata	Trombidiformes	Sperchontidae	80	7	13	20	27	20	7	13	13	7	0	3
Insecta	Coleoptera	Dytiscidae	13	3	13	0	0	7	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	53	47	147	7	27	0	7	0	0	3	40	3
Insecta	Coleoptera	Hydrophilidae	0	3	27	0	0	0	0	0	13	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	7	3	13	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	7	0	0	0	0	0	3
Insecta	Diptera	Chironomidae	893	392	1,454	173	1,280	292	407	2,007	1,073	910	2,064	257
Insecta	Diptera	Dixidae	0	0	0	7	0	0	0	0	13	0	13	0
Insecta	Diptera	Empididae	0	3	20	0	0	0	20	120	113	80	228	33
Insecta	Diptera	Pelecorhynchidae	13	0	0	7	0	7	50	20	40	3	134	33
Insecta	Diptera	Psychodidae	0	0	0	13	0	0	7	27	27	7	80	10
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	7	13	0
Insecta	Diptera	Tipulidae	213	131	218	47	347	54	47	100	53	40	67	30
Insecta	Ephemeroptera	Ameletidae	0	0	0	7	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	7	120	27	20	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	7	0	7	13	0	0	0	0	3
Insecta	Ephemeroptera	Heptageniidae	13	20	20	7	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	1,400	357	560	673	1,707	613	193	200	127	100	147	160
Insecta	Plecoptera	Chloroperlidae	0	0	67	7	53	0	13	0	7	3	80	20
Insecta	Plecoptera	Leuctridae	13	0	7	7	0	0	0	7	0	0	0	0
Insecta	Plecoptera	Nemouridae	293	87	47	87	240	80	367	300	353	420	333	133
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	3	0	0
Insecta	Plecoptera	Perlodidae	27	57	87	27	107	27	50	100	37	53	210	37
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	0	67	73	50	40	13
Insecta	Trichoptera	Apataniidae	0	0	0	7	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	27	33	7	20	133	0	67	20	0	0	13	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	3	13	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	160	210	633	7	27	33	87	87	27	53	53	57
Insecta	Trichoptera	Rhyacophilidae	53	13	33	47	187	20	13	20	53	30	60	7
Insecta	Trichoptera	Uenoidae	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	133	57	40	333	53	200	20	60	160	310	53	3

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on Family Level of Taxonomy, 2019 to 2022

Taxon			Density											
Higher Level Classification		Family	2021											
			RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6
Bivalvia	Veneroida	Pisidiidae	0	0	0	0	0	0	6	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	12	0	0
Clitellata	-	Enchytraeidae	0	0	6	12	0	0	6	0	30	0	0	12
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	12	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	36	24	42	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0	18	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	18	0	0	6	0	0	0	0	0	6
Insecta	Coleoptera	Dytiscidae	0	12	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	12	84	30	108	12	18	12	9	0	12	0	0
Insecta	Coleoptera	Hydrophilidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	36	36	18	60	30	48	102	159	378	756	306	162
Insecta	Diptera	Dixidae	0	0	0	0	18	0	0	0	0	12	0	0
Insecta	Diptera	Empididae	0	0	18	12	0	0	30	18	6	72	60	66
Insecta	Diptera	Pelecorhynchidae	0	0	0	0	0	0	51	12	15	12	0	0
Insecta	Diptera	Psychodidae	0	0	6	0	0	0	12	3	18	24	18	18
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	60	0	42	36	6	0	6	15	12	24	24	6
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	12	24	18	12	0	0	24	15	36	228	162	72
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	0	6	6	0	0	0
Insecta	Ephemeroptera	Heptageniidae	12	36	0	0	0	12	0	3	0	0	0	0
Insecta	Plecoptera	Capniidae	120	564	378	300	246	462	180	72	54	336	42	84
Insecta	Plecoptera	Chloroperlidae	0	0	12	0	0	0	0	18	12	12	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	12	18	3	6	0	0	0
Insecta	Plecoptera	Nemouridae	12	24	18	24	42	96	306	162	282	1,320	336	390
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	6	3	0	0	0	0
Insecta	Plecoptera	Perlodidae	0	30	24	18	12	33	3	12	42	84	30	36
Insecta	Plecoptera	Taeniopterygidae	0	36	0	12	12	0	18	9	60	240	108	60
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	96	12	24	96	168	66	12	201	36	24	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	6	0	0	0	0
Insecta	Trichoptera	Limnephilidae	24	24	6	12	6	0	18	18	6	24	0	24
Insecta	Trichoptera	Rhyacophilidae	0	12	6	0	6	18	102	60	48	60	6	6
Insecta	Trichoptera	Uenoidae	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	42	24	72	18

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on Family Level of Taxonomy, 2019 to 2022

Taxon			Density											
Higher Level Classification		Family	2022											
			RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6
Bivalvia	Veneroida	Pisidiidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	12	6	0	0	0	0	0	6	0	0	0
Clitellata	-	Enchytraeidae	0	12	0	0	0	0	6	18	6	24	12	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	6	0	0	18	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	6	0	6	6	6	0	0	0	0	0	6
Euchelicerata	Trombidiformes	Limnesiidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	6	0	6	0	6	6	0	0	0	6	3
Insecta	Coleoptera	Dytiscidae	0	0	6	6	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	42	78	60	48	66	48	6	0	0	0	0	3
Insecta	Coleoptera	Hydrophilidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	6	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	12	12	0	0	12	6	0	0	0	0	0
Insecta	Diptera	Chironomidae	72	54	36	48	9	18	780	240	150	132	114	87
Insecta	Diptera	Dixidae	0	0	0	0	0	12	0	0	0	0	6	0
Insecta	Diptera	Empididae	0	18	42	24	3	102	48	174	144	36	36	39
Insecta	Diptera	Pelecorhynchidae	0	0	0	12	3	0	42	6	6	0	24	18
Insecta	Diptera	Psychodidae	0	0	0	0	0	0	6	12	30	24	12	39
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	21	9	6	6	0	0	0	0	6	18	0	6
Insecta	Ephemeroptera	Ameletidae	0	0	0	6	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0	0	12	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	36	0	0	30	9	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	24	414	792	330	411	1,224	0	0	18	12	24	9
Insecta	Plecoptera	Chloroperlidae	0	0	24	24	6	6	0	12	0	0	18	3
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	18	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	24	180	174	36	93	324	318	72	180	78	102	48
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	6	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	12	27	30	27	24	111	90	114	147	84	126	21
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	12	0	0	30	18	0
Insecta	Trichoptera	Apataniidae	0	0	6	6	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	30	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	6	240	54	24	42	60	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	6	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	18	6	6	6	3	21	0	0	0	0	0	3
Insecta	Trichoptera	Rhyacophilidae	18	24	6	24	69	51	93	42	18	12	18	3
Insecta	Trichoptera	Uenoidae	0	0	6	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	12	0	0	0	0	0	6	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.6: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on Family Level of Taxonomy, 2019 to 2022

Taxon			Area-based Kick Samples											
Higher Level Classification		Family	2019											
			RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6
Bivalvia	Veneroida	Pisidiidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	0	0.429	0.414	0	0	0	0	0	1.39	2.72	0.821
Euchelicerata	Trombidiformes	Hydryphantidae	0.158	0	0	0	0	0.768	0	0	0	0.199	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0.423	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0.414	0.282	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0.423	0.643	0.414	0	0	0.764	0.549	0	0	0	1.23
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0.317	1.27	0.429	0	0.847	0.192	0	0	0	0	0	0.205
Insecta	Coleoptera	Hydrophilidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0.282	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	8.87	9.73	9.86	6.21	9.04	12.5	45.1	68.1	34.7	48.5	32.0	19.3
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	0	0	0.214	0.414	0	0.195	1.02	0	0	0.398	2.38	3.49
Insecta	Diptera	Pelecorhynchidae	0.164	0	0	0	0	0	0.764	0	0	0	0.680	0
Insecta	Diptera	Psychodidae	0	0	0	0	0	0	0	0.549	0	0.596	0	0.205
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0.680	0.821
Insecta	Diptera	Tipulidae	0	0.846	1.71	0	0.282	0.584	3.31	0	0	0.398	2.04	2.87
Insecta	Ephemeroptera	Ameletidae	0	0	0	0.414	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0.792	0	0.429	0.414	0.282	0	0.764	0	0	0.398	0.680	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	0.255	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0.414	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	77.2	63.9	73.1	81.2	78.2	66.2	11.2	6.04	20.0	9.94	29.6	31.8
Insecta	Plecoptera	Chloroperlidae	0	0.423	0.214	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	9.67	9.94	9.11	7.87	6.21	9.98	31.6	17.6	16.0	28.0	23.1	30.6
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0.509	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0.317	0.634	1.50	0.828	1.48	0.768	0.700	0	0	0.199	0.340	0.616
Insecta	Plecoptera	Taeniopterygidae	1.27	0.846	0.214	0	0	0.192	0.764	1.10	5.33	3.98	1.70	3.29
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0.764	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	0.317	0.423	0.214	0.207	0	0.960	0.764	0	0	0.398	1.36	0.616
Insecta	Trichoptera	Rhyacophilidae	0.158	0.634	0	0	1.62	0.960	0.764	0	1.33	0.398	0.340	0.205
Insecta	Trichoptera	Uenoidae	0	0.846	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0.792	9.73	1.93	0.828	1.41	6.72	1.02	6.04	22.7	5.17	2.38	3.90

Note: - = not applicable.

Table G.6: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on Family Level of Taxonomy, 2019 to 2022

Taxon			Area-based Kick Samples											
Higher Level Classification		Family	2020											
			RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6
Bivalvia	Veneroida	Pisidiidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	0	0.765	0	0	0.930	4.65	1.46	1.50	1.26	2.13	0.408
Euchelicerata	Trombidiformes	Hydryphantidae	0.772	0.691	0.956	0	0	0.465	0	0	0	0	0	0.408
Euchelicerata	Trombidiformes	Hygrobatidae	0.386	1.15	0.765	0	0	0.930	0	0	0	0	0.709	0
Euchelicerata	Trombidiformes	Lebertiidae	0.772	0	0	0	0	0.930	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	0	0	0	0	0	0	0	0	0	0	0	0.408
Euchelicerata	Trombidiformes	Sperchontidae	2.32	0.461	0.382	1.23	0.633	1.40	0.465	0.418	0.600	0.315	0	0.408
Insecta	Coleoptera	Dytiscidae	0.386	0.230	0.382	0	0	0.465	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	1.54	3.23	4.21	0.410	0.633	0	0.465	0	0	0.158	1.06	0.408
Insecta	Coleoptera	Hydrophilidae	0	0.230	0.765	0	0	0	0	0	0.600	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0.300	0.158	0.354	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0.474	0	0	0	0	0	0.408
Insecta	Diptera	Chironomidae	25.9	27.1	41.7	10.7	30.4	20.4	28.4	62.8	48.3	43.1	54.8	31.4
Insecta	Diptera	Dixidae	0	0	0	0.410	0	0	0	0	0.600	0	0.356	0
Insecta	Diptera	Empididae	0	0.232	0.587	0	0	0	1.40	3.76	5.10	3.79	6.05	4.08
Insecta	Diptera	Pelecorhynchidae	0.386	0	0	0.410	0	0.474	3.49	0.626	1.80	0.158	3.56	4.08
Insecta	Diptera	Psychodidae	0	0	0	0.820	0	0	0.465	0.835	1.20	0.315	2.14	1.22
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0.315	0.356	0
Insecta	Diptera	Tipulidae	6.18	9.04	6.27	2.87	8.23	3.79	3.26	3.13	2.40	1.89	1.78	3.67
Insecta	Ephemeroptera	Ameletidae	0	0	0	0.410	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0.191	7.38	0.633	1.40	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0.410	0	0.465	0.930	0	0	0	0	0.408
Insecta	Ephemeroptera	Heptageniidae	0.386	1.38	0.574	0.410	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	40.5	24.6	16.1	41.4	40.5	42.8	13.5	6.26	5.70	4.73	3.90	19.6
Insecta	Plecoptera	Chloroperlidae	0	0	1.91	0.410	1.27	0	0.930	0	0.300	0.158	2.13	2.45
Insecta	Plecoptera	Leuctridae	0.386	0	0.191	0.410	0	0	0	0.209	0	0	0	0
Insecta	Plecoptera	Nemouridae	8.49	5.99	1.34	5.33	5.70	5.58	25.6	9.39	15.9	19.9	8.86	16.3
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0.158	0	0
Insecta	Plecoptera	Perlodidae	0.772	3.92	2.49	1.64	2.53	1.86	3.49	3.13	1.65	2.52	5.58	4.49
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	0	2.09	3.30	2.37	1.06	1.63
Insecta	Trichoptera	Apataniidae	0	0	0	0.410	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0.772	2.30	0.191	1.23	3.16	0	4.65	0.626	0	0	0.354	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	0.158	0.354	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	4.63	14.5	18.2	0.410	0.633	2.33	6.05	2.71	1.20	2.52	1.42	6.94
Insecta	Trichoptera	Rhyacophilidae	1.54	0.922	0.956	2.87	4.43	1.40	0.930	0.626	2.40	1.42	1.59	0.816
Insecta	Trichoptera	Uenoidae	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	3.86	3.92	1.15	20.5	1.27	13.9	1.40	1.88	7.20	14.7	1.42	0.408

Note: - = not applicable.

Table G.6: **Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on Family Level of Taxonomy, 2019 to 2022**

Taxon			Area-based Kick Samples											
Higher Level Classification		Family	2021											
			RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6
Bivalvia	Veneroida	Pisidiidae	0	0	0	0	0	0	0.645	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0.366	0	0
Clitellata	-	Enchytraeidae	0	0	0.885	1.71	0	0	0.645	0	2.75	0	0	1.25
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	1.77	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	8.57	2.61	6.19	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0	1.94	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	2.65	0	0	0.778	0	0	0	0	0	0.625
Insecta	Coleoptera	Dytiscidae	0	1.31	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	2.86	9.15	4.42	15.4	2.15	2.33	1.29	1.12	0	0.366	0	0
Insecta	Coleoptera	Hydrophilidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	8.57	3.92	2.65	8.55	5.38	6.23	11.0	19.8	34.7	23.1	26.3	16.9
Insecta	Diptera	Dixidae	0	0	0	0	3.23	0	0	0	0	0.366	0	0
Insecta	Diptera	Empididae	0	0	2.65	1.71	0	0	3.23	2.24	0.551	2.20	5.15	6.88
Insecta	Diptera	Pelecorhynchidae	0	0	0	0	0	0	5.48	1.49	1.38	0.366	0	0
Insecta	Diptera	Psychodidae	0	0	0.885	0	0	0	1.29	0.373	1.65	0.733	1.55	1.88
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	14.3	0	6.19	5.13	1.08	0	0.645	1.87	1.10	0.733	2.06	0.625
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	2.86	2.61	2.65	1.71	0	0	2.58	1.87	3.31	6.96	13.9	7.50
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	0	0.746	0.551	0	0	0
Insecta	Ephemeroptera	Heptageniidae	2.86	3.92	0	0	0	1.56	0	0.373	0	0	0	0
Insecta	Plecoptera	Capniidae	28.6	61.4	55.8	42.7	44.1	59.9	19.4	8.96	4.96	10.3	3.61	8.75
Insecta	Plecoptera	Chloroperlidae	0	0	1.77	0	0	0	0	2.24	1.10	0.366	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	1.56	1.94	0.373	0.551	0	0	0
Insecta	Plecoptera	Nemouridae	2.86	2.61	2.65	3.42	7.53	12.4	32.9	20.1	25.9	40.3	28.9	40.6
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0.645	0.373	0	0	0	0
Insecta	Plecoptera	Perlodidae	0	3.27	3.54	2.56	2.15	4.28	0.323	1.49	3.86	2.56	2.58	3.75
Insecta	Plecoptera	Taeniopterygidae	0	3.92	0	1.71	2.15	0	1.94	1.12	5.51	7.33	9.28	6.25
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	22.9	1.31	3.54	13.7	30.1	8.56	1.29	25.0	3.31	0.733	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0.746	0	0	0	0
Insecta	Trichoptera	Limnephilidae	5.71	2.61	0.885	1.71	1.08	0	1.94	2.24	0.551	0.733	0	2.50
Insecta	Trichoptera	Rhyacophilidae	0	1.31	0.885	0	1.08	2.33	11.0	7.46	4.41	1.83	0.515	0.625
Insecta	Trichoptera	Uenoidae	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	3.86	0.733	6.19	1.88

Note: - = not applicable.

Table G.6: **Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek Based on Family Level of Taxonomy, 2019 to 2022**

Taxon			Area-based Kick Samples											
Higher Level Classification		Family	2022											
			RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6	RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6
Bivalvia	Veneroida	Pisidiidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	1.08	0.474	0	0	0	0	0	0.844	0	0	0
Clitellata	-	Enchytraeidae	0	1.08	0	0	0	0	0.409	2.59	0.844	5.33	2.33	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	2.15	0	0	2.62	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0.541	0	0.873	0.806	0.296	0	0	0	0	0	2.08
Euchelicerata	Trombidiformes	Limnesiidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0.541	0	0.873	0	0.296	0.409	0	0	0	1.16	1.04
Insecta	Coleoptera	Dytiscidae	0	0	0.474	0.873	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	15.1	7.03	4.74	6.99	8.87	2.37	0.409	0	0	0	0	1.04
Insecta	Coleoptera	Hydrophilidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0.296	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	1.08	0.948	0	0	0.593	0.409	0	0	0	0	0
Insecta	Diptera	Chironomidae	25.8	4.86	2.84	6.99	1.21	0.889	53.2	34.5	21.1	29.3	22.1	30.2
Insecta	Diptera	Dixidae	0	0	0	0	0	0.593	0	0	0	0	1.16	0
Insecta	Diptera	Empididae	0	1.62	3.32	3.49	0.403	5.04	3.27	25.0	20.2	8.00	6.98	13.5
Insecta	Diptera	Pelecorhynchidae	0	0	0	1.75	0.403	0	2.86	0.862	0.844	0	4.65	6.25
Insecta	Diptera	Psychodidae	0	0	0	0	0	0	0.409	1.72	4.22	5.33	2.33	13.5
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	7.53	0.811	0.474	0.873	0	0	0	0	0.844	4.00	0	2.08
Insecta	Ephemeroptera	Ameletidae	0	0	0	0.873	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0	0	0.818	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	12.9	0	0	4.37	1.21	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	8.60	37.3	62.6	48.0	55.2	60.4	0	0	2.53	2.67	4.65	3.12
Insecta	Plecoptera	Chloroperlidae	0	0	1.90	3.49	0.806	0.296	0	1.72	0	0	3.49	1.04
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0.889	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	8.60	16.2	13.7	5.24	12.5	16.0	21.7	10.3	25.3	17.3	19.8	16.7
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0.409	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	4.30	2.43	2.37	3.93	3.23	5.48	6.13	16.4	20.7	18.7	24.4	7.29
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	0.818	0	0	6.67	3.49	0
Insecta	Trichoptera	Apataniidae	0	0	0.474	0.873	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	2.04	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	2.15	21.6	4.27	3.49	5.65	2.96	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0.409	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	6.45	0.541	0.474	0.873	0.403	1.04	0	0	0	0	0	1.04
Insecta	Trichoptera	Rhyacophilidae	6.45	2.16	0.474	3.49	9.27	2.52	6.34	6.03	2.53	2.67	3.49	1.04
Insecta	Trichoptera	Uenoidae	0	0	0.474	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	1.08	0	0	0	0	0	0.862	0	0	0	0

Note: - = not applicable.

Table G.7: Spearman Rank Correlations Between Benthic Invertebrate Endpoints and Water Quality Constituents with Early Warning Triggers, 2017 to 2022

Constituent	Density (No. org./m²)		Total Biomass (g/m²)		LPL Richness		Family Richness		%EPT		%Ephemeroptera		%Plecoptera		%Trichoptera		%Diptera	
	P-value	r_s	P-value	r_s	P-value	r_s	P-value	r_s	P-value	r_s	P-value	r_s	P-value	r_s	P-value	r_s	P-value	r_s
Antimony - Total (mg/L)	<0.001	0.278	0.103	0.118	0.0276	-0.159	<0.001	-0.361	<0.001	-0.436	0.00357	-0.209	<0.001	-0.300	<0.001	-0.366	<0.001	0.455
Barium - Total (mg/L)	<0.001	-0.488	<0.001	-0.287	0.00455	0.204	<0.001	0.325	<0.001	0.465	<0.001	0.257	<0.001	0.463	0.00288	0.214	<0.001	-0.434
Boron - Total (mg/L)	0.733	0.0248	0.137	0.108	0.00149	0.228	<0.001	0.258	0.00101	0.235	0.968	-0.00292	0.117	0.114	<0.001	0.335	<0.001	-0.281
Cadmium - Dissolved (mg/L)	0.280	0.0783	0.326	0.0713	0.153	0.103	0.624	-0.0356	0.0734	-0.130	0.731	0.0250	<0.001	-0.252	0.103	0.118	0.477	0.0517
Cobalt - Total (mg/L)	0.115	0.114	0.217	0.0896	0.496	0.0494	0.0100	-0.185	0.00508	-0.201	<0.001	-0.311	0.204	-0.0921	0.178	-0.0977	<0.001	0.242
Lithium - Total (mg/L)	0.270	0.0800	0.961	-0.00355	0.377	-0.0640	0.227	-0.0877	0.00174	-0.225	<0.001	-0.280	0.111	-0.115	0.187	-0.0956	<0.001	0.286
Manganese - Total (mg/L)	0.00106	0.235	0.0313	0.155	0.552	-0.0432	<0.001	-0.266	<0.001	-0.308	<0.001	-0.311	0.00111	-0.234	0.211	-0.0907	<0.001	0.251
Molybdenum - Total (mg/L)	<0.001	0.320	<0.001	0.272	0.639	-0.0341	0.997	0.00024	<0.001	-0.259	0.0513	0.141	<0.001	-0.332	0.420	-0.0585	0.0519	0.141
Nickel - Total (mg/L)	<0.001	0.286	0.317	0.0726	0.00361	-0.209	<0.001	-0.461	<0.001	-0.546	<0.001	-0.353	<0.001	-0.357	<0.001	-0.468	<0.001	0.594
Nitrate as N (mg/L)	<0.001	0.275	0.671	0.0308	<0.001	-0.275	<0.001	-0.496	<0.001	-0.517	<0.001	-0.388	<0.001	-0.306	<0.001	-0.512	<0.001	0.581
Nitrite as N (mg/L)	<0.001	0.265	<0.001	0.265	0.477	0.0516	<0.001	0.253	0.00783	-0.191	<0.001	0.280	<0.001	-0.400	0.0126	0.180	0.645	0.0335
Selenium - Total (mg/L)	<0.001	0.298	0.437	0.0564	<0.001	-0.280	<0.001	-0.500	<0.001	-0.590	<0.001	-0.420	<0.001	-0.392	<0.001	-0.470	<0.001	0.644
Sulfate (mg/L)	<0.001	0.302	0.417	0.0590	<0.001	-0.275	<0.001	-0.508	<0.001	-0.546	<0.001	-0.490	<0.001	-0.313	<0.001	-0.518	<0.001	0.611
Total Dissolved Solids (mg/L)	<0.001	0.320	0.249	0.0836	0.00144	-0.228	<0.001	-0.479	<0.001	-0.521	<0.001	-0.439	<0.001	-0.324	<0.001	-0.493	<0.001	0.589
Uranium - Total (mg/L)	<0.001	0.387	0.0525	0.140	<0.001	-0.266	<0.001	-0.501	<0.001	-0.637	<0.001	-0.488	<0.001	-0.426	<0.001	-0.484	<0.001	0.686
Zinc - Total (mg/L)	<0.001	0.364	<0.001	0.254	0.0518	-0.141	<0.001	-0.303	<0.001	-0.403	<0.001	-0.318	<0.001	-0.376	0.393	-0.0621	<0.001	0.316

P-value <0.05/n parameters = 0.05/16 = 0.00313.

$r_s \leq -0.6$ or $r_s \geq 0.6$.

Notes: No. org./m² = number of organisms per square metre; g/m² = grams per square metre; LPL = Lowest Practical Level; % = percent; EPT = Ephemeroptera, Plecoptera, and Trichoptera combined; rs = Spearman's correlation coefficient; mg/L = milligrams per litre; < = less than; ≤ = less than or equal to; ≥ = greater than or equal to.

Table G.8: Spearman's Correlation Relationships between Benthic Invertebrate Community Metrics and Calcite, Greenhills and Gardine Creeks, 2017 to 2022

Endpoint	Calcite Index		Concretion Score	
	r_s	p-value	r_s	p-value
Density (No. organisms/m²)	0.0208	0.775	-0.000652	0.993
Total Biomass (g/m²)	-0.268	<0.001	-0.289	<0.001
LPL Richness	-0.320	<0.001	-0.326	<0.001
Family Richness	-0.488	<0.001	-0.508	<0.001
%EPT	-0.484	<0.001	-0.467	<0.001
%Ephemeroptera	-0.479	<0.001	-0.477	<0.001
%Plecoptera	-0.233	0.00118	-0.211	0.00339
%Trichoptera	-0.590	<0.001	-0.603	<0.001
%Diptera	0.620	<0.001	0.615	<0.001

P-value <0.025 (0.05/2 for Bonferroni correction).

$r_s \leq -0.6$ or $r_s \geq 0.6$.

Notes: rs = Spearman's correlation coefficient; No. organisms/m^2 = number of organisms per square metre; g/m^2 = grams per square metre; < = less than; LPL = Lowest Practical Level; % = percent; EPT = Ephemeroptera, Plecoptera, and Trichoptera combined; ≤ = less than or equal to; ≥ = greater than or equal to.

Table G.9: Statistical Comparisons of Benthic Invertebrate Community Endpoints for Biological Monitoring Areas on Gardine Creek (RG_GAUT and RG_GANF), 2019 to 2022

Biological Monitoring Area	Endpoints	Test [a]	Data Transformation	Test P-value	MCT				MOD [b]		
					2019	2020	2021	2022	2020	2021	2022
RG_GAUT	Density (No./m²)	ANOVA	log_{10}	<0.001	2,858	2,356	655	860	-0.28	-2.1	-1.7
	Total Biomass (g/m²)	ANOVA	log_{10}	<0.001	1.79	7.27	0.925	1.12	2.4	-1.1	-0.79
	LPL Richness	ANOVA	log_{10}	<0.001	20.8	30.3	15.7	21.4	4.0	-2.9	0.30
	Family Richness	ANOVA	log_{10}	0.003	12.6	17.8	11.9	14.9	3.6	-0.56	1.8
	%EPT	ANOVA	none	<0.001	85.0	55.1	77.8	78.2	-5.3	-1.3	-1.2
	%Ephemeroptera	K-W	rank	0.196	0.356	1.07	2.18	0.605	1.4	3.5	0.47
	%Plecoptera	ANOVA	none	0.002	83.5	42.7	58.5	62.3	-7.0	-4.3	-3.6
	%Trichoptera	ANOVA	none	0.016	1.06	10.2	16.3	12.7	11	18	14
	%Diptera	ANOVA	log_{10}	0.005	9.86	30.7	10.1	8.58	4.7	0.077	-0.58
RG_GANF	Density (No./m²)	ANOVA	log_{10}	0.054	1,133	2,011	1,200	604	0.56	0.055	-0.61
	Total Biomass (g/m²)	ANOVA	log_{10}	0.045	0.490	2.11	0.996	0.558	1.0	0.49	0.090
	LPL Richness	ANOVA	none	0.002	17.3	29.3	21.3	17.7	1.9	0.64	0.054
	Family Richness	ANOVA	log_{10}	0.011	11.2	18.6	16.3	12.1	1.2	0.88	0.19
	%EPT	ANOVA	log_{10}	0.008	45.1	35.3	66.3	42.5	-0.72	1.1	-0.18
	%Ephemeroptera	K-W	rank	0.002	0.199	0	5.41	0	-0.67	18	-0.67
	%Plecoptera	ANOVA	none	0.070	45.7	31.2	49.7	39.2	-1.0	0.29	-0.46
	%Trichoptera	K-W	rank	0.010	1.08	4.03	5.78	3.08	4.4	7.0	3.0
	%Diptera	ANOVA	none	0.005	44.6	55.2	29.2	53.2	0.71	-1.0	0.57

P-value <0.1.
P-value <0.1 and MOD < -2.
P-value <0.1 and MOD >2.

Notes: MCT= Measure of Central Tendency; MOD = Magnitude of Difference; No./m^2 = number per square metre; ANOVA = Analysis of Variance; < = less than; g/m^2 = grams per square metre; LPL = Lowest Practical Level; % = percent; EPT = Ephemeroptera, Plecoptera, and Trichoptera; K-W = Kruskal-Wallis; > = greater than; HSD = Honestly Significant Difference; M-W = Mann-Whitney; SD = standard deviation.

[a] Statistical tests included an ANOVA followed by Tukey's HSD *post hoc* tests, or a K-W H-test followed by a M-W U-test.

[b] MOD = ($MCT_{later\ year}$ - MCT_{2019})/SD_{2019}.

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
				2016														
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHUT						RG_GHNF						RG_GHFF		
				RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	57	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	347	254	92	57	137	79	80	60	93	33	76	174	12	13	61
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	32	0	46	0	20	0	0	20	27	7	12	44	24	17	23
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	13	0	36	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	32	0	46	0	0	20	13	0	0	0	0	0	6	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	13	0	10	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	159	0	23	0	0	86	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	446	91	115	170	102	172	41	7	27	87	19	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	223	114	137	284	508	388	41	7	0	18	19	0	69	66	196
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	45	0	0	0	0	0	7	40	7	86	131	6	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	43	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	64	0	0	341	0	0	14	158	0	0	0	566	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	1,814	432	115	625	407	452	232	239	667	131	1,095	958	1,004	607	1,339
Insecta	Diptera	Chironomidae	Pagastia	0	23	23	0	61	43	14	0	0	0	0	0	257	126	613
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	27	48	0	0	19	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	32	0	23	227	0	43	0	0	0	0	0	0	6	0	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	64	0	0	0	0	43	55	139	0	7	0	131	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	127	136	46	0	41	86	137	48	53	7	106	218	44	17	0
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	22	0	0	0	0	80	7	27	34	67	87	96	77	53
Insecta	Diptera	Empididae	Clinocera	32	22	23	0	0	0	13	20	0	0	115	44	30	7	8
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	23	0	26	59	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	22	0	0	0	0	13	37	13	0	48	0	36	10	8
Insecta	Diptera	Psychodidae	Pericoma	63	0	115	170	0	59	13	13	13	0	0	131	12	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	114	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	284	216	183	398	235	98	293	290	360	20	154	392	36	3	8
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	13	0	0	0	0	0	3	7
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	39	0	0	0	0	0	0	0	0	8
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	32	0	0	0	0	39	0	7	0	0	0	0	18	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metNote: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
				2016														
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHUT						RG_GHNF						RG_GHFF		
				RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3
Insecta	Plecoptera	Capniidae	Capnia	158	85	0	114	0	20	80	53	67	123	67	131	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	347	317	252	1,705	275	197	347	110	133	53	134	915	42	3	8
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	23	0	0	0	13	0	27	17	10	0	6	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	57	0	0	0	0	0	7	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	63	21	23	398	353	414	80	13	13	0	10	305	42	13	15
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	42	23	0	0	0	187	163	347	33	267	392	0	7	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	3	0	0	3	0	0	0	27	17	0	0	6	10	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	158	21	0	57	39	0	0	30	0	7	19	0	36	7	107
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	21	0	170	0	20	0	0	0	10	10	0	0	10	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	32	0	0	227	78	20	0	0	13	7	10	0	36	13	8
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	63	0	0	0	0	0	0	0	0	0	0	0	39	13	69
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square me Note: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
Higher Level Classification		Family	Lowest Practical Level Identification	2016			2017											
				RG_GHFF			RG_GHUT						RG_GHNF					
				RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	195	48	8	160	280	97	303	90	80	0	10	57	37	23	17
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	21	0	10	0	0	0	3	0	0	0	0	7	0	3
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	10	0	0	0	0	0	0	0	0	0	3
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	10	0	33	0	0	0	0	0	0	0	3
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0	3	10	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	10	0	0	0	3	0	0	0	7	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	20	0	35	0	21	4	0	7	0	4	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	7	0	35	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	432	209	112	458	170	376	29	9	53	99	26	51
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	35	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	274	93	125	0	131	116	884	82	134	14	4	7	9	48	12
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	34	37	11	70	24	21	0	127	42	9	11	12
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0	0	0	0	0	4	35	20	63	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	1,299	1,486	602	1,720	798	576	3,427	514	1,423	7	39	182	0	37	71
Insecta	Diptera	Chironomidae	Pagastia	957	380	258	105	50	49	458	82	207	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	35	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	29	9	0	74	28	178	61	74	0	0	42	0	0	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	14	0	10	0	0	0	0	0	0	0	7	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	114	151	39	95	81	14	248	31	11	69	4	0	0	66	31
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	119	103	17	10	7	0	0	0	0	0	20	0	17	3	0
Insecta	Diptera	Empididae	Clinocera	43	28	8	10	7	3	0	10	20	0	0	0	0	0	3
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	10	13	10	0	3	0	3	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	0	33	0	0	0	7	7	7	3	0
Insecta	Diptera	Psychodidae	Pericoma	11	14	0	23	30	3	100	10	30	0	7	50	3	13	7
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	11	0	0	23	0	0	0	0	10	3	0	0	0	10	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	54	34	0	70	137	77	473	30	90	7	7	323	13	33	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	3	0	0	3	0	0	0	0	0	7	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	13	0	0	0	0	3	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	11	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	3	0	7	0	3

Notes: No./m^2= number of organisms per square metNote: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
Higher Level Classification		Family	Lowest Practical Level Identification	2016			2017											
				RG_GHFF			RG_GHUT						RG_GHNF					
				RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	33	20	3	203	20	40	40	17	373	17	103	127
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	65	14	8	893	270	200	3,740	200	257	140	167	1,217	287	663	773
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	7	0	67	13	10	0	0	0	13	0	3
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	13	0	33	10	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	7	0	0	0	0	0	0	0	0	3	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	65	75	41	80	30	17	170	80	227	0	0	0	3	27	37
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	76	96	17	0	0	0	0	0	0	33	27	40	3	13	20
Insecta	Plecoptera	Perlodidae	Megarcys	14	0	4	0	0	0	67	3	20	0	3	0	0	0	3
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	141	21	58	10	0	10	33	3	0	17	0	0	0	7	17
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	7	12	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	11	41	4	0	7	10	0	40	60	0	0	17	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	14	17	23	0	3	33	0	0	0	0	0	3	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square me Note: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
Higher Level Classification		Family	Lowest Practical Level Identification	2017						2018								
				RG_GHFF						RG_GHUT						RG_GHNF		
				RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	7	0	7	10	0	3	240	800	53	27	640	320	0	0	160
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	80	0	0	0	53	27	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	3	3	10	0	7	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0	0	0	0	53	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	53	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	3	0	0	0	0	11	97	0	33	107	203	192	139	759	53
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	97	0	0	0	68	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	0	0	64	0	28	0
Insecta	Diptera	Chironomidae	Diamesa	14	10	14	25	0	11	0	61	0	0	0	1,280	28	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	36	0	64	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	3	17	0	32	10	7	552	1,280	329	286	4,737	2,944	388	197	107
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	325	61	559	0	135	0	0	225	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	3	48	4	42	0	25	32	0	0	0	135	64	0	28	0
Insecta	Diptera	Chironomidae	Orthocladius complex	367	360	190	486	197	372	649	853	361	1,285	1,692	960	166	84	133
Insecta	Diptera	Chironomidae	Pagastia	232	367	176	342	92	207	65	61	33	143	0	128	55	28	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	7	0	4	17	0	292	0	230	0	880	576	0	56	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	10	0	4	3	11	130	244	296	464	1,963	128	1,997	1,715	267
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	20	47	20	57	20	33	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	3	0	0	3	0	27	0	27	53	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	7	7	0	7	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	107	0	0	0	27
Insecta	Diptera	Pelecorhynchidae	Glutops	0	23	0	3	0	7	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	0	3	0	3	0	0	0	53	187	27	320	0	133	53	187
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	10	30	10	13	0	23	880	373	187	427	747	267	293	213	427
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	10	0	3	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	3	0	3	0	3	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	13	17	7	7	3	27	27	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metNote: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
				2017						2018								
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHFF						RG_GHUT						RG_GHNF		
				RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	0	0	0	0	80	0	0	0	0	53	27	133	53
Insecta	Plecoptera	Capniidae	Paracapnia	23	147	23	33	0	43	1,520	427	773	427	2,027	533	693	1,307	613
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	10	0	3	0	0	53	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	10	3	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	13	90	43	60	3	50	53	107	27	0	320	480	133	27	80
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	3	7	0	0	27	0	80	27	53	0	107	107	187
Insecta	Plecoptera	Perlodidae	Megarcys	20	17	13	33	0	23	0	0	0	0	53	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	53	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	60	23	3	60	13	133	0	0	0	0	0	53	107	27	53
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	3	0	0	0	7	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	3	0	7	7	3	3	0	0	27	0	107	0	27	27	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	13	23	20	33	3	17	27	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square me Note: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
				2018									2019					
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHNF			RG_GHFF						RG_GHUT					
				RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	53	0	7	0	0	0	7	7	213	400	40	133	227	433
Collembola	Collembola	-	Collembola	453	27	27	0	0	0	13	0	0	0	0	53	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	27	0	0	0	3	0	0	3	0	0	13	13	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	7	0	3	0	0	0	0	0	0	13	0	7
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0	0	7	0	0	0	0	13	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	27	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	27	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	170	383	270	0	0	0	0	0	0	0	0	28	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	135	0	0	0	21	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28
Insecta	Diptera	Chironomidae	Eukiefferiella	0	118	135	63	98	72	21	49	23	975	993	266	557	675	2,013
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	28	0	0	0	0	0	0	0	0	271	827	883	70	55	28
Insecta	Diptera	Chironomidae	Limnophyes	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0	0	0	14	0	3	0	0	0	0	0	28	0	14	0
Insecta	Diptera	Chironomidae	Orthocladius complex	57	88	135	797	922	538	524	480	317	1,300	1,048	308	1,059	1,019	340
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	571	671	179	478	371	298	379	386	112	348	234	451
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	28	0	0	0	0	0	0	0	0	54	221	210	14	41	28
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	1,047	531	757	7	56	7	25	56	23	433	552	98	125	69	87
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0	67	53	10	13	13	73	0	27	0	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	73	13	20	17	3	10	0	0	40	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	108	0	0	0	0	0	0	0	0	0	0	0	13
Insecta	Diptera	Pelecorhynchidae	Glutops	0	27	0	0	0	7	3	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	27	80	243	0	0	0	10	0	7	53	133	160	53	27	27
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	187	107	162	73	13	17	17	10	47	267	187	187	160	107	73
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	27	0	0	7	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	27	0	0	0	13	7	0	0	0	13	13	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	20	0	13	10	10	7	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metNote: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
Higher Level Classification		Family	Lowest Practical Level Identification	2018									2019					
				RG_GHNF			RG_GHFF						RG_GHUT					
				RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	53	27	80	0	0	3	0	0	0	53	53	13	0	53	7
Insecta	Plecoptera	Capniidae	Paracapnia	507	320	587	233	93	47	23	47	33	507	347	227	240	107	113
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	13	3	0	17	10	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	7	0	0	0	0	3	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0	0	0	0	0	0	0	13	0	47
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	27	187	133	627	840	477	310	187	153	53	53	67	160	80	113
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	53	133	80	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	33	53	20	13	27	57	27	0	0	3	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	7	13	3	7	7	10	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	80	187	140	253	113	50	43	50	80	107	0	13	13	13
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	13	0	0	10	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	13	3	0	0	0	0	0	67	0	0	27
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	27	67	80	27	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	0	13	53	17	3	27	13	0	0	0	7	13	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square me Note: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
Higher Level Classification		Family	Lowest Practical Level Identification	2019												2020		
				RG_GHNF						RG_GHFF						RG_GHUT		
				RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	27	13	0	3	3	0	120	0	3	0	100	10	347	293	267
Collembola	Collembola	-	Collembola	0	27	0	7	60	293	13	0	3	3	0	3	0	40	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	3	27	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0	0	0	3	3	7	0	27	0	53
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	53	0	3	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	27	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	30	28	15	25	29	0	0	0	0	0	0	0	108	55
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	4	0	0	0	56	92	274
Insecta	Diptera	Chironomidae	Diamesa	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	141	105	444	7	25	200	1,544	128	165	270	920	404	790	62	766
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	141	15	444	11	8	114	76	0	254	0	56	31	113	523	985
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	29	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0	0	28	0	0	0	45	0	16	0	16	12	113	77	274
Insecta	Diptera	Chironomidae	Orthocladius complex	226	179	222	11	4	57	363	8	40	76	120	31	1,523	431	547
Insecta	Diptera	Chironomidae	Pagastia	735	30	250	0	0	143	2,316	78	57	113	1,767	602	705	15	164
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	28	0	166	7	0	57	30	0	40	0	0	4	28	62	492
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	9,580	986	7,991	152	58	5,664	666	12	16	8	208	66	113	92	657
Insecta	Diptera	Chironomidae	Zavrelimyia	0	15	28	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	53	0	0	3	0	27	147	13	0	7	80	27	40	27	0
Insecta	Diptera	Empididae	Clinocera	27	13	0	10	0	0	0	7	3	17	67	3	40	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	27	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53
Insecta	Diptera	Psychodidae	Pericoma	400	108	133	40	20	480	80	0	3	7	13	20	53	200	1,120
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	13	0	23	17	80	0	0	0	0	0	7	27	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	133	0	53	3	0	160	267	0	13	0	147	17	400	163	1,227
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	3	0	0	0	0	0	0	0	0	27	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	13	0	0	0	0	27	0	0	0	13	0	27	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	3	0	0	0	3	0	7	0	0	0	0	0

Notes: No./m^2= number of organisms per square metNote: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
Higher Level Classification		Family	Lowest Practical Level Identification	2019												2020		
				RG_GHNF						RG_GHFF						RG_GHUT		
				RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	133	160	213	90	33	320	0	0	0	0	0	0	0	80	0
Insecta	Plecoptera	Capniidae	Paracapnia	427	160	827	230	57	693	133	3	33	10	213	10	213	53	907
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	13	0	0	0	0	13	0	0	3	7	0	0	13	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	3	0	0	0	0	0	0	53
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	7	0	0	0	0	0	0	7	0	0	373
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	133	387	853	167	30	613	1,773	143	87	103	1,307	310	80	27	0
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	133	67	80	23	10	107	13	3	0	0	40	3	0	13	160
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0	3	0	3	7	0	10	7	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	27	67	53	33	13	53	40	17	3	10	13	13	0	0	0
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	67	107	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	13	803
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	10	10	0	13	0	13	3	0	7	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	0	0	0	0	43	7	0	10	7	3	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	27	0	0

Notes: No./m^2= number of organisms per square me Note: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
Higher Level Classification		Family	Lowest Practical Level Identification	2020														
				RG_GHUT			RG_GHNF						RG_GHFF					
				RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	293	240	1,707	107	67	53	0	80	27	80	0	7	67	7	67
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0	13	0	13	13	40	7	0	13	27
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	27	107	0	0	0	0	0	0	13	0	0	0	7	40
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	14	0	13	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	30	61	0	0	14	0	0	14	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	60	91	113	126	69	0	0	130	64	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	91	0	113	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	634	1,067	5,649	126	14	34	15	0	32	123	115	142	29	97	111
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	315	14	51	0	58	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	694	1,554	1,243	441	263	0	15	115	0	165	115	0	462	14	111
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	754	1,737	904	63	0	0	0	14	0	178	29	14	0	14	28
Insecta	Diptera	Chironomidae	Orthocladius complex	121	1,310	3,954	63	0	17	0	0	0	370	288	654	881	839	319
Insecta	Diptera	Chironomidae	Pagastia	211	427	3,276	126	0	0	0	0	0	1,001	620	1,180	823	562	2,306
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	17	0	0	0	0	0	0	14	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	272	274	339	189	152	0	0	43	0	41	14	0	0	14	28
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	573	305	1,582	1,324	166	0	194	29	64	55	58	36	58	0	97
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	28	0	0	14	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0	160	53	133	56	27	13	293	262	206	320	92	253
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	13	28	0	0	13	18	14	0	8	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	107	53	13	0	54	0	80	0	0	27	7	0
Insecta	Diptera	Psychodidae	Pericoma	613	933	2,133	267	80	133	98	54	13	173	0	0	160	27	40
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	350	880	1,387	2,027	280	347	140	338	253	80	80	13	200	40	133
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	53	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	27	0	0	0	0	0	0	0	67	107	27	93	40	53
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0

Notes: No./m^2= number of organisms per square metNote: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
Higher Level Classification		Family	Lowest Practical Level Identification	2020														
				RG_GHUT			RG_GHNF						RG_GHFF					
				RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	98	0	409	1,542	175	201	91	45	124	0	122	0	17	0	29
Insecta	Plecoptera	Capniidae	Paracapnia	782	907	2,044	1,285	491	345	136	728	249	173	305	7	117	20	345
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	27	0	0	0	0	27	0	0	0	13	0	0	0	7	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	27	13	0	0	0	0	13	0	0	7	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	293	0	0	120	0	0	31	165	0	0	14	39
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	347	240	640	293	53	53	120	0	173	1,009	2,035	380	800	193	2,161
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	80	0	0	320	67	93	120	40	40	13	20	0	20	0	16
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0	0	0	0	0	0	27	60	20	20	0	64
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	0	13	0	13	0	13	0	53	7	40
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	53	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	107	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	0	80	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	693	1,413	853	53	53	27	13	53	0	107	0	53	13	0	80
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	3	0	0	0	0	0	0	27	120	13	13	0	53
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square me Note: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
Higher Level Classification		Family	Lowest Practical Level Identification	2021														
				RG_GHUT						RG_GHNF						RG_GHFF		
				RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	432	132	216	120	24	144	120	96	0	0	48	48	0	6	6
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	48	12	24	0	3	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	24	0	48	0	0	24	0	0	0	24	0	0	36	6	24
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	24	0	24	24	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	24	120	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	116	0	29	0	0	80	0	52	206	29	0	26	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	185	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	58	0	58	54	0	0	26	104	51	29	26	185	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	26	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	51	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	6,325	2,478	2,324	4,129	3,459	3,107	79	0	0	29	0	0	1,259	873	373
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	52	208	51	0	0	79	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	29	0	0	0	0	260	0	0	0	132	0	15	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	29	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	58	0	0	0	0	0	26	208	51	0	0	371	0	177	7
Insecta	Diptera	Chironomidae	Orthocladius complex	347	507	581	751	195	186	315	52	154	29	40	212	364	29	41
Insecta	Diptera	Chironomidae	Pagastia	1,126	718	581	885	335	372	2,073	520	1,543	57	675	715	1,161	265	210
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	70	349	80	28	0	52	312	206	0	13	79	0	0	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	347	42	58	54	112	0	3,805	5,099	7,766	713	410	6,247	0	15	0
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	60	0	0	0	0	360	144	72	24	132	96	228	24	126
Insecta	Diptera	Empididae	Clinocera	72	0	48	48	0	96	72	0	72	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	120	0	0	24	0	24	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	3	0	48	0	0	0	0	0	6	0
Insecta	Diptera	Psychodidae	Pericoma	312	192	360	96	312	336	120	864	432	144	48	528	0	54	18
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	192	156	192	144	168	144	336	144	576	48	132	648	0	3	6
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	24	0	0	0	0	0	0	0	0	6
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metNote: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
Higher Level Classification		Family	Lowest Practical Level Identification	2021														
				RG_GHUT						RG_GHNF						RG_GHFF		
				RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	41	0	0	0	0	34	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	450	84	336	126	48	343	293	246	79	40	167	1,606	0	0	12
Insecta	Plecoptera	Capniidae	Paracapnia	613	24	168	42	48	103	763	2,538	2,225	80	229	1,874	0	6	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	24	0	0	0	24	0	0	24	0	0	0	0	6
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	96	0	24	0	72	0	56	88	172	0	41	0	0	9	0
Insecta	Plecoptera	Nemouridae	Visoka	96	0	24	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	768	48	48	168	0	336	1,792	1,592	1,460	528	367	768	240	45	228
Insecta	Plecoptera	Peltoperlidae	Yoraperla	24	12	0	0	24	48	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	144	72	240	24	144	312	408	624	48	120	13	288	12	0	6
Insecta	Plecoptera	Perlodidae	Megarcys	24	0	0	24	0	0	3	0	0	0	203	24	0	6	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	48	0	0	0	48	72	96	96	240	48	72	168	48	24	12
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	36	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	48	84	264	384	456	360	144	384	48	216	60	0	0	18	18
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	48	0	0	24	0	48	0	0	0	0	0	0	12	3	30
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square me Note: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
Higher Level Classification		Family	Lowest Practical Level Identification	2021			2022											
				RG_GHFF			RG_GHUT						RG_GHNF					
				RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	6	24	96	720	36	3	24	48	72	336	144	3	48	48	48
Collembola	Collembola	-	Collembola	0	0	0	0	0	3	0	0	0	24	0	3	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	12	24	36	12	0	0	0	0	0	24	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	6	12	48	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	3	0	144	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	13	6	0	14	0	0	0	10	49	51	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	13	0	0	0	0	0	26	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	14	30	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	917	1,513	1,521	1,159	307	3	51	413	2,929	51	0	5	0	51	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	485	70	0	0	0	49
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	95	154	64	55	22	234	269	434	187	0	296	0	881
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0	42	109	0	0	0	0	0	30	51	23	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	119	113	652	760	115	0	7	0	508	51	0	5	49	51	0
Insecta	Diptera	Chironomidae	Pagastia	476	551	1,712	386	166	0	44	138	747	0	0	26	395	973	245
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	27	129	80	29	94	207	418	230	23	0	198	0	735
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	0	51	51	0	58	289	60	1,020	47	88	4,052	8,041	5,386
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	102	70	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	84	156	432	12	0	0	12	0	72	192	252	35	144	192	320
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	24	9	12	45	0	0	0	0	0	0	64
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	15	0	0	0	4	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	3	0	0	0	192	165	3	0	0	57
Insecta	Diptera	Psychodidae	Pericoma	18	84	144	96	72	69	132	456	504	96	84	9	96	288	48
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0	12	0	0	60	24	18	12	96	144	12	6	96	48	144
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metNote: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density														
Higher Level Classification		Family	Lowest Practical Level Identification	2021			2022											
				RG_GHFF			RG_GHUT						RG_GHNF					
				RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	36	0	36	36	30	168	572	52	0	15	555	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	12	0	456	36	0	0	84	172	1,244	72	0	741	288	2,064
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	24	0	0	0	0	24	48	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	24	0	12	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	18	0	81	0	0	0	0	0	0	48	0	0	0	0	144
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	96	300	423	36	0	0	6	0	192	0	12	12	96	0	0
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	24	12	6	0	24	24	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	12	36	12	36	30	30	96	288	696	156	110	1,488	816	1,440
Insecta	Plecoptera	Perlodidae	Megarcys	6	0	0	0	12	0	0	24	24	0	0	28	3	0	3
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	72	48	120	12	24	0	0	0	0	0	12	0	0	48	0
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	48	0	0	0	27	6	132	168	0	120	3	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	6	12	0	0	0	3	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square me Note: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density											
Higher Level Classification		Family	Lowest Practical Level Identification	2022											
				RG_GHFF						RG_GHDT					
				RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHDT-1	RG_GHDT-2	RG_GHDT-3	RG_GHDT-4	RG_GHDT-5	RG_GHDT-6
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	21	0	6	15	51	108	0	0	0	6	6	6
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	12	6	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	6	6	3	12	0	6	0	6	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	3	3	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	6	0	12	12	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	4	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0	7	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	4	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	400	0	530	109	468	1,007	218	663	375	54	142	134
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	3	0	0	11	0	28	82	0	0	11	7	4
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	4	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	17	0	0	35	7	248	14	0	0	7	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	27	0	50	74	82	441	14	21	79	11	54	32
Insecta	Diptera	Chironomidae	Pagastia	143	0	129	46	386	1,489	41	137	16	47	162	46
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	4	0	14	0	0	0	4	0	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	28	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	10	0	14	7	71	441	41	103	7	18	74	28
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	7	0	4
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	3	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	53	0	45	73	90	456	72	36	3	33	48	15
Insecta	Diptera	Empididae	Clinocera	11	0	0	5	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	3	0	3	9	0	12	12	0	0	3	18	3
Insecta	Diptera	Psychodidae	Pericoma	15	0	9	150	66	288	48	0	3	15	24	6
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0	0	0	0	3	60	0	6	0	3	12	3
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	3	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	3	0	0	6	18	0	0	0	0	3	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	3	0	0	0	6	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metNote: " - " indicates no data available

Table G.10: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density											
				2022											
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHFF						RG_GHDT					
				RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHDT-1	RG_GHDT-2	RG_GHDT-3	RG_GHDT-4	RG_GHDT-5	RG_GHDT-6
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	0	0	0	0	16	18	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	12	0	3	15	3	48	32	0	3	24	66	12
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	15	6	12	0	0	0	0	6	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	3	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	108	0	48	51	126	228	48	60	12	24	6	36
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	7	0	12	6	45	144	72	77	3	27	6	6
Insecta	Plecoptera	Perlodidae	Megarcys	11	0	0	30	3	48	0	10	18	0	24	9
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	6	0	3	3	27	72	48	54	18	3	30	9
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	3	0	0	0	0	0	0	0	0	0	0	3
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	3	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	12	6	0	9	48	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	15	0	9	9	12	0	24	6	3	0	30	6
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	15	0	0	24	18	48	24	0	0	3	6	3
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square me Note: " - " indicates no data available

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Three-minute Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014				2015				2021			2022
				RG_GHCKU	GREE4-25				GREE3-75				RG_GHNF			RG_GHNF
				RG_GHCKU-1	GREE3-25-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHCKU-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-1
Clitellata	Tubificida	Naididae	Nais	0	0	1.13	0	0.289	0	0	0.254	0.338	0	0.496	0.605	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0.643
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0.946	0.761	0.338	0	0	0	1.29
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	0.847	0	0.403	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0.289	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0.156	0.289	0.287	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0.156	0	0.287	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0.313	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0	0	0	0	0	0.338	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0.156	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0.254	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0.157	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0.333	0	0.379	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0.482	0.306	0	0	0	0	0.726	1.12	0.226	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0.306	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	0.726	0.279	0	0
Insecta	Diptera	Chironomidae	Diamesa	89.0	10.8	5.27	51.7	20.2	0.985	0.667	2.69	5.69	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	36.6	13.8	4.02	0	1.64	3.00	1.61	7.20	0	0	0	0.346
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0.363	3.91	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	2.05	0	0.306	1.97	3.33	1.61	0.379	0	1.95	0	3.46
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0.538	0	1.09	0.279	0.226	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0	0.336	0.293	0.803	4.59	1.31	2.00	0	0.379	0.726	11.2	1.35	0
Insecta	Diptera	Chironomidae	Monodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	53.8	49.3	47.1	25.4	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	23.2	11.1	13.0	38.5	0	0	0	0	2.91	4.47	2.26	0
Insecta	Diptera	Chironomidae	Pagastia	0	1.68	0	0	0.612	1.64	2.33	0.807	0	4.72	8.10	27.8	4.16
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0.333	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0.673	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0.333	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0.293	0.321	0.612	0.985	2.00	0.538	1.14	0.363	1.67	0	5.54
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	0.269	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0.293	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0.306	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0.657	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0.306	0	0	1.34	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Three-minute Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014				2015				2021			2022
				RG_GHCKU	GREE4-25				GREE3-75				RG_GHNF			RG_GHNF
				RG_GHCKU-1	GREE3-25-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHCKU-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-1
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0.558	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	0.879	0.964	2.45	2.30	0.667	2.15	4.93	6.17	6.14	13.3	12.8
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0.693
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0.282	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0.313	0	0.567	0.392	0	1.72	2.22	0	1.43	0	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	0.392	0	0	0	0	5.02	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0.637	0	0	0	0	0	0	0	0	0.748	1.41	7.35
Insecta	Diptera	Empididae	Trichoclinocera	0	0	0	0	0	0	0	0	0	0	0	0	0.367
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0.319	0	0	3.18	0	0	3.30	0	0.565	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	0	0	0	0.339	0	0	0	0.643
Insecta	Diptera	Psychodidae	Pericoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	1.57	1.91	1.70	1.10	1.73	3.72	0.317	3.55	2.38	10.2	8.97	2.82	1.29
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0.157	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0.188	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	0.188	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	0.313	4.46	1.13	2.45	0	0.860	0.317	0	6.45	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0.940	0.319	2.27	1.10	0.867	2.58	1.27	0.254	10.9	4.52	3.74	4.44	0.643
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0.338	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	1.88	0.317	1.13	0.939	0	0	0.315	0	1.01	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0.338	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0.254	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0.635	0	0	0.578	1.15	0.946	0	0.676	0	0	0	0.643
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0.315	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	3.45	1.90	0.567	1.88	1.16	0.573	2.21	0.254	0.338	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0.287	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	1.01	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0.627	5.71	17.6	12.2	10.1	1.43	2.84	16.5	19.3	49.5	19.8	12.4	28.6
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	0	0	0	0	0	0	0	0	0	0	0.341
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0.469	0	0	1.58	0.254	0.338	0.291	0.251	0	4.09
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	0.874	0.753	0.639	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0	0	0	0	0	0	0	1.53
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	4.85	12.9	0.469	5.06	8.02	4.73	14.2	2.36	7.86	18.9	0	1.53
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	1.39	8.61	0.469	3.03	1.43	0	0	0	0	0.379	16.2	0
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	1.39	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0.156	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Three-minute Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014				2015				2021			2022
				RG_GHCKU	GREE4-25				GREE3-75				RG_GHNF			RG_GHNF
				RG_GHCKU-1	GREE3-25-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHCKU-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-1
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	1.10	0.867	0	0	1.27	0	0	0	6.61	21.5
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.635	2.83	0	0	2.87	1.89	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	4.95	4.27	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	1.59	12.8	2.19	3.47	8.60	12.3	0	1.01	2.33	0.502	8.95	0
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0.283	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	0.573	0.868	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0.313	0	2.55	0	0.578	0	0.434	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0.627	0.317	0	0.939	0	0	1.74	0.254	0	0	1.49	0.403	2.57
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0.313	0	0	1.10	0	0.287	0.434	0	0.338	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	0.313	0.317	0	0.156	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Three-minute Kick Samples		Area-based Kick Samples												
				2022		2016												
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHNF		RG_GHUT						RG_GHNF						
				RG_GHNF-2	RG_GHNF-3	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5		
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0	0		
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	1.10	0	0	0	0	0	0	0		
Clitellata	Tubificida	Naididae	Tubificinae	2.62	1.11	0	0	0	0	0	0	0	0	0	0	0		
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	7.59	13.3	6.90	1.10	6.01	3.20	4.51	4.01	4.70	5.32	3.19		
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0	0		
Collembola	Collembola	-	Collembola	0.581	0	0	0	0	0	0	0	0	0	0	0	0		
Euchelicerata	Sarcoptiformes	-	Oribatida	0.291	0	0	0	0	0	0	0	0	0	0	0	0		
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0		
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0		
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.581	0	0.690	0	3.45	0	0.858	0	0	1.34	1.34	1.06	0.498		
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	0	0	0.671	0	1.49		
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0.800	0	0	0	0	0		
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0.690	0	3.45	0	0	0.800	0.752	0	0	0	0		
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0.671	0	0.419		
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Brillia	0	0.395	3.49	0	1.72	0	0	3.50	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0.875	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Corynoneura	0.309	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Diamesa	0	0	9.76	4.77	8.62	3.30	4.45	7.00	2.31	0.490	1.34	14.0	0.801		
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0.198	4.88	5.96	10.3	5.49	22.2	15.8	2.31	0.490	0	2.91	0.801		
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Hydrobaenus	27.8	5.73	0	2.38	0	0	0	0	0	0.490	2.01	1.16	3.60		
Insecta	Diptera	Chironomidae	Limnophyes	0.619	0	0	0	0	0	0	0	0	0	0.671	0	0		
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	1.75	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Micropsectra	0.309	0.198	1.39	0	0	6.59	0	0	0.770	10.6	0	0	0		
Insecta	Diptera	Chironomidae	Monodiamesa	0.309	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Orthocladius complex	0	0.989	39.7	22.6	8.62	12.1	17.8	18.4	13.1	15.9	33.6	20.9	45.7		
Insecta	Diptera	Chironomidae	Pagastia	1.55	7.32	0	1.19	1.72	0	2.67	1.75	0.770	0	0	0	0		
Insecta	Diptera	Chironomidae	Parametriocnemus	0.309	0.395	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	1.54	3.19	0	0	0.801		
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0.401		
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Pseudodiamesa	8.66	3.76	0.697	0	1.72	4.40	0	1.75	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	1.39	0	0	0	0	1.75	3.08	9.32	0	1.16	0		
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0		

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Three-minute Kick Samples		Area-based Kick Samples												
				2022		2016												
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHNF		RG_GHUT						RG_GHNF						
				RG_GHNF-2	RG_GHNF-3	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5		
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Chironomidae	Tvetenia	1.24	61.1	2.79	7.15	3.45	0	1.78	3.50	7.70	3.19	2.68	1.16	4.41		
Insecta	Diptera	Chironomidae	Zavrelimyia	2.17	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0	1.13	0	0	0	0	4.51	0.445	1.34	5.43	2.80		
Insecta	Diptera	Empididae	Clinocera	0	0	0.690	1.13	1.72	0	0	0	0.752	1.34	0	0	4.81		
Insecta	Diptera	Empididae	Neoplasta	6.69	0.923	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Empididae	Trichoclinocera	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Muscidae	Muscidae	0	0.185	0	0	1.72	0	1.15	2.40	0	0	0	0	0		
Insecta	Diptera	Pelecorhynchidae	Glutops	1.16	0	0	1.13	0	0	0	0	0.752	2.45	0.671	0	2.00		
Insecta	Diptera	Psychodidae	Pericoma	0	0	1.38	0	8.62	3.30	0	2.40	0.752	0.891	0.671	0	0		
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	7.85	1.85	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0.445	0	0	0		
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	2.20	0	0	0	0	0	0	0		
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Tipulidae	Dicranota	2.33	0.185	6.21	11.3	13.8	7.69	10.3	4.00	16.5	19.4	18.1	3.26	6.41		
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0.891	0	0	0		
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	8.62	3.30	0	2.40	0.752	0.891	0.671	0	0		
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0	0.445	0	0	0		
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	2.20	0	0	0	0	0	0	0		
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0.690	0	0	0	0	0	0	0	0	0	0		
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	11.3	13.8	7.69	10.3	4.00	16.5	19.4	18.1	3.26	6.41		
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0.891	0	0	0		
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Plecoptera	Capniidae	Capnia	0	0	3.45	0	0	0	0	0	0	0	0	0	0		
Insecta	Plecoptera	Capniidae	Capniidae	7.85	4.67	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Plecoptera	Capniidae	Mesocapnia	0.581	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	7.59	0	0	0	0	1.60	0	0	0	0	0		
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0	0	1.60	0	0.445	0	0	0		
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Plecoptera	Nemouridae	Zapada	0	0	1.38	0	0	0	0	0	0	0	0	0	0		
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0.581	0.373	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0		
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	0	0	4.44	0	2.20	0	0.800	4.51	3.56	3.36	19.7	2.79		
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0		

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Three-minute Kick Samples		Area-based Kick Samples										
Higher Level Classification		Family	Lowest Practical Level Identification	2022		2016										
				RG_GHNF		RG_GHUT						RG_GHNF				
				RG_GHNF-2	RG_GHNF-3	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	9.07	2.66	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	16.6	19.0	33.0	12.0	8.00	19.6	7.35	6.71	8.51	5.58
Insecta	Plecoptera	Perlodidae	Megarcys	2.27	7.98	0	0	1.72	0	0	0	0.752	0	1.34	2.66	0.398
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	3.45	0	0	1.10	0	0	0	0	0	1.06	0
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	1.11	1.72	7.69	15.4	16.8	4.51	0.891	0.671	0	0.398
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	2.22	1.72	0	0	0	10.5	10.9	17.4	5.32	11.2
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0.175	0	0	0.146	0	0	0	1.34	2.66	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0.690	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	1.11	0	1.10	1.72	0	0	2.00	0	1.06	0.797
Insecta	Trichoptera	Limnephilidae	Limnephilidae	13.9	0	0	1.11	0	3.30	0	0.800	0	0	0	1.60	0.398
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0.317	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	1.38	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2016							2017					
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHNF	RG_GHFF						RG_GHUT					
				RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	3.77	0.634	1.30	2.39	5.64	1.80	0.672	4.24	12.3	7.14	2.71	5.96	2.48
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.943	1.27	1.63	0.896	0	0.771	0	0.265	0	0	0	0.221	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	0.440	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0.440	0	0.298	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0.317	0	0	0	0	0	0	0	0	0	0.221	0.310
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0.246	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0.265	0	0	0	0.221	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0	0	0.888	0	0.312	0	0.654
Insecta	Diptera	Chironomidae	Chaetocladius	0	0.665	0	0	0	0	0	0	0.296	0	0.312	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0.296	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	11.4	9.18	8.31	4.09	11.3	11.7
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0.312	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	3.66	6.48	7.68	7.91	3.50	10.1	0	5.77	8.57	7.90	5.41	4.14
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	2.83	0.332	0	0	0	0	0	0.901	1.63	0.779	0.625	1.58	0.654
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	12.3	0	0	0	0	0	0	0	0	0.260	0.312	1.35	1.96
Insecta	Diptera	Chironomidae	Monodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	20.8	53.2	59.3	52.5	37.5	55.7	49.0	45.6	35.1	42.6	30.6	34.0	44.2
Insecta	Diptera	Chironomidae	Pagastia	0	13.6	12.3	24.0	27.7	14.3	21.0	2.79	2.22	3.63	4.09	5.41	6.43
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0.312	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0.260	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0.332	0	0	0	1.08	0.699	0	3.26	2.08	1.59	4.06	2.29
Insecta	Diptera	Chironomidae	Psilometriocnemus	2.83	0	0	0	0	0.538	0	0.270	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0.332	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2016							2017					
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHNF	RG_GHFF						RG_GHUT					
				RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	4.72	2.33	1.71	0	3.29	5.65	3.15	2.52	3.55	1.04	2.22	2.03	0.327
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	1.89	5.07	7.49	2.09	3.44	3.87	1.35	0.265	0.293	0	0	0	0
Insecta	Diptera	Empididae	Clinocera	0.943	1.58	0.651	0.299	1.25	1.03	0.677	0.265	0.293	0.246	0	0.662	0.620
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Trichoclinocera	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0.265	0.587	0.739	0	0.221	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	1.24
Insecta	Diptera	Pelecorhynchidae	Glutops	0	1.90	0.977	0.299	0	0	0	0	0	0	0.298	0	0
Insecta	Diptera	Psychodidae	Pericoma	2.83	0.634	0	0	0.313	0.516	0	0.618	1.32	0.246	0.894	0.662	0.931
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0.313	0	0	0.618	0	0	0	0	0.310
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0.265	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	8.49	1.90	0.326	0.299	1.57	1.29	0	1.86	6.01	5.67	4.23	1.99	2.79
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0.326	0.261	0	0	0.273	0	0	0.246	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	2.83	0.634	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0.299	0	0	0	0	0.587	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0.313	0	0	0	0	0	0	0.221	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	8.49	1.90	0.326	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0.326	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0.883	0.880	0.246	1.82	1.32	1.24
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0	0.299	1.88	0.514	0.672	23.7	11.9	14.8	33.4	13.2	7.96
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	0	0	0	0	0.293	0	0.596	0.883	0.310
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0.587	0	0.298	0.662	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0.951	0	0	0	0	0	0	0.293	0	0	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	0	0	0	0.597	1.88	2.83	3.36	2.12	1.32	1.23	1.52	5.30	7.03
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	2.83	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2016							2017					
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHNF	RG_GHFF						RG_GHUT					
				RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	2.19	3.60	1.34	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	19.8	2.22	0.326	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.317	0	0	0.410	0	0.336	0	0	0	0.596	0.221	0.620
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	4.18	4.07	0.771	4.70	0.265	0	0.739	0.298	0.221	0
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0.317	0	0	0	0.257	1.01	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	6.60	2.22	1.30	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0.896	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	8.49	0	0.651	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0.317	0.977	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0.299	0.313	1.54	0.336	0	0.293	0.739	0	2.65	1.86
Insecta	Trichoptera	Limnephilidae	Homophylax	0	1.90	0.651	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0.977	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	0	2.69	0	0.514	1.34	0.618	0	0.246	0.298	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2017												2018
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHNF						RG_GHFF						RG_GHUT
				RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	2.22	2.32	6.83	2.13	1.39	0.820	0	1.22	0.777	0	0.326	4.64
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	1.24	0	0.279	0	0.257	0.610	0.777	0	0.651	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0.279	0	0.257	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0.279	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0.621	0.304	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0.273	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0.978	0	0.287	0	0.333	0	0.426	0	0	0	0	1.05	1.88
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	0	1.88
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	7.82	1.94	2.15	18.4	2.33	4.26	1.70	0.794	2.62	1.92	0	1.05	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	3.91	0.970	0.287	1.67	4.33	0.984	0.426	1.32	0	2.46	2.74	0.699	10.7
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	28.1	1.72	1.67	1.000	0.984	0	0	0	0	0	0	6.28
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0	0	0	0	0	0	0.426	3.70	0.655	3.28	0	2.44	0.628
Insecta	Diptera	Chironomidae	Monodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	1.96	8.73	7.45	0	3.33	5.91	45.1	27.8	34.7	37.8	52.9	36.3	12.6
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	28.5	28.3	32.1	26.6	24.6	20.3	1.26
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	1.72	0	0	0	0	0.529	0	0.274	4.56	0	5.65
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0.287	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0.287	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2017												2018
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHNF						RG_GHFF						RG_GHUT
				RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	18.6	0.970	0	0	6.00	2.62	0	0.794	0	0.274	0.912	1.05	2.51
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	4.44	0	3.11	0.304	0	2.46	3.60	3.66	4.40	5.36	3.26	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0.279	0	0.257	0	0	0.893	0	0.515
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Trichoclinocera	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0.923	0	0	0	0	0	0.820	0.514	0	0.518	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	1.48	0.273	1.24	0.304	0	0	1.80	0	0.259	0	0.651	0
Insecta	Diptera	Psychodidae	Pericoma	0	1.48	2.05	0.621	1.22	0.557	0	0.257	0	0.259	0	0	0
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0.923	0	0	0	0.912	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	1.85	1.48	13.2	2.48	3.04	0	1.23	2.31	1.83	1.04	0	2.28	17.0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0.273	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0.771	0	0.259	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0.901	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	0	0.257	0	0.259	0	0.326	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0.741	0	1.24	0	0.279	1.64	1.29	1.22	0.518	0.893	2.61	0.515
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	10.8	3.70	15.3	3.11	9.42	10.6	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	0	0	0	0	0	0	0	0	0	0	1.55
Insecta	Plecoptera	Capniidae	Paracapnia	37.8	37.0	49.8	53.4	60.5	64.6	2.87	11.3	4.27	2.59	0	4.23	29.4
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	2.48	0	0.279	0	0.771	0	0.259	0	0	1.03
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0.771	0.610	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0.304	0	0	0.257	0	0	0.893	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	0	0	0	0.621	2.43	3.06	1.64	6.94	7.93	4.66	0.893	4.89	1.03
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2017												2018
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHNF						RG_GHFF						RG_GHUT
				RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	9.01	5.93	1.64	0.621	1.22	1.67	0	0	0.610	0.518	0	0	0.515
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.741	0	0	0	0.279	2.46	1.29	2.44	2.59	0	2.28	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	4.50	0	0	0	0.608	1.39	7.38	1.80	0.610	4.66	3.57	13.0	0
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0.257	0	0	0	0.651	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0.682	0	0	0	0.410	0	1.22	0.518	0.893	0.326	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	0	0.621	0	0	1.64	1.80	3.66	2.59	0.893	1.63	0.515
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2018												
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHUT					RG_GHNF						RG_GHFF	
				RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	18.5	1.63	0.806	4.49	3.90	0	0	6.74	0	2.44	0	0.239	0
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	2.44	0	0	0	1.23	0.529	0	16.7	1.22	0.870	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0	0	0	0	1.22	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	0	0	0	0.239	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0.375	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0.649	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0.870	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	1.00	3.24	1.43	2.34	3.19	15.1	2.25	6.24	17.5	8.82	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0.475	0	0	0	0	0	0	4.41	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0.779	0	0.558	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	1.41	0	0	0	15.6	0.638	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	1.08	0	0.779	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	29.6	10.0	8.64	33.3	35.8	8.93	3.90	4.49	0	5.39	4.41	2.27	3.08
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	1.41	17.0	0	0.951	0	0	4.46	0	1.04	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	2.08	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0	0	0	0.951	0.779	0	0.558	0	0	0	0	0.505	0
Insecta	Diptera	Chironomidae	Monodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	19.8	11.0	38.9	11.9	11.7	3.83	1.67	5.62	2.08	4.04	4.41	28.5	29.1
Insecta	Diptera	Chironomidae	Pagastia	1.41	1.00	4.32	0	1.56	1.28	0.558	0	0	0	0	20.5	21.1
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	7.01	0	6.18	7.01	0	1.12	0	1.04	0	0	0	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2018												
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHUT					RG_GHNF						RG_GHFF	
				RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	5.64	9.02	14.0	13.8	1.56	45.9	34.0	11.2	38.5	24.3	24.7	0.253	1.76
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0	0	0	0	0	0	0	0	0	2.39	1.68
Insecta	Diptera	Empididae	Clinocera	0	0.813	1.61	0	0	0	0	0	0	0	0	2.63	0.420
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Trichoclinocera	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0.749	0	0	0	1.12	0	0	3.53	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	0	0	0	0	1.22	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	1.23	5.69	0.806	2.25	0	3.07	1.06	7.87	0.980	3.66	7.93	0	0
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	8.64	5.69	12.9	5.24	3.25	6.75	4.23	18.0	6.86	4.88	5.29	2.63	0.420
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	1.12	0.980	0	0	0.239	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	0	0	0	0	0	0.955	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	0	0.716	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	0	0	0.649	0.613	2.65	2.25	1.96	1.22	2.61	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	9.88	23.6	12.9	14.2	6.49	15.9	25.9	25.8	18.6	14.6	19.1	8.35	2.94
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0.420
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0.239	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	2.47	0.813	0	2.25	5.84	3.07	0.529	3.37	0.980	8.54	4.35	22.4	26.5
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2018												
				RG_GHUT					RG_GHNF						RG_GHFF	
				RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	2.44	0.806	0.375	0	2.45	2.12	7.87	1.96	6.10	2.61	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0.375	0	0	0	0	0	0	0	1.19	1.68
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0.649	0	0	0	0	0	0	0.239	0.420
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0.649	2.45	0.529	2.25	0	3.66	6.09	5.01	7.98
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0.420
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0.813	0	0.749	0	0.613	0.529	0	0	0	0	0	0.420
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	0	0	0	0	0	0	0	0	0	0.477	1.68
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2018				2019								
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHFF				RG_GHUT						RG_GHNF		
				RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0.480	0.576	4.55	7.46	1.40	4.33	8.13	11.3	0.216	0.541	0
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0.855	0	0	0	0	1.86	0	0	0	0	1.08	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0.423	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.211	0	0	0.288	0	0	0.465	0.433	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0.211	0	0	0	0	0	0	0.433	0	0.173	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0.576	0	0	0	0	0.478	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0.211	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0.577	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0.977	0	0	0	0	1.21	0.233
Insecta	Diptera	Chironomidae	Chaetocladius	0	1.36	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0	0.228	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0.721	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	4.59	1.36	3.53	1.96	20.8	18.5	9.29	18.1	24.2	52.3	1.14	4.24	3.72
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	5.77	15.4	30.8	2.26	1.98	0.721	1.14	0.605	3.72
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0.219	0	0	0	0	0	0.977	0	0.494	0	0	0	0.233
Insecta	Diptera	Chironomidae	Monodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	34.1	33.6	34.5	27.4	27.7	19.6	10.8	34.4	36.6	8.83	1.83	7.26	1.86
Insecta	Diptera	Chironomidae	Pagastia	11.4	30.7	26.7	25.8	8.08	7.20	3.91	11.3	8.40	11.7	5.94	1.21	2.09
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	1.15	4.12	7.33	0.453	1.48	0.721	0.228	0	1.40
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2018				2019								
				RG_GHFF				RG_GHUT						RG_GHNF		
				RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0.437	1.59	4.03	1.96	9.23	10.3	3.42	4.08	2.47	2.25	77.4	40.0	67.0
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0.605	0.233
Insecta	Diptera	Dixidae	Dixa	0	0	0.240	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0.634	0.855	0.959	6.34	0	0.498	0	0	0	0	0.431	0	0
Insecta	Diptera	Empididae	Clinocera	1.27	1.07	0.240	0.865	0	0	1.40	0	0	0	0.216	0.545	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Trichoclinocera	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0.347	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0.423	0.214	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	0	0.641	0	0.576	1.14	2.49	5.58	1.73	0.957	0.693	3.23	4.36	1.12
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0.545	0
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	1.06	1.07	0.719	4.03	5.68	3.48	6.51	5.20	3.83	1.91	1.08	0	0.447
Insecta	Diptera	Tipulidae	Limnophila	0	0	0.240	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0.211	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0.480	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0.959	0.576	0	0	0	0.433	0.478	0	0	0.541	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0.846	0.641	0.719	0.576	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0.211	0	0	0	1.14	0.995	0.465	0	1.91	0.173	1.08	6.49	1.79
Insecta	Plecoptera	Capniidae	Paracapnia	2.96	1.50	3.36	2.88	10.8	6.47	7.91	7.80	3.83	2.95	3.45	6.49	6.94
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0.211	0	1.20	0.865	0	0	0	0	0	0	0	0.541	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0.288	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0	0	0.433	0	1.21	0	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	30.2	19.9	13.4	13.3	1.14	0.995	2.33	5.20	2.87	2.95	1.08	15.7	7.16
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2018				2019								
				RG_GHFF				RG_GHUT						RG_GHNF		
				RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0	0	0	0	0	1.08	2.70	0.671
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	1.27	0.855	1.92	4.90	0.568	0	0	0.108	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0.211	0.427	0.480	0.865	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	7.19	3.21	3.12	4.32	1.70	1.99	0	0.433	0.478	0.347	0.216	2.70	0.447
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0.719	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0.211	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0.211	0	0	0	0	0	2.33	0	0	0.693	0	2.70	0.895
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0.498	2.33	2.60	0.957	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	1.06	0.214	1.92	1.15	0	0	0	0.217	0.478	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2019									2020			
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHNF			RG_GHFF						RG_GHUT			
				RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0.391	0.862	0	1.54	0	0.435	0	1.96	0.629	7.22	12.1	2.89	4.36
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0.781	15.5	3.21	0.171	0	0.435	0.505	0	0.210	0	1.66	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0.862	0.292	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0.435	0.505	0.130	0	0.555	0	0.578	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0.684	0	0.435	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0.555	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	1.70	6.42	0.313	0	0	0	0	0	0	0	4.46	0.593	0.449
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0.637	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0.526	0	0	0	1.17	3.82	2.96	0.898
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0	0	0	1.35
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0.851	6.42	2.19	19.8	29.5	21.6	40.8	18.0	25.4	16.4	2.55	8.30	9.43
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	1.28	2.14	1.25	0.971	0	33.2	0	1.09	1.95	2.35	21.7	10.7	10.3
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0.313	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0	0	0	0.583	0	2.11	0	0.313	0.733	2.35	3.19	2.96	11.2
Insecta	Diptera	Chironomidae	Monodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	1.28	1.07	0.625	4.66	1.90	5.26	11.6	2.35	1.95	31.7	17.8	5.93	1.80
Insecta	Diptera	Chironomidae	Pagastia	0	0	1.56	29.7	18.1	7.37	17.1	34.6	37.9	14.7	0.637	1.78	3.14
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0.637	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0.851	0	0.625	0.388	0	5.26	0	0	0.244	0.587	2.55	5.34	4.04
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2019									2020			
				RG_GHNF			RG_GHFF						RG_GHUT			
				RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	17.9	15.0	61.9	8.55	2.85	2.11	1.22	4.07	4.15	2.35	3.82	7.11	8.53
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0.391	0	0.292	1.88	3.08	0	1.01	1.56	1.68	0.833	1.10	0	0
Insecta	Diptera	Empididae	Clinocera	1.17	0	0	0	1.54	0.435	2.53	1.30	0.210	0.833	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Trichoclinocera	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0.555	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	0	0	0	0	0	0	0.578	0
Insecta	Diptera	Psychodidae	Pericoma	4.69	5.17	5.25	1.03	0	0.435	1.01	0.261	1.26	1.11	8.28	12.1	9.12
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	2.73	4.31	0.875	0	0	0	0	0	0.419	0.555	0	0	0
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0.391	0	1.75	3.42	0	1.74	0	2.87	1.05	8.33	6.76	13.3	5.21
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0.130	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0.391	0	0	0	0	0	0	0	0	0.555	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0.342	0	0	0	0.261	0	0.555	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0.391	0	0	0	0.769	0	1.01	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	10.6	8.62	3.50	0	0	0	0	0	0	0	3.31	0	1.45
Insecta	Plecoptera	Capniidae	Paracapnia	26.9	14.7	7.58	1.71	0.769	4.35	1.52	4.17	0.629	4.44	2.21	9.82	11.6
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0.171	0	0	0.505	0.130	0	0	0.552	0	0.397
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0.769	0	0	0	0	0	0	0.578	0
Insecta	Plecoptera	Nemouridae	Malenka	0	1.72	0	0	0	0	0	0	0.419	0	0	4.04	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	19.5	7.76	6.71	22.8	33.1	11.3	15.7	25.6	19.5	1.67	1.10	0	5.16
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2019									2020			
				RG_GHNF			RG_GHFF						RG_GHUT			
				RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	2.73	2.59	1.17	0.171	0.769	0	0	0.782	0.210	0	0.552	1.73	1.19
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.862	0	0.0428	1.54	0	1.52	0.130	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	3.91	3.45	0.583	0.513	3.85	0.435	1.52	0.261	0.839	0	0	0	0
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0.171	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0.435	0	0	0	0.0694	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0.552	8.70	10.3
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	1.17	2.59	0	0.171	0	1.74	0.505	0	0.419	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	0	0.556	1.54	0	1.52	0.130	0.210	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0.555	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2020												
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHUT		RG_GHNF						RG_GHFF				
				RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	2.09	6.42	1.14	3.14	3.36	0	4.26	2.47	1.92	0	0.239	1.59	0.329
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0.840	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	1.14	0	1.23	0.319	0.852	0.239	0	0.658
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	0	0	0.239	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0.232	0.402	0	0	0	0	0	0	0.319	0	0	0	0.329
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0.719	0	0.319	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0.530	0	0	0.653	0	0	0.767	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0.767	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0.795	0.425	1.35	3.27	0	0	6.91	5.93	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0.425	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	9.28	21.3	1.35	0.653	2.16	1.27	0	2.96	2.96	2.46	5.10	0.687	4.79
Insecta	Diptera	Chironomidae	Heleniella	0	0	3.38	0.653	3.24	0	3.07	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	13.5	4.68	4.73	12.4	0	1.27	6.14	0	3.94	2.46	0	11.0	0.685
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	15.1	3.40	0.675	0	0	0	0.767	0	4.27	0.614	0.510	0	0.685
Insecta	Diptera	Chironomidae	Monodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	11.4	14.9	0.675	0	1.08	0	0	0	8.87	6.14	23.5	21.0	41.4
Insecta	Diptera	Chironomidae	Pagastia	3.71	12.3	1.35	0	0	0	0	0	24.0	13.2	42.4	19.6	27.7
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	1.08	0	0	0	0	0	0	0.344	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	2.39	1.28	2.03	7.18	0	0	2.30	0	0.986	0.307	0	0	0.685
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2020												
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHUT		RG_GHNF						RG_GHFF				
				RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	2.65	5.95	14.2	7.84	0	16.6	1.53	5.93	1.31	1.23	1.28	1.37	0
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	1.31	0	0	0.767	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0.719	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	1.71	2.52	8.40	4.78	1.44	1.23	7.03	5.59	7.40	7.62	4.52
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0.840	2.39	0	0	0.319	0.373	0.493	0	0.411
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Trichoclinocera	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	1.14	2.52	0.840	0	2.88	0	1.92	0	0	0.635	0.329
Insecta	Diptera	Psychodidae	Pericoma	8.12	8.03	2.86	3.77	8.40	8.36	2.88	1.23	4.15	0	0	3.81	1.32
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	7.66	5.22	21.7	13.2	21.9	11.9	18.0	23.5	1.92	1.70	0.478	4.76	1.97
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0.571	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0.232	0	0	0	0	0	0	0	1.60	2.27	0.957	2.22	1.97
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0.319	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	1.54	16.5	8.28	12.7	7.73	2.42	11.5	0	2.60	0	0.397	0
Insecta	Plecoptera	Capniidae	Paracapnia	7.89	7.70	13.8	23.2	21.8	11.6	38.7	23.1	4.15	6.49	0.239	2.78	0.987
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	1.68	0	0	0	0.319	0	0	0	0.329
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	1.26	0.840	0	0	0	0	0.284	0	0	0.329
Insecta	Plecoptera	Nemouridae	Malenka	0	0	3.14	0	0	10.2	0	0	0.733	3.52	0	0	0.680
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	2.09	2.41	3.14	2.52	3.36	10.2	0	16.1	24.2	43.4	13.6	19.1	9.52
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2020												
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHUT		RG_GHNF						RG_GHFF				
				RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0.239	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	3.43	3.14	5.88	10.2	2.13	3.70	0.319	0.426	0	0.476	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0	0	0	0	0	0.639	1.28	0.718	0.476	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	1.14	0	1.23	0	0.284	0	1.27	0.329
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0.571	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0.402	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0.317	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	1.70	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	12.3	3.21	0.571	2.52	1.68	1.14	2.84	0	2.56	0	1.91	0.317	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0.284	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0.0125	0	0	0	0	0	0	0.639	2.56	0.478	0.317	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2021												
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHFF	RG_GHUT						RG_GHNF					
				RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	1.03	3.61	2.73	3.57	1.67	0.439	2.31	1.08	0.702	0	0	1.79	0.336
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	0	2.13	0.446	0.168
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.412	0.201	0	0.794	0	0	0.384	0	0	0	1.06	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0.333	0	0.384	0.217	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0.397	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0.619	0.201	2.48	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0.967	0	0.480	0	0	1.28	0	0.380	1.33	1.26	0	0.185
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	0	1.30
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0.483	0	0.960	0.745	0	0	0.237	0.761	0.332	1.26	0.984	1.30
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0.237	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0.332	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	1.72	52.9	51.2	38.4	57.4	63.2	49.8	0.711	0	0	1.26	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0.474	1.52	0.332	0	0	0.555
Insecta	Diptera	Chironomidae	Hydrobaenus	1.72	0	0	0.480	0	0	0	0	1.90	0	0	0	0.925
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	1.26	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0.430	0.483	0	0	0	0	0	0.237	1.52	0.332	0	0	2.59
Insecta	Diptera	Chironomidae	Monodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	4.94	2.90	10.5	9.60	10.4	3.57	2.98	2.85	0.380	0.995	1.26	1.48	1.48
Insecta	Diptera	Chironomidae	Pagastia	35.6	9.42	14.8	9.60	12.3	6.12	5.95	18.7	3.80	9.95	2.53	25.1	5.00
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0.430	0	1.46	5.76	1.12	0.510	0	0.474	2.28	1.33	0	0.492	0.555
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2021												
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHFF	RG_GHUT						RG_GHNF					
				RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	1.50	2.90	0.874	0.960	0.745	2.04	0	34.4	37.3	50.1	31.6	15.2	43.7
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	3.92	0	1.24	0	0	0	0	3.25	1.05	0.464	1.06	4.91	0.671
Insecta	Diptera	Empididae	Clinocera	0	0.602	0	0.794	0.667	0	1.54	0.651	0	0.464	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Trichoclinocera	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	1.00	0	0	0.333	0	0.384	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	0	0.0481	0	0.351	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	0.619	2.61	3.97	5.95	1.33	5.70	5.38	1.08	6.32	2.79	6.38	1.79	3.69
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	2.06	1.61	3.23	3.17	2.00	3.07	2.31	3.04	1.05	3.72	2.13	4.91	4.53
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0.384	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0.825	0	0	0	0	0	0.384	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0.342	0	0	0	0	0.549	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0.444	3.76	1.74	5.56	1.75	0.877	5.49	2.65	1.80	0.512	1.77	6.20	11.2
Insecta	Plecoptera	Capniidae	Paracapnia	5.33	5.13	0.496	2.78	0.583	0.877	1.65	6.89	18.6	14.3	3.55	8.53	13.1
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0.397	0	0	0	0.217	0	0	1.06	0	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0.608	0.803	0	0.397	0	1.32	0	0.506	0.646	1.11	0	1.52	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0.803	0	0.397	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	33.4	6.43	0.993	0.794	2.33	0	5.38	16.2	11.6	9.42	23.4	13.7	5.37
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2021												
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHFF	RG_GHUT						RG_GHNF					
				RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0.201	0.248	0	0	0.439	0.769	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0.247	1.20	1.49	3.97	0.333	2.63	5.00	3.69	4.56	0.310	5.32	0.473	2.01
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0.990	0.201	0	0	0.333	0	0	0.0271	0	0	0	7.56	0.168
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0.619	0.402	0	0	0	0.877	1.15	0.867	0.702	1.55	2.13	2.68	1.17
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0.412	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0.744	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0.397	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	1.24	0.402	1.74	4.37	5.33	8.33	5.77	1.30	2.81	0.310	9.57	2.23	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0.825	0.402	0	0	0.333	0	0.769	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2021						2022						
				RG_GHFF						RG_GHUT						RG_GHNF
				RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	2.51	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0.377	0.532	0.327	0.810	1.74	17.8	3.01	0.980	4.35	3.41	2.06	0
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0.188	0	0	0	0	0	0	0.980	0	0	0	1.43
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0.405	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	1.07	0.377	2.13	0.654	0.810	0.651	0.297	0	0	0	0.201	0.229	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	0	0	0.201	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0	0	0	1.09	0	0.229	1.43
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0.297	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0	1.07	2.10	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0.318	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	37.5	54.8	33.0	50.0	51.0	27.5	28.6	25.6	1.05	9.21	31.3	19.2	25.9
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0.925	0	0	0	1.72	3.82	5.33	17.8	3.95	0	0.526	9.71
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0	11.1	0.601	0	1.43	1.96	0	0	0	0	0.497	4.73	1.62
Insecta	Diptera	Chironomidae	Monodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	10.8	1.85	3.60	6.48	3.82	11.8	18.8	9.60	0	1.32	5.47	8.42	1.62
Insecta	Diptera	Chironomidae	Pagastia	34.6	16.6	18.6	25.9	18.6	30.9	9.55	13.9	0	7.89	25.9	28.4	4.86
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0.491	3.18	6.67	9.43	17.1	0	0.263	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0.526	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2021						2022						
				RG_GHFF						RG_GHUT						RG_GHNF
				RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0.925	0	0	0	0	1.27	4.27	0	10.5	4.72	8.42	4.86
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0.188	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	6.79	1.51	11.2	4.58	5.26	7.81	0.297	0	0	2.17	6.02	8.70	8.57
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	2.01	2.94	2.17	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Trichoclinocera	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0.377	0	0	0	0	0	0	0.980	0	0	0.229	1.43
Insecta	Diptera	Psychodidae	Pericoma	0	3.39	1.60	0.980	2.83	2.60	2.37	6.02	22.6	23.9	4.42	5.49	5.71
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0.188	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0.327	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0	0.188	0.532	0	0.405	0	0	5.01	7.84	3.26	0.201	1.14	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0.532	0	0	0.217	0	0	0	0	1.20	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	0.402	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	1.06	0	0	0.651	0	3.01	11.8	5.43	0	0	1.90
Insecta	Plecoptera	Capniidae	Paracapnia	0	0.377	0	0	0.405	0	11.3	3.01	0	0	0.201	0.915	3.81
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0.532	0	0	0	0	2.01	0	0	0.402	0.229	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0.565	0	0.955	0	1.47	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	7.14	2.82	20.2	5.25	10.1	7.64	0.890	0	0	1.09	8.43	4.35	5.71
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2021						2022						
				RG_GHFF						RG_GHUT						RG_GHNF
				RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0.593	1.00	1.96	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0.357	0	0.532	0	0.405	0.651	0.297	3.01	9.80	5.43	3.01	2.75	8.57
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.377	0	0.327	0	0	0	1.00	0	0	0.201	0.915	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	1.43	1.51	1.06	3.92	1.62	2.17	0.297	2.01	0	0	1.81	1.37	5.71
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	0	0	0	1.43
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	1.13	1.60	0	1.62	0	0	0	8.82	1.09	0.803	0	2.86
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0.357	0.188	2.66	0.327	0.405	0	0	0	0.980	0	1.20	0.915	2.86
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2022												
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHNF					RG_GHFF						RG_GHDT	
				RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHDT-1	RG_GHDT-2
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	1.87	0.781	1.65	2.37	3.08	0.692	2.07	3.41	2.06	3.41	2.06
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0.494	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.494	0	1.87	0	0	0	0	0.692	0.826	0.201	0.229	0.201	0.229
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	0.413	0.201	0	0.201	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0.342	0	0.826	0	0.229	0	0.229
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0.483	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0.563	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	1.12	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	54.6	69.1	16.8	18.4	36.8	45.2	20.8	61.1	15.0	31.3	19.2	31.3	19.2
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	3.36	0.877	0.968	0.377	0	0	1.45	0	0.526	0	0.526
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0.483	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0	0	2.24	0	0	1.88	0	0	4.83	0.497	4.73	0.497	4.73
Insecta	Diptera	Chironomidae	Monodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	1.69	14.5	3.36	7.02	8.71	3.01	1.39	5.78	10.1	5.47	8.42	5.47	8.42
Insecta	Diptera	Chironomidae	Pagastia	11.3	3.03	14.6	21.1	12.6	16.2	19.0	14.9	6.28	25.9	28.4	25.9	28.4
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	1.12	0	0	0	0	0	0.483	0	0.263	0	0.263
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0.526	0	0.526
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
				2022												
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHNF					RG_GHFF						RG_GHDT	
				RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHDT-1	RG_GHDT-2
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	8.44	1.21	5.61	9.65	7.74	1.13	2.31	1.65	0.966	4.72	8.42	4.72	8.42
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	2.24	0	0.968	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0.552	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	2.96	0.552	10.3	6.25	4.13	5.93	16.1	5.19	10.1	6.02	8.70	6.02	8.70
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	1.19	0	0	0.632	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Trichoclinocera	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0.935	2.34	0.826	0.339	1.03	0.346	1.24	0	0.229	0	0.229
Insecta	Diptera	Psychodidae	Pericoma	0	0.552	4.67	3.12	1.65	1.69	3.08	1.04	20.7	4.42	5.49	4.42	5.49
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0.494	0	0.935	1.56	0.826	0	1.37	0	0	0.201	1.14	0.201	1.14
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0.413	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0.935	0	0	0.339	1.37	0	0.826	1.20	0	1.20	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0.339	1.03	0	0	0.402	0	0.402	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	1.48	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0.552	7.48	8.59	3.31	1.36	1.71	0.346	2.07	0.201	0.915	0.201	0.915
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0.781	0	0	1.03	0	2.07	0.402	0.229	0.402	0.229
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0.413	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	4.94	2.21	7.48	0.781	9.92	12.2	9.93	5.54	7.02	8.43	4.35	8.43	4.35
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2022												
				RG_GHNF					RG_GHFF						RG_GHDT	
				RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHDT-1	RG_GHDT-2
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	6.36	0.552	8.41	0.781	1.65	0.814	0.716	1.38	0.826	3.01	2.75	3.01	2.75
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0.796	3.31	0	3.12	2.48	1.22	7.16	0	4.13	0.201	0.915	0.201	0.915
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	4.44	3.31	0.935	3.91	2.48	0.678	0	0.346	0.413	1.81	1.37	1.81	1.37
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0.826	0.339	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0.413	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0.494	0	2.80	6.25	0	0	0.342	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0.494	0.552	0	3.91	1.65	1.69	0.685	1.04	1.24	0.803	0	0.803	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	0.935	0.781	0.826	1.69	7.53	0	3.31	1.20	0.915	1.20	0.915
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples			
				2022			
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHDT			
				RG_GHDT-3	RG_GHDT-4	RG_GHDT-5	RG_GHDT-6
Clitellata	Tubificida	Naididae	Nais	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	1.87
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0
Collembola	Collembola	-	Collembola	1.43	0.494	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0.494	0	1.87
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	1.43	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0.563	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	1.12
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	25.9	54.6	69.1	16.8
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	9.71	0	0	3.36
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	1.62	0	0	2.24
Insecta	Diptera	Chironomidae	Monodiamesa	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	1.62	1.69	14.5	3.36
Insecta	Diptera	Chironomidae	Pagastia	4.86	11.3	3.03	14.6
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	1.12
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples			
				2022			
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHDT			
				RG_GHDT-3	RG_GHDT-4	RG_GHDT-5	RG_GHDT-6
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	4.86	8.44	1.21	5.61
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	2.24
Insecta	Diptera	Dixidae	Dixa	0	0	0.552	0
Insecta	Diptera	Empididae	Chelifera/Metachela	8.57	2.96	0.552	10.3
Insecta	Diptera	Empididae	Clinocera	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0
Insecta	Diptera	Empididae	Trichoclinocera	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	1.43	0	0	0.935
Insecta	Diptera	Psychodidae	Pericoma	5.71	0	0.552	4.67
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0	0.494	0	0.935
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0.935
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	1.90	1.48	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	3.81	0	0.552	7.48
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	5.71	4.94	2.21	7.48
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0

Note: - = not applicable.

Table G.11: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples			
				2022			
				RG_GHDT			
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHDT-3	RG_GHDT-4	RG_GHDT-5	RG_GHDT-6
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	8.57	6.36	0.552	8.41
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.796	3.31	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	5.71	4.44	3.31	0.935
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	1.43	0.494	0	2.80
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	2.86	0.494	0.552	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	2.86	0	0	0.935
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0

Note: - = not applicable.

Table G.12: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2022

Taxon			Density																
			2016																
Higher Level Classification		Family	RG_GHUT						RG_GHNF						RG_GHFF				
			RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5
Clitellata	Tubificida	Naididae	0	0	0	57	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	347	254	92	57	137	79	80	60	93	33	76	174	12	13	61	195	48
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	32	0	46	0	20	0	0	20	27	7	12	44	24	17	23	0	21
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	0	0	0	0	13	0	36	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	32	0	46	0	0	20	13	0	0	0	0	0	6	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	13	0	10	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	2,928	841	481	1,648	1,118	1,379	560	653	800	259	1,354	2,004	1,406	817	2,148	2,644	2,153
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	32	43	23	0	0	0	93	27	27	34	182	131	126	83	61	163	131
Insecta	Diptera	Muscidae	0	0	23	0	26	59	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	22	0	0	0	0	13	37	13	0	48	0	36	10	8	0	0
Insecta	Diptera	Psychodidae	63	0	115	170	0	59	13	13	13	0	0	131	12	0	0	11	14
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	11	0
Insecta	Diptera	Stratiomyidae	0	0	0	114	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	284	216	183	398	235	98	293	303	360	20	154	392	36	7	14	54	34
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0	39	0	0	0	0	0	0	0	0	8	0	0
Insecta	Ephemeroptera	Ephemerellidae	32	0	0	0	0	39	0	7	0	0	0	0	18	0	0	11	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	504	402	252	1,818	275	217	427	163	200	177	201	1,046	42	3	8	65	14
Insecta	Plecoptera	Chloroperlidae	0	0	23	0	0	0	13	0	27	17	10	0	6	0	0	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	57	0	0	0	0	0	7	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	63	21	23	398	353	414	80	13	13	0	10	305	48	13	15	65	75
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0	46	23	0	3	0	187	163	373	50	267	392	6	17	0	90	96
Insecta	Plecoptera	Taeniopterygidae	158	21	0	57	39	0	0	30	0	7	19	0	36	7	107	141	21
Insecta	Trichoptera	Apataniidae	0	21	0	170	0	20	0	0	0	10	10	0	0	10	0	0	7
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	0	0
Insecta	Trichoptera	Hydropsychidae	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	32	0	0	227	78	20	0	0	13	7	10	0	36	13	8	11	41
Insecta	Trichoptera	Rhyacophilidae	63	0	0	0	0	0	0	0	0	0	0	0	39	13	69	0	14
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.12: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2022

Taxon			Density																
Higher Level Classification		Family	2016	2017															
			RG_GHFF	RG_GHUT						RG_GHNF						RG_GHFF			
			RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	8	160	280	97	303	90	80	0	10	57	37	23	17	7	0	7	10
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	10	0	0	0	3	0	0	0	0	7	0	3	0	3	3	10
Euchelicerata	Trombidiformes	Sperchontidae	0	0	10	0	0	0	0	0	0	0	0	0	3	0	3	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	10	0	33	0	0	0	0	0	0	0	3	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	0	3	0	3	10	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	10	0	0	0	3	0	0	0	7	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	1,033	2,397	1,413	913	5,897	983	2,330	123	183	347	117	190	177	623	820	383	933
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	25	30	27	13	0	13	20	3	20	0	17	3	3	27	57	20	63
Insecta	Diptera	Muscidae	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	0	0	33	0	0	0	7	7	7	3	0	0	23	0	3
Insecta	Diptera	Psychodidae	0	23	30	3	100	10	30	0	7	50	3	13	7	0	3	0	3
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0	23	0	0	0	0	10	3	0	0	0	10	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	3	80	137	80	473	30	90	7	7	330	13	33	0	10	40	10	17
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	13	0	0	0	0	3	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3	0	3
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0	0	0	3	0	7	0	3	13	17	7	7
Insecta	Plecoptera	Capniidae	8	927	290	203	3,943	220	297	180	183	1,590	303	767	900	23	147	23	33
Insecta	Plecoptera	Chloroperlidae	0	0	7	0	67	13	10	0	0	0	13	0	3	0	10	0	3
Insecta	Plecoptera	Leuctridae	0	0	13	0	33	10	0	0	0	0	0	0	0	0	10	3	0
Insecta	Plecoptera	Nemouridae	41	80	37	17	170	80	227	0	0	0	3	30	37	13	93	43	60
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	21	0	0	0	67	3	20	33	30	40	3	13	23	20	17	17	40
Insecta	Plecoptera	Taeniopterygidae	58	10	0	10	33	3	0	17	0	0	0	7	17	60	23	3	60
Insecta	Trichoptera	Apataniidae	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	4	0	7	10	0	40	60	0	0	17	0	0	0	3	0	7	7
Insecta	Trichoptera	Rhyacophilidae	17	23	0	3	33	0	0	0	0	0	3	0	0	13	23	20	33
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.12: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2022

Taxon			Density														
Higher Level Classification		Family	2017		2018												
			RG_GHFF		RG_GHUT						RG_GHNF						RG_GHFF
			RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	3	240	800	53	27	640	320	0	0	160	0	53	0	7
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	7	0	0	0	0	0	0	0	0	0	0	27	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	0	0	0	0	53	53	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	320	643	2,240	2,560	1,840	2,320	9,813	6,400	2,773	3,120	560	1,387	1,120	1,433	1,453
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	23	33	27	0	27	53	0	0	0	0	0	0	0	0	140
Insecta	Diptera	Muscidae	0	0	0	0	0	0	107	0	0	0	27	0	0	108	0
Insecta	Diptera	Pelecorhynchidae	0	7	0	0	0	0	0	0	0	0	0	0	27	0	0
Insecta	Diptera	Psychodidae	0	0	0	53	187	27	320	0	133	53	187	27	80	243	0
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	0	23	880	373	187	427	747	267	293	213	453	213	107	162	80
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	3	0	0	0	0	0	0	0	0	0	0	0	0	27
Insecta	Ephemeroptera	Heptageniidae	3	27	27	0	0	0	0	0	0	0	0	0	0	0	20
Insecta	Plecoptera	Capniidae	0	43	1,600	427	773	427	2,027	587	720	1,440	667	560	347	667	233
Insecta	Plecoptera	Chloroperlidae	0	0	53	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Insecta	Plecoptera	Nemouridae	7	50	53	107	27	0	320	480	133	27	80	27	187	133	627
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0	23	27	0	80	27	107	53	107	107	187	53	133	80	40
Insecta	Plecoptera	Taeniopterygidae	13	133	0	0	0	0	0	53	107	27	53	0	80	187	140
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	3	3	0	0	27	0	107	0	27	27	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	3	17	27	0	0	0	0	0	0	0	0	0	0	0	13
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	80	0	0	0	53	27	0	453	27	27	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.12: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2022

Taxon			Density															
Higher Level Classification		Family	2018					2019										
			RG_GHFF					RG_GHUT						RG_GHNF				
			RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	0	0	7	7	213	400	40	133	227	433	27	13	0	3	3
Euchelicerata	Trombidiformes	Hydryphantidae	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	3	0	0	3	0	0	13	13	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	3	0	0	0	0	0	0	13	0	7	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	3	0	0	7	0	0	0	0	13	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	1,747	800	1,070	957	660	3,440	4,027	1,933	2,173	2,107	2,973	10,880	1,359	9,600	203	120
Insecta	Diptera	Dixidae	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	67	30	30	17	83	0	27	40	0	0	0	80	13	0	13	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	7	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	0	0	10	0	7	53	133	160	53	27	27	400	108	133	40	20
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	13	0	23	17
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	13	17	17	13	47	267	187	187	160	107	73	133	0	53	3	0
Insecta	Ephemeroptera	Ameletidae	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	7	0	0	0	0	0	0	0	0	0	0	3	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	13	7	0	0	0	13	13	0	0	13	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	13	10	10	7	0	0	0	0	0	0	0	0	0	3	0
Insecta	Plecoptera	Capniidae	93	50	23	47	33	560	400	240	240	160	120	560	320	1,040	320	90
Insecta	Plecoptera	Chloroperlidae	13	3	0	17	10	0	0	0	0	0	0	0	13	0	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	840	477	310	187	153	53	53	67	173	80	160	133	387	853	167	37
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	67	23	20	33	67	27	0	0	3	0	0	133	67	80	23	13
Insecta	Plecoptera	Taeniopterygidae	253	113	50	43	50	80	107	0	13	13	13	27	67	53	33	13
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	13	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	13	3	0	0	0	0	27	133	80	27	27	0	67	107	10	10
Insecta	Trichoptera	Rhyacophilidae	53	17	3	27	13	0	0	0	7	13	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	13	0	0	0	0	53	0	0	0	0	27	0	7	60

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.12: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2022

Taxon			Density																
			2019							2020									
Higher Level Classification		Family	RG_GHNF	RG_GHFF						RG_GHUT						RG_GHNF			
			RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	120	0	3	0	100	10	347	293	267	293	240	1,707	107	67	53	0
Euchelicerata	Trombidiformes	Hydryphantidae	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	3	3	7	0	27	0	53	0	0	0	0	0	0	13
Euchelicerata	Trombidiformes	Sperchontidae	0	53	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	0	0	0	0	0	0	0	0	0	27	107	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	27	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	6,293	5,040	227	593	467	3,087	1,150	3,440	1,493	4,213	3,440	6,827	17,173	2,773	720	120	224
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	27	147	20	3	23	147	30	80	27	0	0	0	0	160	53	147	84
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	27	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	0	0	0	0	0	0	0	53	0	0	0	107	53	13	0
Insecta	Diptera	Psychodidae	480	80	0	3	7	13	20	53	200	1,120	613	933	2,133	267	80	133	98
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	80	0	0	0	0	0	7	27	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	160	267	0	13	0	153	17	400	163	1,227	350	880	1,387	2,027	280	347	140
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0	0	0	27	0	0	0	0	0	53	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	27	0	0	0	13	0	27	0	0	0	27	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	3	0	7	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	1,013	133	3	33	10	213	10	213	133	907	880	907	2,453	2,827	667	547	227
Insecta	Plecoptera	Chloroperlidae	0	13	0	0	3	7	0	0	13	0	27	0	0	0	0	27	0
Insecta	Plecoptera	Leuctridae	0	0	3	0	0	0	0	0	0	53	0	0	0	0	27	13	0
Insecta	Plecoptera	Nemouridae	613	1,773	143	87	103	1,307	317	80	27	373	347	240	640	587	53	53	240
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	107	17	10	0	10	47	3	0	13	160	80	0	0	320	67	93	120
Insecta	Plecoptera	Taeniopterygidae	53	40	17	3	10	13	13	0	0	0	0	0	0	0	0	0	13
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	13	0	0	0	0	0	0	0	0	0	0	0	53	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	107	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	0	13	0	13	3	0	7	0	13	803	693	1,413	853	53	53	27	13
Insecta	Trichoptera	Rhyacophilidae	0	43	7	0	10	7	3	0	0	0	0	0	3	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	27	0	0	0	0	0	0	0	0	0
-	-	Collembola	293	13	0	3	3	0	3	0	40	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.12: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2022

Taxon			Density																
Higher Level Classification		Family	2020								2021								
			RG_GHNF		RG_GHFF						RG_GHUT						RG_GHNF		
			RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	80	27	80	0	7	67	7	67	432	132	216	120	24	144	120	96	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	13	13	40	7	0	13	27	24	0	48	0	0	24	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	7	0	0	0	0	0	0	24	0	24	24	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	13	0	0	0	7	40	24	120	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	14	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	433	160	1,933	1,240	2,027	2,267	1,540	3,000	8,376	3,816	4,008	5,952	4,128	3,744	6,456	6,816	10,080
Insecta	Diptera	Dixidae	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	27	13	307	280	220	320	100	253	72	60	48	48	0	96	432	144	144
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	120	0	0	24	0	24	0	0	0
Insecta	Diptera	Pelecorhynchidae	54	0	80	0	0	27	7	0	0	0	0	0	0	3	0	48	0
Insecta	Diptera	Psychodidae	54	13	173	0	0	160	27	40	312	192	360	96	312	336	120	864	432
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	338	253	80	80	13	200	40	133	192	156	192	144	168	168	336	144	576
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	67	107	27	93	40	53	0	0	0	0	0	24	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	773	373	173	427	7	133	20	373	1,104	108	504	168	96	480	1,056	2,784	2,304
Insecta	Plecoptera	Chloroperlidae	0	0	13	0	0	0	7	0	0	0	24	0	0	0	24	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	13	0	0	7	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	0	173	1,040	2,200	380	800	207	2,200	960	48	96	168	72	336	1,848	1,680	1,632
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	7	0	0	0	24	12	0	0	24	48	0	0	0
Insecta	Plecoptera	Perlodidae	40	40	40	80	20	40	0	80	168	72	240	48	144	312	411	624	48
Insecta	Plecoptera	Taeniopterygidae	0	13	0	13	0	53	7	40	48	0	0	0	48	72	96	96	240
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	13	0	27	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	36	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	53	0	107	93	53	13	0	80	48	84	288	384	456	360	144	384	48
Insecta	Trichoptera	Rhyacophilidae	0	0	27	120	13	13	0	53	48	0	0	24	0	48	0	0	0
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.12: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2022

Taxon			Density																
Higher Level Classification		Family	2021									2022							
			RG_GHNF			RG_GHFF						RG_GHUT						RG_GHNF	
			RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	48	48	0	6	6	6	24	96	720	36	3	24	48	72	336	144
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	24	0	0	36	6	24	12	24	36	12	0	0	0	0	0	24	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	0	0	0	0	0	0	0	0	0	0	6	12	48	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	912	1,164	8,232	2,784	1,374	630	1,512	2,220	4,116	2,652	795	93	276	1,308	4,992	2,448	420
Insecta	Diptera	Dixidae	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	24	132	96	228	24	126	84	156	432	12	24	9	24	60	72	192	252
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	0	0	6	0	0	0	0	0	0	3	0	0	0	192	165
Insecta	Diptera	Psychodidae	144	48	528	0	54	18	18	84	144	96	72	69	132	456	504	96	84
Insecta	Diptera	Sciomyzidae	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	48	132	648	0	3	6	0	12	0	0	60	24	18	12	120	144	24
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	6	0	0	12	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	120	396	3,480	0	6	12	0	12	36	456	72	36	30	252	744	1,296	72
Insecta	Plecoptera	Chloroperlidae	24	0	0	0	0	6	0	0	0	0	24	0	0	0	0	24	48
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	12
Insecta	Plecoptera	Nemouridae	528	408	768	240	54	228	114	300	504	36	0	0	6	0	192	48	12
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	24	12	6	0	24	24	0	0
Insecta	Plecoptera	Perlodidae	120	216	312	12	6	6	6	12	36	12	48	30	30	120	312	696	156
Insecta	Plecoptera	Taeniopterygidae	48	72	168	48	24	12	72	48	120	12	24	0	0	0	0	0	12
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	216	60	0	0	18	18	0	48	0	0	0	27	6	132	168	0	120
Insecta	Trichoptera	Rhyacophilidae	0	0	0	12	3	30	6	12	0	0	0	3	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	48	12	24	0	3	0	0	0	0	0	0	3	0	0	0	24	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.12: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2022

Taxon			Density															
			2022															
Higher Level Classification		Family	RG_GHNF				RG_GHFF						RG_GHDT					
			RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHDT-1	RG_GHDT-2	RG_GHDT-3	RG_GHDT-4	RG_GHDT-5	RG_GHDT-6
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	3	48	48	48	21	0	6	15	51	108	0	0	0	6	6	6
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0	6	6	3	12	0	6	0	6	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	0	0	0	0	0	6	0	12	12	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	3	0	144	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	135	5,040	9,168	7,296	600	0	723	291	1,014	3,696	408	930	477	162	438	246
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
Insecta	Diptera	Empididae	39	144	192	384	63	0	45	78	90	456	72	36	3	33	48	15
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	3	0	0	57	3	0	3	9	0	12	12	0	0	3	18	3
Insecta	Diptera	Psychodidae	9	96	288	48	15	0	9	150	66	288	48	0	3	15	24	6
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	6	96	48	144	0	0	0	3	3	60	0	6	0	3	12	3
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	3	0	0	6	18	0	0	0	0	3	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	3	0	0	0	6	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	15	1,296	288	2,064	12	0	3	15	3	48	48	18	3	24	66	12
Insecta	Plecoptera	Chloroperlidae	0	0	0	0	0	0	0	15	6	12	0	0	0	0	6	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	12	96	0	144	108	0	48	51	126	228	48	60	12	24	6	36
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	138	1,491	816	1,443	18	0	12	36	48	192	72	87	21	27	30	15
Insecta	Plecoptera	Taeniopterygidae	0	0	48	0	6	0	3	3	27	72	48	54	18	3	30	9
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	3
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	3	0	0	0	15	0	9	9	12	0	36	12	3	9	78	6
Insecta	Trichoptera	Rhyacophilidae	0	0	0	0	15	0	0	24	18	48	24	0	0	3	6	3
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	3	0	0	0	0	0	0	0	0	0	12	6	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.13: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2022

Taxon			Three-minute Kick Samples														
Higher Level Classification		Family	2012	2014				2015				2021			2022		
			RG_GHCKU	GREE3-25	GREE3-75	GREE4-25	GREE4-75	RG_GHCKU	GREE3-75	GREE4-25	GREE4-75	RG_GHNF			RG_GHNF		
			RG_GHCKU-1	GREE3-25-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHCKU-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3
Clitellata	Tubificida	Naididae	0	0	1.13	0	0.289	0	0	0.254	0.338	0	0.496	0.605	0.643	2.62	1.11
Clitellata	-	Enchytraeidae	0	0	0	0	0	0	0.946	0.761	0.338	0	0	0	1.29	0	0
Collembola	Collembola	Entomobryidae	0	0	0	0	0	0	0	0	0	0.847	0	0.403	0	0.581	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0	0	0.289	0	0	0	0	0	0	0	0	0.291	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0.156	0.289	0.287	0	0	0	0	0	0	0	0.581	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0.156	0	0.287	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	0.313	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0.338	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	0	0.156	0	0	0	0.254	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0.157	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	89.0	73.3	34.0	71.3	68.5	65.3	64.3	58.6	45.5	17.8	39.6	45.2	27.0	43.3	80.1
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0.282	0	0	0	0	0
Insecta	Diptera	Empididae	0.313	0.637	0.567	0.784	0	1.72	2.22	0	6.45	0	0.748	1.41	7.72	6.69	0.923
Insecta	Diptera	Muscidae	0	0.319	0	0	3.18	0	0	3.30	0	0.565	0	0	0	0	0.185
Insecta	Diptera	Pelecorhynchidae	0	0	0	0	0	0	0	0	0.339	0	0	0	0.643	1.16	0
Insecta	Diptera	Psychodidae	1.57	1.91	1.70	1.25	1.73	3.72	0.317	3.55	2.38	10.2	8.97	2.82	1.29	7.85	1.85
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0.313	4.46	1.13	2.82	0	0.860	0.317	0	6.45	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	0.940	0.319	2.27	1.10	0.867	2.58	1.27	0.254	10.9	4.52	3.74	4.44	0.643	2.33	0.185
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0.338	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	1.88	0.317	1.13	0.939	0	0	0.315	0	1.01	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0.635	0	0	0.578	1.15	0.946	0.254	1.01	0	0	0	0.643	0	0
Insecta	Ephemeroptera	Heptageniidae	3.45	1.90	0.567	1.88	1.16	0.860	2.52	0.254	0.338	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	0.627	5.71	17.6	12.2	10.1	1.43	2.84	16.5	20.3	49.5	19.8	12.4	28.9	8.43	4.67
Insecta	Plecoptera	Chloroperlidae	0	0	0	0.469	0	0	1.58	0.254	0.338	0.291	0.251	0	4.09	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0	0	0.874	0.753	0.639	0	0	0
Insecta	Plecoptera	Nemouridae	0	7.62	21.5	0.939	8.09	9.46	4.73	14.2	2.36	7.86	19.3	16.2	3.07	0.581	0.373
Insecta	Plecoptera	Peltoperlidae	0	0	0	0.156	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0	0.635	2.83	1.10	0.867	2.87	1.89	1.27	0	4.95	4.27	6.61	21.5	11.3	10.6
Insecta	Plecoptera	Taeniopterygidae	0	1.59	12.8	2.19	3.47	8.60	12.3	0	1.01	2.33	0.502	8.95	0	0	0
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0.283	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0.573	0.868	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0.313	0	2.55	0	0.578	0	0.434	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	0.627	0.317	0	0.939	0	0	1.74	0.254	0	0	1.49	0.403	2.57	13.9	0
Insecta	Trichoptera	Rhyacophilidae	0.627	0.317	0	1.25	0	0.287	0.434	0	0.338	0	0	0	0	0.317	0
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.13: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2022

Taxon			Area-based Kick Samples														
Higher Level Classification		Family	2016														
			RG_GHUT						RG_GHNF						RG_GHFF		
			RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3
Clitellata	Tubificida	Naididae	0	0	0	1.10	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	7.59	13.3	6.90	1.10	6.01	3.20	4.51	4.01	4.70	5.32	3.19	3.77	0.634	1.30	2.39
Collembola	Collembola	Entomobryidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0.690	0	3.45	0	0.858	0	0	1.34	1.34	1.06	0.498	0.943	1.27	1.63	0.896
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	0	0	0	0	0.671	0	1.49	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0.800	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0.690	0	3.45	0	0	0.800	0.752	0	0	0	0	0	0.317	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0.671	0	0.419	0	0	0	0
Insecta	Diptera	Chironomidae	64.1	44.1	36.2	31.9	48.9	56.0	31.6	43.6	40.3	41.3	56.5	43.4	74.5	79.8	84.2
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	0.690	2.26	1.72	0	0	0	5.26	1.78	1.34	5.43	7.61	2.83	6.65	8.14	2.39
Insecta	Diptera	Muscidae	0	0	1.72	0	1.15	2.40	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	1.13	0	0	0	0	0.752	2.45	0.671	0	2.00	0	1.90	0.977	0.299
Insecta	Diptera	Psychodidae	1.38	0	8.62	3.30	0	2.40	0.752	0.891	0.671	0	0	2.83	0.634	0	0
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0.445	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	2.20	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	6.21	11.3	13.8	7.69	10.3	4.00	16.5	20.3	18.1	3.26	6.41	8.49	1.90	0.651	0.560
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0	1.60	0	0	0	0	0	0	0	0	0.299
Insecta	Ephemeroptera	Ephemerellidae	0.690	0	0	0	0	1.60	0	0.445	0	0	0	0	0.951	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	11.0	21.1	19.0	35.2	12.0	8.80	24.1	10.9	10.1	28.2	8.36	22.6	2.22	0.326	0.299
Insecta	Plecoptera	Chloroperlidae	0	0	1.72	0	0	0	0.752	0	1.34	2.66	0.398	0	0.317	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	1.10	0	0	0	0	0	1.06	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	1.38	1.11	1.72	7.69	15.4	16.8	4.51	0.891	0.671	0	0.398	6.60	2.54	1.30	0.597
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0	2.39	1.72	0	0.146	0	10.5	10.9	18.8	7.98	11.2	8.49	0.317	1.63	0
Insecta	Plecoptera	Taeniopterygidae	3.45	1.11	0	1.10	1.72	0	0	2.00	0	1.06	0.797	0	1.90	0.651	4.18
Insecta	Trichoptera	Apataniidae	0	1.11	0	3.30	0	0.800	0	0	0	1.60	0.398	0	0	0.977	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.896
Insecta	Trichoptera	Hydropsychidae	0	1.11	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	0.690	0	0	4.40	3.43	0.800	0	0	0.671	1.06	0.398	0	1.90	1.30	0.299
Insecta	Trichoptera	Rhyacophilidae	1.38	0	0	0	0	0	0	0	0	0	0	0	2.08	1.30	2.69
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.13: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2022

Taxon			Area-based Kick Samples														
Higher Level Classification		Family	2016			2017											
			RG_GHFF			RG_GHUT						RG_GHNF					
			RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	5.64	1.80	0.672	4.24	12.3	7.14	2.71	5.96	2.48	0	2.22	2.32	6.83	2.13	1.39
Collembola	Collembola	Entomobryidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0.771	0	0.265	0	0	0	0.221	0	0	0	0	1.24	0	0.279
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	0.440	0	0	0	0	0	0	0	0	0	0.279
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0.440	0	0.298	0	0	0	0	0	0	0	0.279
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0.621	0.304	0
Insecta	Coleoptera	Elmidae	0	0	0	0	0	0.246	0	0.221	0.310	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0.265	0	0	0	0.221	0	0	0	0.273	0	0	0
Insecta	Diptera	Chironomidae	76.4	80.7	83.9	63.5	62.2	67.5	52.7	65.1	72.3	33.2	40.7	14.2	21.7	17.3	14.8
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	4.70	4.90	2.03	0.795	1.17	0.985	0	0.883	0.620	0.923	4.44	0	3.11	0.304	0.279
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	1.24	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	0	0	0	0	0.298	0	0	0	1.48	0.273	1.24	0.304	0
Insecta	Diptera	Psychodidae	0.313	0.516	0	0.618	1.32	0.246	0.894	0.662	0.931	0	1.48	2.05	0.621	1.22	0.557
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0.313	0	0	0.618	0	0	0	0	0.310	0.923	0	0	0	0.912	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	1.57	1.29	0.273	2.12	6.01	5.91	4.23	1.99	2.79	1.85	1.48	13.5	2.48	3.04	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0.587	0	0	0	0	0.901	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0.313	0	0	0	0	0	0	0.221	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0.741	0	1.24	0	0.279
Insecta	Plecoptera	Capniidae	1.88	0.514	0.672	24.6	12.8	15.0	35.2	14.6	9.20	48.6	40.7	65.1	56.5	69.9	75.2
Insecta	Plecoptera	Chloroperlidae	0	0	0	0	0.293	0	0.596	0.883	0.310	0	0	0	2.48	0	0.279
Insecta	Plecoptera	Leuctridae	0	0	0	0	0.587	0	0.298	0.662	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	1.88	2.83	3.36	2.12	1.61	1.23	1.52	5.30	7.03	0	0	0	0.621	2.74	3.06
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	2.60	3.60	1.68	0	0	0	0.596	0.221	0.620	9.01	6.67	1.64	0.621	1.22	1.95
Insecta	Plecoptera	Taeniopterygidae	4.07	0.771	4.70	0.265	0	0.739	0.298	0.221	0	4.50	0	0	0	0.608	1.39
Insecta	Trichoptera	Apataniidae	0	0.257	1.01	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	0.313	1.54	0.336	0	0.293	0.739	0	2.65	1.86	0	0	0.682	0	0	0
Insecta	Trichoptera	Rhyacophilidae	0	0.514	1.34	0.618	0	0.246	0.298	0	0	0	0	0	0.621	0	0
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.13: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2022

Taxon			Area-based Kick Samples														
Higher Level Classification		Family	2017						2018								
			RG_GHFF						RG_GHUT						RG_GHNF		
			RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0.820	0	1.22	0.777	0	0.326	4.64	18.5	1.63	0.806	4.49	3.90	0	0	6.74
Collembola	Collembola	Entomobryidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0.257	0.610	0.777	0	0.651	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0.257	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	0	0	0	0	0	0	0	0	0.375	0.649	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	76.6	63.2	70.1	72.5	85.7	62.9	43.3	59.3	56.1	70.2	68.9	77.9	63.8	61.9	23.6
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	3.28	4.37	3.66	4.92	6.25	3.26	0.515	0	0.813	1.61	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0.749	0	0	0	1.12
Insecta	Diptera	Pelecorhynchidae	0	1.80	0	0.259	0	0.651	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	0	0.257	0	0.259	0	0	0	1.23	5.69	0.806	2.25	0	3.07	1.06	7.87
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	1.23	3.08	1.83	1.30	0	2.28	17.0	8.64	5.69	12.9	5.24	3.25	6.75	4.23	19.1
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0.257	0	0.259	0	0.326	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	1.64	1.29	1.22	0.518	0.893	2.61	0.515	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	2.87	11.3	4.27	2.59	0	4.23	30.9	9.88	23.6	12.9	14.2	7.14	16.6	28.6	28.1
Insecta	Plecoptera	Chloroperlidae	0	0.771	0	0.259	0	0	1.03	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	0	0.771	0.610	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	1.64	7.20	7.93	4.66	1.79	4.89	1.03	2.47	0.813	0	2.25	5.84	3.07	0.529	3.37
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	2.46	1.29	3.05	3.11	0	2.28	0.515	0	2.44	0.806	0.749	0.649	2.45	2.12	7.87
Insecta	Plecoptera	Taeniopterygidae	7.38	1.80	0.610	4.66	3.57	13.0	0	0	0	0	0	0.649	2.45	0.529	2.25
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0.257	0	0	0	0.651	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	0.410	0	1.22	0.518	0.893	0.326	0	0	0.813	0	0.749	0	0.613	0.529	0
Insecta	Trichoptera	Rhyacophilidae	1.64	1.80	3.66	2.59	0.893	1.63	0.515	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	2.44	0	0	0	1.23	0.529	0

Note: - = not applicable.

Table G.13: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2022

Taxon			Area-based Kick Samples														
			2018									2019					
Higher Level Classification		Family	RG_GHNF			RG_GHFF						RG_GHUT					
			RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	2.44	0	0.239	0	0	0	0.480	0.576	4.55	7.46	1.40	4.33	8.13	11.3
Collembola	Collembola	Entomobryidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0.423	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	1.22	0	0	0	0.211	0	0	0.288	0	0	0.465	0.433	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0.239	0	0.211	0	0	0	0	0	0	0.433	0	0.173
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	0	0	0	0.211	0	0	0.576	0	0	0	0	0.478	0
Insecta	Coleoptera	Staphylinidae	0	0	0.870	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	51.0	51.2	46.7	52.0	55.0	50.7	68.6	68.8	57.1	73.3	75.1	67.4	70.6	75.6	77.3
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0.240	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	0	0	0	5.01	2.10	1.90	1.92	1.20	7.20	0	0.498	1.40	0	0	0
Insecta	Diptera	Muscidae	0	0	3.53	0	0	0	0	0	0	0	0	0	0	0	0.347
Insecta	Diptera	Pelecorhynchidae	0	1.22	0	0	0	0.423	0.214	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	0.980	3.66	7.93	0	0	0	0.641	0	0.576	1.14	2.49	5.58	1.73	0.957	0.693
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	7.84	4.88	5.29	2.86	0.420	1.06	1.07	0.959	4.03	5.68	3.48	6.51	5.20	3.83	1.91
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0.211	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0	0	0	0.480	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0.955	0	0	0	0.959	0.576	0	0	0	0.433	0.478	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0.716	0	0.846	0.641	0.719	0.576	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	20.6	15.8	21.7	8.35	2.94	3.17	1.50	3.36	2.88	11.9	7.46	8.37	7.80	5.74	3.12
Insecta	Plecoptera	Chloroperlidae	0	0	0	0	0.420	0.211	0	1.20	0.865	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0.239	0	0	0	0	0.288	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	0.980	8.54	4.35	22.4	26.5	30.2	19.9	13.4	13.3	1.14	0.995	2.33	5.63	2.87	4.16
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	1.96	6.10	2.61	1.43	2.10	1.48	1.28	2.40	5.76	0.568	0	0	0.108	0	0
Insecta	Plecoptera	Taeniopterygidae	0	3.66	6.09	5.01	7.98	7.19	3.21	3.12	4.32	1.70	1.99	0	0.433	0.478	0.347
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0.420	0	0	0.719	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0.211	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	0	0	0	0	0.420	0.211	0	0	0	0	0.498	4.65	2.60	0.957	0.693
Insecta	Trichoptera	Rhyacophilidae	0	0	0	0.477	1.68	1.06	0.214	1.92	1.15	0	0	0	0.217	0.478	0
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	16.7	1.22	0.870	0	0	0	0.855	0	0	0	0	1.86	0	0	0

Note: - = not applicable.

Table G.13: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2022

Taxon			Area-based Kick Samples															
Higher Level Classification		Family	2019												2020		
			RG_GHNF						RG_GHFF						RG_GHUT		
			RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2	RG_GHUT-3
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0.216	0.541	0	0.391	0.862	0	1.54	0	0.435	0	1.96	0.629	7.22	12.1	2.89
Collembola	Collembola	Entomobryidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0.862	0.292	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0	0	0	0.435	0.505	0.130	0	0.555	0	0.578
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	0	0	0.684	0	0.435	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0.555	0	0
Insecta	Diptera	Chironomidae	87.9	55.1	80.5	23.8	31.0	68.8	64.7	52.3	77.4	70.7	60.4	72.3	71.6	61.8	45.6
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	0.647	0.545	0	1.56	0	0.292	1.88	4.62	0.435	3.54	2.87	1.89	1.67	1.10	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	0.555	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.578
Insecta	Diptera	Psychodidae	3.23	4.36	1.12	4.69	5.17	5.25	1.03	0	0.435	1.01	0.261	1.26	1.11	8.28	12.1
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0	0.545	0	2.73	4.31	0.875	0	0	0	0	0	0.419	0.555	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	1.08	0	0.447	0.391	0	1.75	3.42	0	1.74	0	3.00	1.05	8.33	6.76	13.3
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0.391	0	0	0	0	0	0	0	0	0.555	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0.541	0	0	0	0	0.342	0	0	0	0.261	0	0.555	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0.391	0	0	0	0.769	0	1.01	0	0	0	0	0
Insecta	Plecoptera	Capniidae	4.53	13.0	8.72	37.5	23.3	11.1	1.71	0.769	4.35	1.52	4.17	0.629	4.44	5.52	9.82
Insecta	Plecoptera	Chloroperlidae	0	0.541	0	0	0	0	0.171	0	0	0.505	0.130	0	0	0.552	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0.769	0	0	0	0	0	0	0.578
Insecta	Plecoptera	Nemouridae	1.08	15.7	7.16	19.5	9.48	6.71	22.8	33.1	11.3	15.7	25.6	19.9	1.67	1.10	4.04
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	1.08	2.70	0.671	2.73	3.45	1.17	0.214	2.31	0	1.52	0.913	0.210	0	0.552	1.73
Insecta	Plecoptera	Taeniopterygidae	0.216	2.70	0.447	3.91	3.45	0.583	0.513	3.85	0.435	1.52	0.261	0.839	0	0	0
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0.171	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0.435	0	0	0	0.0694	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	0	2.70	0.895	1.17	2.59	0	0.171	0	1.74	0.505	0	0.419	0	0.552	8.70
Insecta	Trichoptera	Rhyacophilidae	0	0	0	0	0	0	0.556	1.54	0	1.52	0.130	0.210	0	0	0
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0.555	0	0
-	-	Collembola	0	1.08	0	0.781	15.5	3.21	0.171	0	0.435	0.505	0	0.210	0	1.66	0

Note: - = not applicable.

Table G.13: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2022

Taxon			Area-based Kick Samples														
			2020														
Higher Level Classification		Family	RG_GHUT			RG_GHNF						RG_GHFF					
			RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	4.36	2.09	6.42	1.14	3.14	3.36	0	4.26	2.47	1.92	0	0.239	1.59	0.329	1.03
Collembola	Collembola	Entomobryidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0.840	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0	1.14	0	1.23	0.319	0.852	0.239	0	0.658	0.412
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	0	0	0	0	0	0	0	0.239	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0.232	0.402	0	0	0	0	0	0	0.319	0	0	0	0.329	0.619
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0.719	0	0.319	0	0	0	0	0
Insecta	Diptera	Chironomidae	51.2	59.4	64.7	29.7	34.0	7.56	19.1	23.0	14.8	46.3	26.4	72.7	54.0	76.0	46.4
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0.719	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	0	0	0	1.71	2.52	9.24	7.17	1.44	1.23	7.35	5.97	7.89	7.62	4.93	3.92
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	0	1.14	2.52	0.840	0	2.88	0	1.92	0	0	0.635	0.329	0
Insecta	Diptera	Psychodidae	9.12	8.12	8.03	2.86	3.77	8.40	8.36	2.88	1.23	4.15	0	0	3.81	1.32	0.619
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	5.21	7.66	5.22	21.7	13.2	21.9	11.9	18.0	23.5	1.92	1.70	0.478	4.76	1.97	2.06
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0.571	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0.232	0	0	0	0	0	0	0	1.60	2.27	0.957	2.22	1.97	0.825
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0	0	0	0	0.319	0	0	0	0	0
Insecta	Plecoptera	Capniidae	13.1	7.89	9.24	30.3	31.4	34.5	19.3	41.1	34.6	4.15	9.09	0.239	3.17	0.987	5.77
Insecta	Plecoptera	Chloroperlidae	0.397	0	0	0	0	1.68	0	0	0	0.319	0	0	0	0.329	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	1.26	0.840	0	0	0	0	0.284	0	0	0.329	0
Insecta	Plecoptera	Nemouridae	5.16	2.09	2.41	6.29	2.52	3.36	20.4	0	16.1	24.9	46.9	13.6	19.1	10.2	34.0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0.239	0	0	0
Insecta	Plecoptera	Perlodidae	1.19	0	0	3.43	3.14	5.88	10.2	2.13	3.70	0.958	1.70	0.718	0.952	0	1.24
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	1.14	0	1.23	0	0.284	0	1.27	0.329	0.619
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0.571	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0.402	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0.317	0	0.412
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	10.3	12.3	3.21	0.571	2.52	1.68	1.14	2.84	0	2.56	1.99	1.91	0.317	0	1.24
Insecta	Trichoptera	Rhyacophilidae	0	0	0.0125	0	0	0	0	0	0	0.639	2.56	0.478	0.317	0	0.825
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.13: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2022

Taxon			Area-based Kick Samples														
			2021														
Higher Level Classification		Family	RG_GHUT						RG_GHNF						RG_GHFF		
			RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4	RG_GHUT-5	RG_GHUT-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-4	RG_GHNF-5	RG_GHNF-6	RG_GHFF-1	RG_GHFF-2	RG_GHFF-3
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	3.61	2.73	3.57	1.67	0.439	2.31	1.08	0.702	0	0	1.79	0.336	0	0.377	0.532
Collembola	Collembola	Entomobryidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0.201	0	0.794	0	0	0.384	0	0	0	1.06	0	0	1.07	0.377	2.13
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0.333	0	0.384	0.217	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0.397	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0.201	2.48	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	70.1	78.9	66.3	82.7	75.4	60.0	58.3	49.8	65.0	40.4	43.3	57.5	82.9	86.2	55.9
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0.188	0
Insecta	Diptera	Empididae	0.602	1.24	0.794	0.667	0	1.54	3.90	1.05	0.929	1.06	4.91	0.671	6.79	1.51	11.2
Insecta	Diptera	Muscidae	1.00	0	0	0.333	0	0.384	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	0	0	0	0.0481	0	0.351	0	0	0	0	0	0.377	0
Insecta	Diptera	Psychodidae	2.61	3.97	5.95	1.33	5.70	5.38	1.08	6.32	2.79	6.38	1.79	3.69	0	3.39	1.60
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0.188	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	1.61	3.23	3.17	2.00	3.07	2.69	3.04	1.05	3.72	2.13	4.91	4.53	0	0.188	0.532
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0.384	0	0	0	0	0	0	0	0	0.532
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	9.24	2.23	8.33	2.33	1.75	7.69	9.54	20.4	14.9	5.32	14.7	24.3	0	0.377	1.06
Insecta	Plecoptera	Chloroperlidae	0	0	0.397	0	0	0	0.217	0	0	1.06	0	0	0	0	0.532
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	8.03	0.993	1.59	2.33	1.32	5.38	16.7	12.3	10.5	23.4	15.2	5.37	7.14	3.39	20.2
Insecta	Plecoptera	Peltoperlidae	0.201	0.248	0	0	0.439	0.769	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	1.41	1.49	3.97	0.667	2.63	5.00	3.71	4.56	0.310	5.32	8.04	2.18	0.357	0.377	0.532
Insecta	Plecoptera	Taeniopterygidae	0.402	0	0	0	0.877	1.15	0.867	0.702	1.55	2.13	2.68	1.17	1.43	1.51	1.06
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0.744	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	0.402	1.74	4.76	5.33	8.33	5.77	1.30	2.81	0.310	9.57	2.23	0	0	1.13	1.60
Insecta	Trichoptera	Rhyacophilidae	0.402	0	0	0.333	0	0.769	0	0	0	0	0	0	0.357	0.188	2.66
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	0	2.13	0.446	0.168	0	0.188	0

Note: - = not applicable.

Table G.13: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2022

Taxon			Area-based Kick Samples					
			2022					
Higher Level Classification		Family	RG_GHFF			RG_GHNF		
			RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3
Clitellata	Tubificida	Naididae	0	0	0	0.643	2.62	1.11
Clitellata	-	Enchytraeidae	0.327	0.810	1.74	1.29	0	0
Collembola	Collembola	Entomobryidae	0	0	0	0	0.581	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0	0	0.291	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0.405	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0.654	0.810	0.651	0	0.581	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	82.3	74.9	74.4	27.0	43.3	80.1
Insecta	Diptera	Dixidae	0	0	0	0	0	0
Insecta	Diptera	Empididae	4.58	5.26	7.81	7.72	6.69	0.923
Insecta	Diptera	Muscidae	0	0	0	0	0	0.185
Insecta	Diptera	Pelecorhynchidae	0	0	0	0.643	1.16	0
Insecta	Diptera	Psychodidae	0.980	2.83	2.60	1.29	7.85	1.85
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	0.327	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	0	0.405	0	0.643	2.33	0.185
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0.217	0.643	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	0	0.405	0.651	28.9	8.43	4.67
Insecta	Plecoptera	Chloroperlidae	0	0	0	4.09	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	6.21	10.1	9.11	3.07	0.581	0.373
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0.327	0.405	0.651	21.5	11.3	10.6
Insecta	Plecoptera	Taeniopterygidae	3.92	1.62	2.17	0	0	0
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	0	1.62	0	2.57	13.9	0
Insecta	Trichoptera	Rhyacophilidae	0.327	0.405	0	0	0.317	0
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0

Note: - = not applicable.

Table G.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density											
Higher Level Classification		Family	Lowest Practical Level Identification	2016						2017					
				RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	377	340	272	461	1,430	373	63	50	47	140	540	137
Clitellata	Tubificida	Naididae	Chaetogaster	0	0	0	0	0	0	0	0	0	10	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	223	1,190	1,371	1,547	0	0	0	20	67	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	470	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	70	19	148	0	0	587	0	0	0	10	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	28	699	1,039	1,152	2,682	4,507	27	313	443	23	200	697
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	78	208	322	422	298	308	57	63	17	87	27	77
Euchelicerata	Trombidiformes	Neoacaridae	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	20	0	0	0	0	39	0	0	0	0	0	7
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	7	0	0	0	13
Gastropoda	Basommatophora	Planorbidae	Gyraulus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	140	117	152	192	0	0	0	10	10	20	7	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	13	0	0	0	0	7
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	14	0	28	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	37	31	32	0	0	0	80	25	45	13	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	6	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0	0	0	30	0	0	0	0	0	16
Insecta	Diptera	Chironomidae	Heleniella	0	31	0	0	72	30	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	32	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0	0	0	0	4	0	0
Insecta	Diptera	Chironomidae	Micropsectra	221	94	712	576	579	628	23	303	101	257	230	144
Insecta	Diptera	Chironomidae	Nanocladius	0	31	97	58	0	0	0	0	0	4	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	37	0	32	0	0	0	11	10	11	0	8	16
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	11	5	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	74	0	129	58	72	30	28	15	6	44	38	25
Insecta	Diptera	Chironomidae	Psectrocladius	0	0	0	0	0	0	0	0	6	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	37	63	226	115	289	269	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	8
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	131	31	33
Insecta	Diptera	Chironomidae	Tvetenia	0	31	0	0	0	0	0	5	6	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	3	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	38	74	154	60	267	0	7	13	10	0	33
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	42	243	172	77	189	27	3	23	7	10	47	7
Insecta	Diptera	Psychodidae	Pericoma	1,146	1,502	2,254	1,920	1,788	507	577	423	527	277	417	433
Insecta	Diptera	Simuliidae	Simuliidae	168	567	247	307	0	613	117	313	273	53	177	357
Insecta	Diptera	Tipulidae	Antocha	14	19	25	346	179	133	3	0	0	0	33	90
Insecta	Diptera	Tipulidae	Dicranota	14	57	49	38	0	27	70	60	87	20	47	50
Insecta	Diptera	Tipulidae	Hexatoma	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	3	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	84	38	74	115	179	53	60	23	13	3	20	63
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	43	67	7	10	7	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	14	0	0	0	0	0	23	10	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density											
Higher Level Classification		Family	Lowest Practical Level Identification	2016						2017					
				RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0	0	0	0	0	0	0	0	7	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	112	19	223	77	119	27	10	3	7	43	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	28	0	0	0	60	0	0	0	0	3	0	7
Insecta	Plecoptera	Nemouridae	Malenka	531	888	798	422	715	293	67	83	40	97	103	63
Insecta	Plecoptera	Nemouridae	Zapada	671	661	322	729	596	107	683	623	650	383	357	350
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	13	0	0	0	0	27	13	7	0	0	7	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	25	0	0	27	7	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	3	0	0	0	90	0
Insecta	Trichoptera	Brachycentridae	Micrasema	14	151	74	269	656	1,467	20	20	30	30	0	257
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	56	38	420	729	596	880	0	0	0	3	40	110
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	126	19	198	38	0	0	43	30	0	10	33	13
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	38	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	233	283	247	576	467	160	77	70	217	0	77	117
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Hyalellidae	Hyalella	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density											
Higher Level Classification		Family	Lowest Practical Level Identification	2018						2019					
				RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	93	147	320	193	287	123	47	147	777	87	387	333
Clitellata	Tubificida	Naididae	Chaetogaster	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	0	20	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	13	67	37	23	13	40	23	7	93	7
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	13	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	3	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	27	213	40	320	73	70	13	20	43	13	80	7
Euchelicerata	Trombidiformes	Neoacaridae	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	13	0	0	20	0	10	13	20	0	0	7	7
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	Gyraulus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	13	0	0	7	3	3	13	0	0	0	7	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	20	0	3	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	7	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	17	52	35	39	0	0	8	56	0	10	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0	0	0	4	0	14	0	0	12	0
Insecta	Diptera	Chironomidae	Heleniella	34	0	141	13	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	7
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	272	288	353	26	39	86	71	169	255	50	36	105
Insecta	Diptera	Chironomidae	Nanocladius	0	0	0	0	4	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	0	0	0	0	0	0	0	0	0	0	7
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	17	0	35	26	0	0	0	0	7	3	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	340	366	141	77	26	30	8	14	7	3	12	14
Insecta	Diptera	Chironomidae	Psectrocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	7	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	40	40	20	17	3	7	13	3	0	0	13
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	27	27	107	3	7	0	27	37	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	1,333	3,947	1,267	1,987	750	307	87	427	737	60	927	87
Insecta	Diptera	Simuliidae	Simuliidae	120	227	333	7	3	27	480	1,147	267	43	587	160
Insecta	Diptera	Tipulidae	Antocha	0	0	0	13	3	17	0	0	3	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	40	53	40	13	7	3	7	40	13	3	47	33
Insecta	Diptera	Tipulidae	Hexatoma	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	20	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	173	427	227	293	70	93	720	2,653	1,350	220	1,200	1,033
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density											
Higher Level Classification		Family	Lowest Practical Level Identification	2018						2019					
				RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	13	3	13	13	7	10	73	40	53	17	87	20
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	67	147	27	313	120	127	100	267	37	27	73	27
Insecta	Plecoptera	Nemouridae	Zapada	1,720	2,227	1,347	1,100	430	383	853	1,400	293	40	940	160
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	3	0	0	0	0	0	0	7	0	13	7
Insecta	Plecoptera	Perlodidae	Skwala	13	13	0	0	0	3	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	13	27	13	33	30	180	27	40	17	3	73	153
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	27	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	3	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	0	0	0	0	10	33	7	0	10	0	0	7
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	80	267	53	40	110	37	67	93	37	3	0	67
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	7	0	0	0	0	7
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	387	413	440	153	90	107	253	867	163	33	187	67
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	7
Malacostraca	Amphipoda	Hyalellidae	Hyalella	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density											
Higher Level Classification		Family	Lowest Practical Level Identification	2020								2021			
				GH_GH1_AS-1	GH_GH1_AS-2	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4
Bivalvia	Veneroida	Pisidiidae	Pisidium	3,653	2,133	1,200	373	1,947	2,307	2,947	500	3,204	624	2,436	1,440
Clitellata	Tubificida	Naididae	Chaetogaster	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	613	693	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	187	0	0	0	0	13	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	800	160	40	10	53	27	53	17	12	54	12	36
Collembola	Collembola	-	Collembola	0	0	13	0	0	0	0	0	0	6	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	53	107	53	20	93	53	40	3	60	12	24	24
Euchelicerata	Trombidiformes	Neoacaridae	Neoacaridae	0	0	0	0	0	13	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	373	907	0	0	0	0	0	7	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	24
Gastropoda	Basommatophora	Planorbidae	Gyraulus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	53	13	27	13	13	3	60	24	12	12
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	13	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	12	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	18	0	12
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	18	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	22	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	41	32	65	19	55	4	0	27	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	33	0	20	0	0	0	0	0	0	14	108	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	458	360	265	53	195	427	589	65	0	14	36	108
Insecta	Diptera	Chironomidae	Nanocladius	0	0	0	0	0	19	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	98	60	0	21	0	19	18	0	0	96	0	0
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	11	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	0	480	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	4	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	327	60	20	11	65	37	92	13	24	41	0	0
Insecta	Diptera	Chironomidae	Psectrocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	98	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	27	0	0	0	0	6	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	27	160	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	7	0	0	0	7	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	27	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	27	27	27	3	48	84	3	3
Insecta	Diptera	Psychodidae	Pericoma	133	53	880	517	1,560	2,053	840	517	864	1,560	288	924
Insecta	Diptera	Simuliidae	Simuliidae	880	853	53	67	53	27	93	13	0	48	96	72
Insecta	Diptera	Tipulidae	Antocha	0	53	0	0	13	0	0	10	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	240	320	0	13	27	13	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Hexatoma	4	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	80	53	133	230	293	307	200	260	0	6	24	24
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density											
Higher Level Classification		Family	Lowest Practical Level Identification	2020								2021			
				GH_GH1_AS-1	GH_GH1_AS-2	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	13	0	0	0	13	0	12	0	0	12
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	13	23	27	53	27	0	12	6	36	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	13	3	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	17	10	32	14	15	5	396	282	591	511
Insecta	Plecoptera	Nemouridae	Zapada	240	107	530	977	341	466	452	88	240	1,137	693	1,457
Insecta	Plecoptera	Perlodidae	Isoperla	27	0	0	3	0	0	0	10	0	6	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	53	53	40	53	147	240	173	460	84	84	84	180
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	1,840	2,187	0	0	0	0	0	3	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	0	0	0	0	0	0	13	7	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	53	267	160	37	187	240	320	27	12	24	72	12
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	13	0	0	0	12	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	107	230	347	213	533	27	144	312	267	651
Malacostraca	Amphipoda	Gammaridae	Gammarus	987	1,013	7	0	27	17	27	27	132	15	36	72
Malacostraca	Amphipoda	Hyalellidae	Hyalella	160	427	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density							
Higher Level Classification		Family	Lowest Practical Level Identification	2021		2022					
				RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	3,804	3,588	744	432	624	792	402	123
Clitellata	Tubificida	Naididae	Chaetogaster	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	339	84	6	18	84	96	0	12
Collembola	Collembola	-	Collembola	0	0	6	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	72	36	12	0	24	12	18	18
Euchelicerata	Trombidiformes	Neoacaridae	Neoacaridae	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	6	9
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	3
Gastropoda	Basommatophora	Planorbidae	Gyraulus	0	0	0	0	0	0	6	3
Insecta	Coleoptera	Elmidae	Heterlimnius	24	0	6	6	24	36	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	12	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	12	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	19	0	8	0	15	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	8	9	31	14	7	0
Insecta	Diptera	Chironomidae	Heleniella	19	0	0	0	15	14	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	8	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	9	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	457	90	16	99	139	101	58	9
Insecta	Diptera	Chironomidae	Nanocladius	0	0	0	0	0	0	0	6
Insecta	Diptera	Chironomidae	Orthocladius complex	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	0	18	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	57	0	16	9	15	0	7	0
Insecta	Diptera	Chironomidae	Psectrocladius	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	32	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	8	0	0	14	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	24	12	6	0	0	0	6	3
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	72	12	0	0	48	42	12	0
Insecta	Diptera	Psychodidae	Pericoma	6,168	912	246	708	1,092	2,856	588	186
Insecta	Diptera	Simuliidae	Simuliidae	108	24	246	186	228	516	72	87
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	45
Insecta	Diptera	Tipulidae	Dicranota	12	0	6	18	60	72	6	3
Insecta	Diptera	Tipulidae	Hexatoma	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	72	12	402	192	552	360	414	228
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2016 to 2022

Taxon				Density							
Higher Level Classification		Family	Lowest Practical Level Identification	2021		2022					
				RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	6	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	120	0	18	12	36	96	12	3
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	24	6	0
Insecta	Plecoptera	Nemouridae	Malenka	1,130	192	105	30	72	108	36	40
Insecta	Plecoptera	Nemouridae	Zapada	1,925	588	543	222	288	216	42	14
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	36	6	36	48	0	3
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	360	516	12	12	24	0	60	276
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	3
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	180	60	0	0	0	0	0	3
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	1,035	240	240	225	471	588	60	39
Malacostraca	Amphipoda	Gammaridae	Gammarus	210	78	6	12	0	15	18	0
Malacostraca	Amphipoda	Hyalellidae	Hyalella	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Three-minute Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014	2015		2018	2019	2020	2021			2022		
				RG_GHCKD	RG_GHCKD	RG_GHCKD	GREE1-50	RG_GHCKD	RG_GHCKD	RG_GHCKD	RG_GHCKD			RG_GHCKD		
				RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	GREE1-50-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3
Bivalvia	Veneroida	Pisidiidae	Pisidiidae	0.0483	0	5.11	0	17.8	16.2	7.31	15.9	19.0	23.2	18.3	17.6	24.1
Bivalvia	Veneroida	Pisidiidae	Pisidium	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Lumbriculida	Lumbriculidae	Lumbriculidae	0	0	0	0	0	0.826	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Chaetogaster	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais	0.532	2.79	0.189	0	1.20	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	12.3	0	0	0	0	0.771	0.935	0.587	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	3.41	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	Hypogastruridae	Hypogastruridae	0	0	0	0	0	0	0	0.257	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0.189	0	0	0	0	0.257	0.312	0.293	0.631	0.309	0.487
Euchelicerata	Trombidiformes	Aturidae	Aturidae	0	0	1.03	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	Feltria	0	1.24	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Protzia	0	0	0	0	0	0	0.292	0	0	0	0	0	0.649
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.0725	0.310	1.44	0	1.51	1.03	0.292	0.257	0.312	2.64	0.946	1.54	1.30
Euchelicerata	Trombidiformes	Neoacaridae	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0.0725	0	0	0	0	0.344	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	Gyraulus	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	Promenetus	0	0	0	0	0	0	0	0	0	0	0	0.309	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0.275	0	0.257	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0.877	0.257	0	0	0.315	0.309	0.487
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0.379	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0.0483	0	0	0	0.301	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia/ Palpomyia	0	0	0.189	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Mallochohelea	0.0483	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	2.63	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0.337	0.565	0	0	0	0	1.51	0	2.51
Insecta	Diptera	Chironomidae	Diamesa	0	0.964	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0.532	0.964	0.201	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0.401	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Labrundinia	0	0.964	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0	0	0	0	0	0	0.449	0
Insecta	Diptera	Chironomidae	Micropsectra	13.3	0.321	17.3	0	6.41	9.32	0	0.720	2.08	1.23	0.505	3.59	27.7
Insecta	Diptera	Chironomidae	Nanocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	1.20	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	0.643	0	0	0	0.565	0	0	0.692	0.411	0	0.449	0
Insecta	Diptera	Chironomidae	Pagastia	0	0.321	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	1.69	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0.0967	0	0	0	0	0.565	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0.643	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	2.01	0	0	0	0	0	0	0	0.505	0	0
Insecta	Diptera	Chironomidae	Procladius	0	0	0.401	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Three-minute Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014	2015		2018	2019	2020	2021			2022		
				RG_GHCKD	RG_GHCKD	RG_GHCKD	GREE1-50	RG_GHCKD	RG_GHCKD	RG_GHCKD	RG_GHCKD			RG_GHCKD		
				RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	GREE1-50-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3
Insecta	Diptera	Chironomidae	Psectrocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	11.9	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	6.22	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0.201	0	0	0	0	2.16	2.77	1.64	0	0	0
Insecta	Diptera	Chironomidae	Thienemannimyia group	0.0967	0.321	5.42	0	0	0.282	0	0	0.692	0.821	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	0.201	0	0	0	0	0.720	0	0	0	0.449	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0.193	4.02	1.70	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0.312	0	0	0.309	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0.189	0	0	1.10	0	0	0	0	0.631	0	0
Insecta	Diptera	Psychodidae	Pericoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	3.04	23.5	8.33	0	26.8	19.3	14.6	8.23	19.3	32.3	30.3	31.5	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	77.1	13.0	8.71	0	0.602	3.31	12.6	3.60	2.49	0.293	9.15	4.32	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0.293	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0.483	0.619	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0.290	2.17	0.568	0	0.452	0	0	0	0	0	0.315	0.309	0
Insecta	Diptera	Tipulidae	Hexatoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0.310	0.568	0	0.452	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0.379	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0.310	5.30	0	2.71	28.4	7.31	0.771	0.623	0.293	8.20	12.0	17.0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0.379	0	0	0	0	0.257	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	1.17	0.257	0	0	0	0	0.243
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0.514	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0.193	0	0.379	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0.292	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0.0483	1.24	2.65	0	0.602	0.826	0.585	0.257	0.623	0.587	0.663	1.27	1.22
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0.189	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Amphinemura	0	0	1.23	0	0	0	0	0	0	0	1.66	3.49	3.41
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	10.8	1.23	2.49	24.3	12.4	8.76	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0.725	6.50	1.23	0	8.49	4.00	31.4	19.9	26.2	11.5	8.62	5.71	5.60
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0.310	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0.292	0	0	0	0.663	0.635	0.973
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0.310	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Pteronarcyidae	Pteronarcella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	0	0.292	0.771	0	1.47	1.33	0	0.243
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0.0483	0	0	0	0	2.73	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0.619	2.99	0	1.45	0	1.49	2.35	1.56	3.38	0	0.383	0.292
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0.338	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0.435	0	0.249	0	0	0	0.893	0.293	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Three-minute Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014	2015		2018	2019	2020	2021			2022		
				RG_GHCKD	RG_GHCKD	RG_GHCKD	GREE1-50	RG_GHCKD	RG_GHCKD	RG_GHCKD	RG_GHCKD			RG_GHCKD		
				RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	GREE1-50-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3
Insecta	Trichoptera	Hydropsychidae	Parapsyche elsis	0	0	0	0	0	0	0.298	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptila	0	0	1.74	0	5.78	0.911	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	0	0.929	0	0	8.67	4.56	2.68	0.293	0.312	1.84	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0.0483	0	0.249	0	0	0	0.595	0.879	0	0	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0.0483	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0.242	9.91	2.24	0	1.45	1.21	3.57	4.98	4.67	3.99	5.22	1.91	3.80
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna grou	0.870	14.6	1.99	0	2.53	2.43	7.14	7.92	3.12	3.69	8.00	7.27	9.05
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila narvae	0	0	0	0	0	0	0	0	0	0	0.348	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	1.06	0	0.631	0	0	0	0.877	2.57	1.56	0.880	2.21	5.86	0.973
Malacostraca	Amphipoda	Hyalellidae	Hyalella	0	0.310	0.316	0	0	0	0	0.257	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples											
Higher Level Classification		Family	Lowest Practical Level Identification	2016						2017					
				RG_GHBP						RG_GHBP					
				RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	Pisidiidae	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Pisidiidae	Pisidium	8.58	5.49	2.98	4.58	11.5	2.88	2.96	1.95	1.82	8.16	20.7	4.37
Clitellata	Lumbriculida	Lumbriculidae	Lumbriculidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Chaetogaster	0	0	0	0	0	0	0	0	0	0.583	0	0
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	2.44	11.8	11.1	11.9	0	0	0	1.17	2.56	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	5.15	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	1.59	0.305	1.63	0	0	4.53	0	0	0	0.583	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0.636	11.3	11.4	11.4	21.6	34.8	1.25	12.2	17.3	1.36	7.67	22.3
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	Hypogastruridae	Hypogastruridae	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Aturidae	Aturidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	Feltria	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Protzia	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	1.78	3.36	3.53	4.20	2.40	2.38	2.65	2.46	0.649	5.05	1.02	2.45
Euchelicerata	Trombidiformes	Neoacaridae	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0.445	0	0	0	0	0.297	0	0	0	0	0	0.213
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0.259	0	0	0	0.426
Gastropoda	Basommatophora	Planorbidae	Gyraulus	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	Promenetus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	3.18	1.89	1.66	1.91	0	0	0	0.389	0.390	1.17	0.256	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0.623	0	0	0	0	0.213
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia/ Palpomyia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0.318	0	0.308	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Mallochohelea	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0.838	0.509	0.355	0	0	0	3.72	0.982	1.75	0.762	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0.219	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0	0	0	0.231	0	0	0	0	0	0.527
Insecta	Diptera	Chironomidae	Heleniella	0	0.509	0	0	0.584	0.231	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0.355	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Labrundinia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0	0	0	0	0.254	0	0
Insecta	Diptera	Chironomidae	Micropsectra	5.03	1.53	7.80	5.73	4.67	4.84	1.06	11.8	3.94	15.0	8.82	4.61
Insecta	Diptera	Chironomidae	Nanocladius	0	0.509	1.06	0.573	0	0	0	0	0	0.254	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0.838	0	0.355	0	0	0	0.531	0.393	0.438	0	0.294	0.527
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	0.531	0.196	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	1.68	0	1.42	0.573	0.584	0.231	1.33	0.589	0.219	2.54	1.47	0.791
Insecta	Diptera	Chironomidae	Procladius	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples											
Higher Level Classification		Family	Lowest Practical Level Identification	2016						2017					
				RG_GHBP						RG_GHBP					
				RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Insecta	Diptera	Chironomidae	Psectrocladius	0	0	0	0	0	0	0	0	0.219	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0.838	1.02	2.48	1.15	2.34	2.08	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0.264
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	7.62	1.18	1.05
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0.509	0	0	0	0	0	0.196	0.219	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0.156	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0.611	0.814	1.53	0.481	2.06	0	0.259	0.519	0.583	0	1.06
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0.954	3.93	1.88	0.763	1.52	0.206	0.156	0.908	0.260	0.583	1.79	0.213
Insecta	Diptera	Psychodidae	Pericoma	26.1	24.3	24.7	19.1	14.4	3.91	26.9	16.5	20.5	16.1	16.0	13.8
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	3.81	9.16	2.71	3.05	0	4.73	5.45	12.2	10.6	3.11	6.78	11.4
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0.318	0.305	0.271	3.44	1.44	1.03	0.156	0	0	0	1.28	2.88
Insecta	Diptera	Tipulidae	Dicranota	0.318	0.916	0.543	0.382	0	0.206	3.27	2.33	3.38	1.17	1.79	1.60
Insecta	Diptera	Tipulidae	Hexatoma	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0.156	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	1.91	0.611	0.814	1.15	1.44	0.412	2.80	0.908	0.519	0.194	0.767	2.02
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	2.02	2.59	0.260	0.583	0.256	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0.318	0	0	0	0	0	1.09	0.389	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0	0	0	0	0	0	0	0	0.256	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	2.54	0.305	2.44	0.763	0.962	0.206	0.467	0.130	0.260	2.52	0	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0.636	0	0	0	0.481	0	0	0	0	0.194	0	0.213
Insecta	Plecoptera	Nemouridae	Amphinemura	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	12.1	14.3	8.75	4.20	5.77	2.26	3.12	3.24	1.56	5.63	3.96	2.02
Insecta	Plecoptera	Nemouridae	Zapada	15.3	10.7	3.53	7.25	4.81	0.823	31.9	24.2	25.3	22.3	13.7	11.2
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0.303	0	0	0	0	0.206	0.623	0.259	0	0	0.256	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Pteronarcyidae	Pteronarcella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0.271	0	0	0.206	0.312	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0.156	0	0	0	3.45	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0.318	2.44	0.814	2.67	5.29	11.3	0.935	0.778	1.17	1.75	0	8.20
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples											
Higher Level Classification		Family	Lowest Practical Level Identification	2016						2017					
				RG_GHBP						RG_GHBP					
				RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Insecta	Trichoptera	Hydropsychidae	Parapsyche elsis	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptila	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	1.27	0.611	4.61	7.25	4.81	6.79	0	0	0	0.194	1.53	3.51
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	2.86	0.305	2.17	0.382	0	0	2.02	1.17	0	0.583	1.28	0.426
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0.382	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna grou	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila narvae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	5.30	4.58	2.71	5.73	3.77	1.23	3.58	2.72	8.44	0	2.94	3.73
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Hyalellidae	Hyalella	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples											
Higher Level Classification		Family	Lowest Practical Level Identification	2018						2019					
				RG_GHBP						RG_GHBP					
				RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	Pisidiidae	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Pisidiidae	Pisidium	1.94	1.65	6.52	3.93	13.5	7.30	1.61	1.95	18.7	13.8	8.11	14.3
Clitellata	Lumbriculida	Lumbriculidae	Lumbriculidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Chaetogaster	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	0	0.407	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0.272	1.36	1.73	1.38	0.459	0.533	0.563	1.06	1.96	0.286
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	Hypogastruridae	Hypogastruridae	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0.178	0	0	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Aturidae	Aturidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	Feltria	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Protzia	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0.532	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.554	2.40	0.815	6.50	3.46	4.14	0.459	0.266	1.05	2.13	1.68	0.286
Euchelicerata	Trombidiformes	Neoacaridae	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0.277	0	0	0.407	0	0.592	0.459	0.266	0	0	0.140	0.286
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	Gyraulus	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	Promenetus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0.277	0	0	0.136	0.157	0.197	0.459	0	0	0	0.140	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0.407	0	0.197	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia/ Palpomyia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0.229	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Mallochohelea	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0.353	0.589	0.720	0.784	0	0	0.271	0.750	0	1.60	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0	0	0	0.222	0	0.187	0	0	0.252	0
Insecta	Diptera	Chironomidae	Heleniella	0.706	0	2.88	0.261	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Labrundinia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0.301
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	5.65	3.24	7.20	0.523	1.86	5.10	2.44	2.25	6.16	7.98	0.755	4.51
Insecta	Diptera	Chironomidae	Nanocladius	0	0	0	0	0.206	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	0	0	0	0	0	0	0	0	0	0	0.301
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0.353	0	0.720	0.523	0	0	0	0	0.179	0.532	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	7.06	4.12	2.88	1.57	1.24	1.78	0.271	0.187	0.179	0.532	0.252	0.602
Insecta	Diptera	Chironomidae	Procladius	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples											
Higher Level Classification		Family	Lowest Practical Level Identification	2018						2019					
				RG_GHBP						RG_GHBP					
				RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Insecta	Diptera	Chironomidae	Psectrocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0.229	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0.450	0.815	0.407	0.786	0.197	0.229	0.178	0.0805	0	0	0.571
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0.300	0.543	2.17	0.157	0.394	0	0.355	0.885	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	27.7	44.4	25.8	40.4	35.4	18.1	2.98	5.68	17.8	9.57	19.4	3.71
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	2.49	2.55	6.79	0.136	0.157	1.58	16.5	15.3	6.44	6.91	12.3	6.86
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0.271	0.157	0.986	0	0	0.0805	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0.831	0.600	0.815	0.271	0.314	0.197	0.229	0.533	0.322	0.532	0.979	1.43
Insecta	Diptera	Tipulidae	Hexatoma	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0.688	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	3.60	4.80	4.62	5.96	3.30	5.52	24.8	35.4	32.6	35.1	25.2	44.3
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0.277	0.0375	0.272	0.271	0.314	0.592	2.52	0.533	1.29	2.66	1.82	0.857
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Amphinemura	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	1.39	1.65	0.543	6.37	5.66	7.50	3.44	3.55	0.885	4.26	1.54	1.14
Insecta	Plecoptera	Nemouridae	Zapada	35.7	25.1	27.4	22.4	20.3	22.7	29.4	18.6	7.08	6.38	19.7	6.86
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.0375	0	0	0	0	0	0	0.161	0	0.280	0.286
Insecta	Plecoptera	Perlodidae	Skwala	0.277	0.150	0	0	0	0.197	0	0	0	0	0	0
Insecta	Plecoptera	Pteronarcyidae	Pteronarcella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0.277	0.300	0.272	0.678	1.42	10.6	0.917	0.533	0.402	0.532	1.54	6.57
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0.554	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0.0805	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples											
				2018						2019					
				RG_GHBP						RG_GHBP					
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Insecta	Trichoptera	Hydropsychidae	Parapsyche elsis	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptila	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	0	0	0	0	0.472	1.97	0.229	0	0.241	0	0	0.286
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	1.66	3.00	1.09	0.813	5.19	2.17	2.29	1.24	0.885	0.532	0	2.86
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0.229	0	0	0	0	0.286
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna grou	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila narvae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	8.03	4.65	8.97	3.12	4.25	6.31	8.72	11.6	3.94	5.32	3.92	2.86
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0.286
Malacostraca	Amphipoda	Hyalellidae	Hyalella	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples											
				2020								2021			
Higher Level Classification		Family	Lowest Practical Level Identification	GH_GH1_AS		RG_GHBP						RG_GHBP			
				GH_GH1_AS-1	GH_GH1_AS	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4
Bivalvia	Veneroida	Pisidiidae	Pisidiidae	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Pisidiidae	Pisidium	31.9	20.3	32.8	13.8	34.9	34.8	44.7	24.0	60.4	13.9	50.3	25.8
Clitellata	Lumbriculida	Lumbriculidae	Lumbriculidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Chaetogaster	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	5.36	6.60	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	1.63	0	0	0	0	0.201	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	6.99	1.52	1.09	0.369	0.957	0.402	0.810	0.800	0.226	1.20	0.248	0.646
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	Hypogastruridae	Hypogastruridae	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0.364	0	0	0	0	0	0	0.133	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Aturidae	Aturidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	Feltria	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Protzia	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.466	1.02	1.46	0.738	1.67	0.804	0.607	0.160	1.13	0.267	0.496	0.431
Euchelicerata	Trombidiformes	Neoacaridae	Neoacaridae	0	0	0	0	0	0.201	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	3.26	8.63	0	0	0	0	0	0.320	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0.431
Gastropoda	Basommatophora	Planorbidae	Gyraulus	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	Promenetus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	1.46	0.492	0.478	0.201	0.202	0.160	1.13	0.533	0.248	0.215
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0.201	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia/ Palpomyia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0.248	0
Insecta	Diptera	Ceratopogonidae	Mallochohelea	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0.400	0	0.215
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0.280	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0.389	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	1.11	1.17	1.17	0.280	0.839	0.208	0	0.610	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0.286	0	0.557	0	0	0	0	0	0	0.305	2.23	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Labrundinia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	4.00	3.43	7.24	1.95	3.50	6.44	8.95	3.12	0	0.305	0.743	1.94
Insecta	Diptera	Chironomidae	Nanocladius	0	0	0	0	0	0.280	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0.857	0.571	0	0.779	0	0.280	0.280	0	0	2.13	0	0
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0.390	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	0	4.57	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0.208	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	2.86	0.571	0.557	0.390	1.17	0.560	1.40	0.624	0.452	0.914	0	0
Insecta	Diptera	Chironomidae	Procladius	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples											
				2020								2021			
Higher Level Classification		Family	Lowest Practical Level Identification	GH_GH1_AS		RG_GHBP						RG_GHBP			
				GH_GH1_AS-1	GH_GH1_AS	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4
Insecta	Diptera	Chironomidae	Psectrocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0.857	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0.478	0	0	0	0	0.133	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0.233	1.52	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	0.246	0	0	0	0.320	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0.233	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0.478	0.402	0.405	0.160	0.905	1.87	0.0620	0.0538
Insecta	Diptera	Psychodidae	Pericoma	1.17	0.508	24.0	19.1	28.0	31.0	12.8	24.8	16.3	34.7	5.95	16.6
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	7.69	8.12	1.46	2.46	0.957	0.402	1.42	0.640	0	1.07	1.98	1.29
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0.508	0	0	0.239	0	0	0.480	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	2.09	3.05	0	0.492	0.478	0.201	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Hexatoma	0.0327	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0.699	0.508	3.64	8.49	5.26	4.63	3.04	12.5	0	0.133	0.496	0.431
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0.364	0	0	0	0.202	0	0.226	0	0	0.215
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0.364	0.861	0.478	0.804	0.405	0	0.226	0.133	0.743	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0.202	0.160	0	0	0	0
Insecta	Plecoptera	Nemouridae	Amphinemura	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0.467	0.373	0.582	0.213	0.229	0.236	7.47	6.27	12.2	9.16
Insecta	Plecoptera	Nemouridae	Zapada	2.10	1.02	14.5	36.0	6.12	7.03	6.86	4.24	4.52	25.3	14.3	26.1
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0.233	0	0	0.123	0	0	0	0.480	0	0.133	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Pteronarcyidae	Pteronarcella	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0.466	0.508	1.09	1.97	2.63	3.62	2.63	22.1	1.58	1.87	1.73	3.23
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	16.1	20.8	0	0	0	0	0	0.160	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples											
				2020								2021			
Higher Level Classification		Family	Lowest Practical Level Identification	GH_GH1_AS		RG_GHBP						RG_GHBP			
				GH_GH1_AS-1	GH_GH1_AS	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4
Insecta	Trichoptera	Hydropsychidae	Parapsyche elsis	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptila	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	0	0	0	0	0	0	0.202	0.320	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0.466	2.54	4.37	1.35	3.35	3.62	4.86	1.28	0.226	0.533	1.49	0.215
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0.202	0	0	0	0.248	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna grou	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila narvae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	0	0	2.91	8.49	6.22	3.22	8.10	1.28	2.71	6.93	5.51	11.7
Malacostraca	Amphipoda	Gammaridae	Gammarus	8.62	9.64	0.182	0	0.478	0.251	0.405	1.28	2.49	0.333	0.743	1.29
Malacostraca	Amphipoda	Hyalellidae	Hyalella	1.40	4.06	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples							
Higher Level Classification		Family	Lowest Practical Level Identification	2021		2022					
				RG_GHBP		RG_GHBP					
				RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	Pisidiidae	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Pisidiidae	Pisidium	23.4	55.5	27.1	19.6	16.1	13.2	21.9	11.0
Clitellata	Lumbriculida	Lumbriculidae	Lumbriculidae	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Chaetogaster	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	2.09	1.30	0.219	0.816	2.17	1.59	0	1.08
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0
Collembola	Collembola	Hypogastruridae	Hypogastruridae	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0.219	0	0	0	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Aturidae	Aturidae	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	Feltria	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Protzia	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.444	0.557	0.438	0	0.619	0.199	0.980	1.61
Euchelicerata	Trombidiformes	Neoacaridae	Neoacaridae	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0.327	0.806
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0.269
Gastropoda	Basommatophora	Planorbidae	Gyraulus	0	0	0	0	0	0	0.327	0.269
Gastropoda	Basommatophora	Planorbidae	Promenetus	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0.148	0	0.219	0.272	0.619	0.598	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0.0739	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia/ Palpomyia	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Mallochohelea	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0.0739	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0.117	0	0.292	0	0.398	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0.292	0.408	0.795	0.239	0.392	0
Insecta	Diptera	Chironomidae	Heleniella	0.117	0	0	0	0.398	0.239	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0.292	0	0	0	0	0
Insecta	Diptera	Chironomidae	Labrundinia	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0.408	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	2.81	1.39	0.584	4.49	3.58	1.67	3.14	0.806
Insecta	Diptera	Chironomidae	Nanocladius	0	0	0	0	0	0	0	0.538
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	0	0.279	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0.352	0	0.584	0.408	0.398	0	0.392	0
Insecta	Diptera	Chironomidae	Procladius	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples							
				2021		2022					
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHBP		RG_GHBP					
				RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Insecta	Diptera	Chironomidae	Psectrocladius	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	1.17	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemannimyia group	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	0.292	0	0	0.239	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0.148	0.186	0.219	0	0	0	0.327	0.269
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0.444	0.186	0	0	1.24	0.698	0.654	0
Insecta	Diptera	Psychodidae	Pericoma	38.0	14.1	8.97	32.1	28.1	47.4	32.0	16.7
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0.665	0.371	8.97	8.44	5.88	8.57	3.92	7.80
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	4.03
Insecta	Diptera	Tipulidae	Dicranota	0.0739	0	0.219	0.816	1.55	1.20	0.327	0.269
Insecta	Diptera	Tipulidae	Hexatoma	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0.444	0.186	14.7	8.71	14.2	5.98	22.6	20.4
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0.219	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0.739	0	0.656	0.544	0.928	1.59	0.654	0.269
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0.399	0.327	0
Insecta	Plecoptera	Nemouridae	Amphinemura	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	6.96	2.97	3.81	1.34	1.86	1.79	1.96	3.55
Insecta	Plecoptera	Nemouridae	Zapada	11.9	9.10	19.8	10.1	7.42	3.59	2.29	1.29
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	1.31	0.272	0.928	0.797	0	0.269
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Pteronarcyidae	Pteronarcella	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	2.22	7.99	0.438	0.544	0.619	0	3.27	24.7
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0.269
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Area-based Kick Samples							
				2021		2022					
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHBP		RG_GHBP					
				RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Insecta	Trichoptera	Hydropsychidae	Parapsyche elsis	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptila	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	1.11	0.929	0	0	0	0	0	0.269
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna grou	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila narvae	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophilidae	6.38	3.71	8.75	10.2	12.1	9.77	3.27	3.49
Malacostraca	Amphipoda	Gammaridae	Gammarus	1.29	1.21	0.219	0.544	0	0.249	0.980	0
Malacostraca	Amphipoda	Hyalellidae	Hyalella	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.16: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Family Level of Taxonomy, 2016 to 2022

Taxon			Density											
Higher Level Classification		Family	2016						2017					
			RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	377	340	272	461	1,430	373	63	50	47	140	540	137
Clitellata	Tubificida	Naididae	70	19	841	1,190	1,371	2,133	0	0	0	40	67	0
Clitellata	-	Enchytraeidae	28	699	1,039	1,152	2,682	4,507	27	313	443	23	200	697
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	78	208	322	422	298	308	57	63	17	87	27	77
Euchelicerata	Trombidiformes	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	20	0	0	0	0	39	0	0	0	0	0	7
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	7	0	0	0	13
Gastropoda	Basommatophora	Planorbidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	140	117	152	192	0	0	13	10	10	20	7	7
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	14	0	28	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	405	283	1,261	806	1,013	987	153	363	180	453	307	243
Insecta	Diptera	Dixidae	0	0	0	0	0	0	3	0	0	0	0	0
Insecta	Diptera	Empididae	0	38	74	154	60	267	0	7	13	10	0	33
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	42	243	172	77	189	27	3	23	7	10	47	7
Insecta	Diptera	Psychodidae	1,146	1,502	2,254	1,920	1,788	507	577	423	527	277	417	433
Insecta	Diptera	Simuliidae	168	567	247	307	0	613	117	313	273	53	177	357
Insecta	Diptera	Tipulidae	28	76	74	384	179	160	77	60	87	20	80	140
Insecta	Ephemeroptera	Baetidae	84	38	74	115	179	53	60	23	13	3	20	63
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	43	67	7	10	7	0
Insecta	Ephemeroptera	Heptageniidae	14	0	0	0	0	0	23	10	0	0	0	0
Insecta	Plecoptera	Capniidae	0	0	0	0	0	0	0	0	0	0	7	0
Insecta	Plecoptera	Chloroperlidae	112	19	223	77	119	27	10	3	7	43	0	0
Insecta	Plecoptera	Leuctridae	28	0	0	0	60	0	0	0	0	3	0	7
Insecta	Plecoptera	Nemouridae	1,202	1,549	1,120	1,152	1,311	400	750	707	690	480	460	413
Insecta	Plecoptera	Perlodidae	13	0	0	0	0	27	13	7	0	0	7	0
Insecta	Plecoptera	Taeniopterygidae	0	0	25	0	0	27	7	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	14	151	74	269	656	1,467	23	20	30	30	90	257
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	56	38	420	729	596	880	0	0	0	3	40	110
Insecta	Trichoptera	Lepidostomatidae	126	19	198	38	0	0	43	30	0	10	33	13
Insecta	Trichoptera	Limnephilidae	0	0	0	38	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	233	283	247	576	467	160	77	70	217	0	77	117
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Hyalellidae	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.16: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Family Level of Taxonomy, 2016 to 2022

Taxon			Density											
Higher Level Classification		Family	2018						2019					
			RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	93	147	320	193	287	123	47	147	777	87	387	333
Clitellata	Tubificida	Naididae	0	0	0	20	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	0	13	67	37	23	13	40	23	7	93	7
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	3	0	0
Euchelicerata	Trombidiformes	Lebertiidae	27	213	40	320	73	70	13	20	43	13	80	7
Euchelicerata	Trombidiformes	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	13	0	0	20	0	10	13	20	0	0	7	7
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	13	0	0	27	3	7	13	0	0	0	7	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	7	0	0	0	0	0
Insecta	Diptera	Chironomidae	680	707	707	180	70	120	87	253	270	67	60	133
Insecta	Diptera	Dixidae	0	0	0	0	0	0	7	0	0	0	0	0
Insecta	Diptera	Empididae	0	40	40	20	17	3	7	13	3	0	0	13
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	27	27	107	3	7	0	27	37	0	0	0
Insecta	Diptera	Psychodidae	1,333	3,947	1,267	1,987	750	307	87	427	737	60	927	87
Insecta	Diptera	Simuliidae	120	227	333	7	3	27	480	1,147	267	43	587	160
Insecta	Diptera	Tipulidae	40	53	40	27	10	20	27	40	17	3	47	33
Insecta	Ephemeroptera	Baetidae	173	427	227	293	70	93	720	2,653	1,350	220	1,200	1,033
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	13	3	13	13	7	10	73	40	53	17	87	20
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	1,787	2,373	1,373	1,413	550	510	953	1,667	330	67	1,013	187
Insecta	Plecoptera	Perlodidae	13	17	0	0	0	3	0	0	7	0	13	7
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	13	27	13	33	30	180	27	40	17	3	73	153
Insecta	Trichoptera	Hydropsychidae	27	0	0	0	0	0	0	0	3	0	0	0
Insecta	Trichoptera	Hydroptilidae	0	0	0	0	10	33	7	0	10	0	0	7
Insecta	Trichoptera	Lepidostomatidae	80	267	53	40	110	37	67	93	37	3	0	67
Insecta	Trichoptera	Limnephilidae	0	0	0	0	0	0	7	0	0	0	0	7
Insecta	Trichoptera	Rhyacophilidae	387	413	440	153	90	107	253	867	163	33	187	67
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	7
Malacostraca	Amphipoda	Hyalellidae	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	13	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.16: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Family Level of Taxonomy, 2016 to 2022

Taxon			Density													
Higher Level Classification		Family	2020								2021					
			GH_GH1_AS-1	GH_GH1_AS-2	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	3,653	2,133	1,200	373	1,947	2,307	2,947	500	3,204	624	2,436	1,440	3,804	3,588
Clitellata	Tubificida	Naididae	800	693	0	0	0	13	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	800	160	40	10	53	27	53	17	12	54	12	36	339	84
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	53	107	53	20	93	53	40	3	60	12	24	24	72	36
Euchelicerata	Trombidiformes	Neoacaridae	0	0	0	0	0	13	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	373	907	0	0	0	0	0	7	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	24	0	0
Gastropoda	Basommatophora	Planorbidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	53	13	27	13	13	3	60	24	12	12	24	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	13	0	0	0	0	0	0	12	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	18	12	12	12	0
Insecta	Diptera	Chironomidae	1,013	960	347	127	347	520	773	87	24	192	144	108	552	108
Insecta	Diptera	Dixidae	0	0	0	0	27	0	0	0	0	6	0	0	0	0
Insecta	Diptera	Empididae	27	160	0	7	0	0	0	7	0	0	0	0	24	12
Insecta	Diptera	Muscidae	27	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	0	0	27	27	27	3	48	84	3	3	72	12
Insecta	Diptera	Psychodidae	133	53	880	517	1,560	2,053	840	517	864	1,560	288	924	6,168	912
Insecta	Diptera	Simuliidae	880	853	53	67	53	27	93	13	0	48	96	72	108	24
Insecta	Diptera	Tipulidae	243	373	0	13	40	13	0	10	0	0	0	0	12	0
Insecta	Ephemeroptera	Baetidae	80	53	133	230	293	307	200	260	0	6	24	24	72	12
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	0	0	13	0	0	0	13	0	12	0	0	12	0	0
Insecta	Plecoptera	Chloroperlidae	0	0	13	23	27	53	27	0	12	6	36	0	120	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	13	3	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	240	107	547	987	373	480	467	93	636	1,419	1,284	1,968	3,054	780
Insecta	Plecoptera	Perlodidae	27	0	0	3	0	0	0	10	0	6	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	53	53	40	53	147	240	173	460	84	84	84	180	360	516
Insecta	Trichoptera	Hydropsychidae	1,840	2,187	0	0	0	0	0	3	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	0	0	0	0	0	0	13	7	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	53	267	160	37	187	240	320	27	12	24	72	12	180	60
Insecta	Trichoptera	Limnephilidae	0	0	0	0	0	0	13	0	0	0	12	0	0	0
Insecta	Trichoptera	Rhyacophilidae	0	0	107	230	347	213	533	27	144	312	267	651	1,035	240
Malacostraca	Amphipoda	Gammaridae	987	1,013	7	0	27	17	27	27	132	15	36	72	210	78
Malacostraca	Amphipoda	Hyalellidae	160	427	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	13	0	0	0	0	0	0	6	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.16: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Family Level of Taxonomy, 2016 to 2022

Taxon			Density					
Higher Level Classification		Family	2022					
			RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	744	432	624	792	123	402
Clitellata	Tubificida	Naididae	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	6	18	84	96	12	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	12	0	24	12	18	18
Euchelicerata	Trombidiformes	Neoacaridae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	9	6
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	3	0
Gastropoda	Basommatophora	Planorbidae	0	0	0	0	3	6
Insecta	Coleoptera	Elmidae	6	6	24	36	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	96	126	216	144	15	72
Insecta	Diptera	Dixidae	0	0	0	0	0	0
Insecta	Diptera	Empididae	6	0	0	0	3	6
Insecta	Diptera	Muscidae	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	48	42	0	12
Insecta	Diptera	Psychodidae	246	708	1,092	2,856	186	588
Insecta	Diptera	Simuliidae	246	186	228	516	87	72
Insecta	Diptera	Tipulidae	6	18	60	72	48	6
Insecta	Ephemeroptera	Baetidae	402	192	552	360	228	414
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	6	0	0	0	0	0
Insecta	Plecoptera	Capniidae	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	18	12	36	96	3	12
Insecta	Plecoptera	Leuctridae	0	0	0	24	0	6
Insecta	Plecoptera	Nemouridae	648	252	360	324	54	78
Insecta	Plecoptera	Perlodidae	36	6	36	48	3	0
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	12	12	24	0	276	60
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	3	0
Insecta	Trichoptera	Hydroptilidae	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	3	0
Insecta	Trichoptera	Limnephilidae	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	240	225	471	588	39	60
Malacostraca	Amphipoda	Gammaridae	6	12	0	15	0	18
Malacostraca	Amphipoda	Hyalellidae	0	0	0	0	0	0
-	-	Collembola	6	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table G.17: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on Family Level of Taxonomy, 2012 to 2022

Taxon			Three-minute Kick Samples												
Higher Level Classification		Family	2012	2014	2015		2018	2019	2020	2021			2022		
			RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	GREE1-50-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3
Bivalvia	Veneroida	Pisidiidae	0.0483	0	5.11	2.67	17.8	16.2	7.31	15.9	19.0	23.2	18.3	17.6	24.1
Clitellata	Lumbriculida	Lumbriculidae	0	0	0	0	0	0.826	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0.532	2.79	12.5	3.47	1.20	0	0	0.771	0.935	0.587	0	0	0
Clitellata	-	Enchytraeidae	0	0	3.41	2.13	0	0	0	0	0	0	0	0	0
Collembola	Collembola	Hypogastruridae	0	0	0	0	0	0	0	0.257	0	0	0	0	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0.189	0	0	0	0	0.257	0.312	0.293	0.631	0.309	0.487
Euchelicerata	Trombidiformes	Aturidae	0	0	1.03	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	0	1.24	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0.292	0	0	0	0	0	0.649
Euchelicerata	Trombidiformes	Lebertiidae	0.0725	0.310	1.44	0	1.51	1.03	0.292	0.257	0.312	2.64	0.946	1.54	1.30
Euchelicerata	Trombidiformes	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0.0725	0	0	0	0	0.344	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	0	0	0	0	0	0	0	0	0	0	0	0.309	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0.275	0	0.257	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	0.379	1.07	0	0	0.877	0.257	0	0	0.315	0.309	0.487
Insecta	Coleoptera	Staphylinidae	0.0483	0	0	0	0.301	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0.0483	0	0.189	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	14.0	17.0	33.5	5.60	8.43	11.3	2.63	3.60	6.23	4.11	2.52	4.94	30.2
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	0.193	4.02	1.70	0.533	0	0	0	0	0.312	0	0	0.309	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	0.189	0.533	0	1.10	0	0	0	0	0.631	0	0
Insecta	Diptera	Psychodidae	3.04	23.5	8.33	44.0	26.8	19.3	14.6	8.23	19.3	32.3	30.3	31.5	0
Insecta	Diptera	Simuliidae	77.1	13.0	8.71	2.40	0.602	3.31	12.6	3.60	2.49	0.293	9.15	4.32	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0.293	0	0	0
Insecta	Diptera	Tipulidae	0.773	3.10	1.14	0.800	0.904	0	0	0	0	0	0.315	0.309	0
Insecta	Ephemeroptera	Ameletidae	0	0	0.379	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0.310	5.30	5.33	2.71	28.4	7.31	0.771	0.623	0.293	8.20	12.0	17.0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0.379	0	0	0	1.17	0.514	0	0	0	0	0.243
Insecta	Ephemeroptera	Heptageniidae	0.193	0	0.379	0.267	0	0	0	0.514	0	0	0	0	0
Insecta	Plecoptera	Capniidae	0	0	0	0	0	0	0.292	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0.0483	1.24	2.65	0.800	0.602	0.826	0.585	0.257	0.623	0.587	0.663	1.27	1.22
Insecta	Plecoptera	Leuctridae	0	0	0.189	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	0.725	6.50	2.46	19.7	19.3	5.23	33.9	44.2	38.6	20.2	10.3	9.21	9.00
Insecta	Plecoptera	Peltoperlidae	0	0.310	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0	0.310	0	0	0	0	0.292	0	0	0	0.663	0.635	0.973
Insecta	Plecoptera	Pteronarcyidae	0	0	0	0.267	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	0.292	0.771	0	1.47	1.33	0	0.243
Insecta	Trichoptera	Brachycentridae	0.0483	0.619	2.99	0.800	1.45	2.73	1.49	2.35	1.56	3.38	0	0.383	0.292
Insecta	Trichoptera	Hydropsychidae	0.773	0	0.249	0.267	0	0	1.19	0.293	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	0	0	1.74	0	5.78	0.911	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0.929	0	0	8.67	4.56	2.68	0.293	0.312	1.84	0	0	0
Insecta	Trichoptera	Limnephilidae	0.0483	0	0.249	4.27	0	0	0.595	0.879	0	0	0	0	0
Insecta	Trichoptera	Phryganeidae	0.0483	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	1.11	24.5	4.24	5.07	3.98	3.64	10.7	12.9	7.79	7.68	13.6	9.19	12.8
Malacostraca	Amphipoda	Gammaridae	1.06	0	0.631	0	0	0	0.877	2.57	1.56	0.880	2.21	5.86	0.973
Malacostraca	Amphipoda	Hyalellidae	0	0.310	0.316	0	0	0	0	0.257	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.17: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on Family Level of Taxonomy, 2012 to 2022

Taxon			Area-based Kick Samples											
Higher Level Classification		Family	2016						2017					
			RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	8.58	5.49	2.98	4.58	11.5	2.88	2.96	1.95	1.82	8.16	20.7	4.37
Clitellata	Lumbriculida	Lumbriculidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	1.59	0.305	9.22	11.8	11.1	16.5	0	0	0	2.33	2.56	0
Clitellata	-	Enchytraeidae	0.636	11.3	11.4	11.4	21.6	34.8	1.25	12.2	17.3	1.36	7.67	22.3
Collembola	Collembola	Hypogastruridae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Aturidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	1.78	3.36	3.53	4.20	2.40	2.38	2.65	2.46	0.649	5.05	1.02	2.45
Euchelicerata	Trombidiformes	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0.445	0	0	0	0	0.297	0	0	0	0	0	0.213
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0.259	0	0	0	0.426
Gastropoda	Basommatophora	Planorbidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	3.18	1.89	1.66	1.91	0	0	0.623	0.389	0.390	1.17	0.256	0.213
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0.318	0	0.308	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	9.22	4.58	13.8	8.02	8.17	7.61	7.17	14.1	7.01	26.4	11.8	7.77
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0.156	0	0	0	0	0
Insecta	Diptera	Empididae	0	0.611	0.814	1.53	0.481	2.06	0	0.259	0.519	0.583	0	1.06
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0.954	3.93	1.88	0.763	1.52	0.206	0.156	0.908	0.260	0.583	1.79	0.213
Insecta	Diptera	Psychodidae	26.1	24.3	24.7	19.1	14.4	3.91	26.9	16.5	20.5	16.1	16.0	13.8
Insecta	Diptera	Simuliidae	3.81	9.16	2.71	3.05	0	4.73	5.45	12.2	10.6	3.11	6.78	11.4
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	0.636	1.22	0.814	3.82	1.44	1.23	3.58	2.33	3.38	1.17	3.07	4.47
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	1.91	0.611	0.814	1.15	1.44	0.412	2.80	0.908	0.519	0.194	0.767	2.02
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	2.02	2.59	0.260	0.583	0.256	0
Insecta	Ephemeroptera	Heptageniidae	0.318	0	0	0	0	0	1.09	0.389	0	0	0	0
Insecta	Plecoptera	Capniidae	0	0	0	0	0	0	0	0	0	0	0.256	0
Insecta	Plecoptera	Chloroperlidae	2.54	0.305	2.44	0.763	0.962	0.206	0.467	0.130	0.260	2.52	0	0
Insecta	Plecoptera	Leuctridae	0.636	0	0	0	0.481	0	0	0	0	0.194	0	0.213
Insecta	Plecoptera	Nemouridae	27.3	25.0	12.3	11.4	10.6	3.09	35.0	27.5	26.9	28.0	17.6	13.2
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0.303	0	0	0	0	0.206	0.623	0.259	0	0	0.256	0
Insecta	Plecoptera	Pteronarcyidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	0	0.271	0	0	0.206	0.312	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0.318	2.44	0.814	2.67	5.29	11.3	1.09	0.778	1.17	1.75	3.45	8.20
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	1.27	0.611	4.61	7.25	4.81	6.79	0	0	0	0.194	1.53	3.51
Insecta	Trichoptera	Lepidostomatidae	2.86	0.305	2.17	0.382	0	0	2.02	1.17	0	0.583	1.28	0.426
Insecta	Trichoptera	Limnephilidae	0	0	0	0.382	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Phryganeidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	5.30	4.58	2.71	5.73	3.77	1.23	3.58	2.72	8.44	0	2.94	3.73
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Hyalellidae	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table G.17: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on Family Level of Taxonomy, 2012 to 2022

Taxon			Area-based Kick Samples											
Higher Level Classification		Family	2018						2019					
			RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	1.94	1.65	6.52	3.93	13.5	7.30	1.61	1.95	18.7	13.8	8.11	14.3
Clitellata	Lumbriculida	Lumbriculidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0	0	0.407	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	0	0.272	1.36	1.73	1.38	0.459	0.533	0.563	1.06	1.96	0.286
Collembola	Collembola	Hypogastruridae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Aturidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0.532	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0.554	2.40	0.815	6.50	3.46	4.14	0.459	0.266	1.05	2.13	1.68	0.286
Euchelicerata	Trombidiformes	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0.277	0	0	0.407	0	0.592	0.459	0.266	0	0	0.140	0.286
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0.277	0	0	0.542	0.157	0.394	0.459	0	0	0	0.140	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0.229	0	0	0	0	0
Insecta	Diptera	Chironomidae	14.1	7.95	14.4	3.66	3.30	7.10	2.98	3.37	6.52	10.6	1.26	5.71
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0.229	0	0	0	0	0
Insecta	Diptera	Empididae	0	0.450	0.815	0.407	0.786	0.197	0.229	0.178	0.0805	0	0	0.571
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0.300	0.543	2.17	0.157	0.394	0	0.355	0.885	0	0	0
Insecta	Diptera	Psychodidae	27.7	44.4	25.8	40.4	35.4	18.1	2.98	5.68	17.8	9.57	19.4	3.71
Insecta	Diptera	Simuliidae	2.49	2.55	6.79	0.136	0.157	1.58	16.5	15.3	6.44	6.91	12.3	6.86
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	0.831	0.600	0.815	0.542	0.472	1.18	0.917	0.533	0.402	0.532	0.979	1.43
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	3.60	4.80	4.62	5.96	3.30	5.52	24.8	35.4	32.6	35.1	25.2	44.3
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0.277	0.0375	0.272	0.271	0.314	0.592	2.52	0.533	1.29	2.66	1.82	0.857
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	37.1	26.7	28.0	28.7	25.9	30.2	32.8	22.2	7.96	10.6	21.3	8.00
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0.277	0.188	0	0	0	0.197	0	0	0.161	0	0.280	0.286
Insecta	Plecoptera	Pteronarcyidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0.277	0.300	0.272	0.678	1.42	10.6	0.917	0.533	0.402	0.532	1.54	6.57
Insecta	Trichoptera	Hydropsychidae	0.554	0	0	0	0	0	0	0	0.0805	0	0	0
Insecta	Trichoptera	Hydroptilidae	0	0	0	0	0.472	1.97	0.229	0	0.241	0	0	0.286
Insecta	Trichoptera	Lepidostomatidae	1.66	3.00	1.09	0.813	5.19	2.17	2.29	1.24	0.885	0.532	0	2.86
Insecta	Trichoptera	Limnephilidae	0	0	0	0	0	0	0.229	0	0	0	0	0.286
Insecta	Trichoptera	Phryganeidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	8.03	4.65	8.97	3.12	4.25	6.31	8.72	11.6	3.94	5.32	3.92	2.86
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0.286
Malacostraca	Amphipoda	Hyalellidae	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0.178	0	0	0	0

Note: - = not applicable.

Table G.17: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on Family Level of Taxonomy, 2012 to 2022

Taxon			Area-based Kick Samples													
Higher Level Classification		Family	2020								2021					
			GH_GH1_AS-1	GH_GH1_AS	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	31.9	20.3	32.8	13.8	34.9	34.8	44.7	24.0	60.4	13.9	50.3	25.8	23.4	55.5
Clitellata	Lumbriculida	Lumbriculidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	6.99	6.60	0	0	0	0.201	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	6.99	1.52	1.09	0.369	0.957	0.402	0.810	0.800	0.226	1.20	0.248	0.646	2.09	1.30
Collembola	Collembola	Hypogastruridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Aturidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0.466	1.02	1.46	0.738	1.67	0.804	0.607	0.160	1.13	0.267	0.496	0.431	0.444	0.557
Euchelicerata	Trombidiformes	Neoacaridae	0	0	0	0	0	0.201	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	3.26	8.63	0	0	0	0	0	0.320	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0.431	0	0
Gastropoda	Basommatophora	Planorbidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	1.46	0.492	0.478	0.201	0.202	0.160	1.13	0.533	0.248	0.215	0.148	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0.201	0	0	0	0	0	0	0.0739	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0.400	0.248	0.215	0.0739	0
Insecta	Diptera	Chironomidae	8.86	9.14	9.47	4.67	6.22	7.84	11.7	4.16	0.452	4.27	2.97	1.94	3.40	1.67
Insecta	Diptera	Dixidae	0	0	0	0	0.478	0	0	0	0	0.133	0	0	0	0
Insecta	Diptera	Empididae	0.233	1.52	0	0.246	0	0	0	0.320	0	0	0	0	0.148	0.186
Insecta	Diptera	Muscidae	0.233	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	0	0	0.478	0.402	0.405	0.160	0.905	1.87	0.0620	0.0538	0.444	0.186
Insecta	Diptera	Psychodidae	1.17	0.508	24.0	19.1	28.0	31.0	12.8	24.8	16.3	34.7	5.95	16.6	38.0	14.1
Insecta	Diptera	Simuliidae	7.69	8.12	1.46	2.46	0.957	0.402	1.42	0.640	0	1.07	1.98	1.29	0.665	0.371
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	2.13	3.55	0	0.492	0.718	0.201	0	0.480	0	0	0	0	0.0739	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0.699	0.508	3.64	8.49	5.26	4.63	3.04	12.5	0	0.133	0.496	0.431	0.444	0.186
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	0	0	0.364	0	0	0	0.202	0	0.226	0	0	0.215	0	0
Insecta	Plecoptera	Chloroperlidae	0	0	0.364	0.861	0.478	0.804	0.405	0	0.226	0.133	0.743	0	0.739	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0.202	0.160	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	2.10	1.02	14.9	36.4	6.70	7.24	7.09	4.48	12.0	31.5	26.5	35.3	18.8	12.1
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0.233	0	0	0.123	0	0	0	0.480	0	0.133	0	0	0	0
Insecta	Plecoptera	Pteronarcyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0.466	0.508	1.09	1.97	2.63	3.62	2.63	22.1	1.58	1.87	1.73	3.23	2.22	7.99
Insecta	Trichoptera	Hydropsychidae	16.1	20.8	0	0	0	0	0	0.160	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	0	0	0	0	0	0	0.202	0.320	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0.466	2.54	4.37	1.35	3.35	3.62	4.86	1.28	0.226	0.533	1.49	0.215	1.11	0.929
Insecta	Trichoptera	Limnephilidae	0	0	0	0	0	0	0.202	0	0	0	0.248	0	0	0
Insecta	Trichoptera	Phryganeidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	0	0	2.91	8.49	6.22	3.22	8.10	1.28	2.71	6.93	5.51	11.7	6.38	3.71
Malacostraca	Amphipoda	Gammaridae	8.62	9.64	0.182	0	0.478	0.251	0.405	1.28	2.49	0.333	0.743	1.29	1.29	1.21
Malacostraca	Amphipoda	Hyalellidae	1.40	4.06	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0.364	0	0	0	0	0	0	0.133	0	0	0	0

Note: - = not applicable.

Table G.17: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on Family Level of Taxonomy, 2012 to 2022

Taxon			Area-based Kick Samples					
Higher Level Classification		Family	2022					
			RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6
Bivalvia	Veneroida	Pisidiidae	27.1	19.6	16.1	13.2	21.9	11.0
Clitellata	Lumbriculida	Lumbriculidae	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0.219	0.816	2.17	1.59	0	1.08
Collembola	Collembola	Hypogastruridae	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Aturidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0.438	0	0.619	0.199	0.980	1.61
Euchelicerata	Trombidiformes	Neoacaridae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	0.327	0.806
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0.269
Gastropoda	Basommatophora	Planorbidae	0	0	0	0	0.327	0.269
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0.219	0.272	0.619	0.598	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	3.50	5.71	5.57	2.39	3.92	1.34
Insecta	Diptera	Dixidae	0	0	0	0	0	0
Insecta	Diptera	Empididae	0.219	0	0	0	0.327	0.269
Insecta	Diptera	Muscidae	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	1.24	0.698	0.654	0
Insecta	Diptera	Psychodidae	8.97	32.1	28.1	47.4	32.0	16.7
Insecta	Diptera	Simuliidae	8.97	8.44	5.88	8.57	3.92	7.80
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	0.219	0.816	1.55	1.20	0.327	4.30
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	14.7	8.71	14.2	5.98	22.6	20.4
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0.219	0	0	0	0	0
Insecta	Plecoptera	Capniidae	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0.656	0.544	0.928	1.59	0.654	0.269
Insecta	Plecoptera	Leuctridae	0	0	0	0.399	0.327	0
Insecta	Plecoptera	Nemouridae	23.6	11.4	9.28	5.38	4.25	4.84
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	1.31	0.272	0.928	0.797	0	0.269
Insecta	Plecoptera	Pteronarcyidae	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0.438	0.544	0.619	0	3.27	24.7
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0.269
Insecta	Trichoptera	Hydroptilidae	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0.269
Insecta	Trichoptera	Limnephilidae	0	0	0	0	0	0
Insecta	Trichoptera	Phryganeidae	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	8.75	10.2	12.1	9.77	3.27	3.49
Malacostraca	Amphipoda	Gammaridae	0.219	0.544	0	0.249	0.980	0
Malacostraca	Amphipoda	Hyalellidae	0	0	0	0	0	0
-	-	Collembola	0.219	0	0	0	0	0

Note: - = not applicable.

Table G.18: Comparison of Benthic Invertebrate Community Endpoints Among Treated (RG_GHBP) and Untreated (RG_GHUT, RG_GHNF, and RG_GHFF) Areas of Greenhills Creek, 2016 to 2022

Endpoint	Transformation	P-values			Year	MCT				Area Contrasts							Temporal Contrasts							
		Year x Area	Year	Area						Letter Contrasts				MOD (%) [a]			RG_GHBP		RG_GHUT		RG_GHNF		RG_GHFF	
						RG_GHBP	RG_GHUT	RG_GHFF	RG_GHNF	RG_GHBP	RG_GHUT	RG_GHNF	RG_GHFF	RG_GHUT	RG_GHNF	RG_GHFF	Letter	MOD (%) [b]	Letter	MOD (%) [b]	Letter	MOD (%) [b]	Letter	MOD (%) [b]
Density (No. organisms/m²)	log_{10}	0.008	<0.001	<0.001	2016	8,587	2,638	1,956	1,822	A	B	B	B	-2.8	-3.7	-3.5	A	baseline	AB	baseline	BC	baseline	AB	baseline
					2017	2,414	2,930	810	812	A	A	B	B	0.94	-5.3	-5.3	B	-3.0	AB	0.20	C	-1.2	B	-1.9
					2018	3,933	5,522	1,809	3,134	AB	A	AB	B	0.55	-0.37	-1.3	AB	-1.9	A	1.4	AB	0.83	AB	-0.16
					2019	2,928	3,654	1,550	3,212	A	A	A	A	0.26	0.11	-0.74	AB	-2.6	AB	0.63	AB	0.87	AB	-0.49
					2020	4,139	7,769	3,799	2,053	AB	A	B	AB	1.3	-1.4	-0.18	AB	-1.7	A	2.1	BC	0.18	A	1.4
					2021	6,382	6,644	2,380	7,670	A	A	A	B	0.085	0.39	-2.1	AB	-0.70	A	1.8	A	2.2	AB	0.41
					2022	2,572	1,560	1,250	3,867	AB	AB	A	B	-0.85	0.69	-1.2	B	-2.9	B	-1.0	AB	1.2	AB	-0.94
Total Biomass (g/m²)	log_{10}	0.004	<0.001	<0.001	2016	6.70	1.19	1.11	1.10	A	B	B	B	-8.8	-9.2	-9.2	AB	baseline	C	baseline	ABC	baseline	AB	baseline
					2017	2.87	1.93	0.891	0.634	A	AB	C	BC	-1.0	-3.8	-3.0	B	-4.3	ABC	0.64	C	-1.4	B	-0.57
					2018	3.55	3.63	1.97	1.35	A	A	B	AB	0.037	-1.6	-0.96	B	-3.2	AB	1.5	ABC	0.51	AB	1.5
					2019	2.96	1.43	0.799	0.951	A	AB	B	B	-0.75	-1.2	-1.3	B	-4.2	BC	0.24	BC	-0.38	B	-0.86
					2020	4.11	4.57	3.20	1.74	AB	A	B	AB	0.22	-1.8	-0.52	AB	-2.5	A	1.8	ABC	1.2	A	2.8
					2021	11.6	4.12	1.31	2.98	A	B	BC	C	-2.8	-3.6	-5.8	A	2.8	AB	1.6	A	2.6	AB	0.45
					2022	3.37	0.978	1.00	2.49	A	C	AB	BC	-1.5	-0.37	-1.5	B	-3.5	C	-0.26	AB	2.1	B	-0.26
LPL Richness	none	<0.001	0.002	<0.001	2016	25.5	18.7	19.0	20.0	A	B	B	B	-2.0	-1.6	-1.9	AB	baseline	BC	baseline	A	baseline	AB	baseline
					2017	25.7	23.5	20.0	16.8	A	AB	C	BC	-1.2	-4.7	-3.0	A	0.048	A	1.5	AB	-1.1	AB	0.32
					2018	21.7	15.7	20.2	15.2	A	B	B	A	-2.6	-2.8	-0.64	ABC	-1.1	C	-0.96	B	-1.6	AB	0.38
					2019	21.0	17.3	19.3	18.7	A	A	A	A	-1.4	-0.92	-0.66	ABC	-1.3	BC	-0.42	AB	-0.45	AB	0.11
					2020	22.7	19.8	22.2	17.8	A	AB	B	A	-1.4	-2.5	-0.25	ABC	-0.82	ABC	0.37	AB	-0.73	A	1.0
					2021	19.2	20.5	15.5	20.5	AB	A	A	B	0.36	0.36	-1.0	C	-1.8	AB	0.58	A	0.17	B	-1.1
					2022	20.8	18.0	21.2	17.2	A	A	A	A	-1.2	-1.5	0.14	BC	-1.4	BC	-0.21	AB	-0.96	A	0.70
Family Richness	none	0.041	0.028	<0.001	2016	19.0	11.8	13.0	12.3	A	B	B	B	-3.6	-3.3	-3.0	A	baseline	A	baseline	A	baseline	A	baseline
					2017	18.8	13.0	13.2	10.8	A	B	B	B	-4.0	-5.4	-3.8	A	-0.083	A	1.00	A	-0.69	A	0.100
					2018	16.7	8.50	14.2	9.17	A	B	B	A	-5.0	-4.6	-1.5	A	-1.2	B	-2.9	A	-1.5	A	0.70
					2019	17.2	10.2	12.8	11.0	A	B	B	B	-3.0	-2.7	-1.9	A	-0.92	AB	-1.4	A	-0.62	A	-0.100
					2020	18.0	10.8	14.2	11.2	A	C	C	B	-3.6	-3.4	-1.9	A	-0.50	AB	-0.86	A	-0.54	A	0.70
					2021	16.7	13.0	11.7	10.8	A	B	B	B	-1.6	-2.6	-2.2	A	-1.2	A	1.00	A	-0.69	A	-0.80
					2022	16.5	11.0	14.8	10.8	A	B	B	A	-2.9	-3.0	-0.89	A	-1.2	AB	-0.71	A	-0.69	A	1.1
%EPT	log_{10}	<0.001	0.002	<0.001	2016	30.0	29.5	10.3	32.3	A	A	A	B	-0.072	0.36	-5.0	B	baseline	A	baseline	BC	baseline	D	baseline
					2017	35.6	22.9	19.2	65.3	B	BC	A	C	-2.3	3.2	-3.3	AB	0.80	AB	-0.72	A	2.6	ABC	3.1
					2018	45.0	18.6	34.5	31.3	A	B	A	A	-5.6	-2.3	-1.7	AB	1.9	ABC	-1.3	BC	-0.12	A	5.9
					2019	60.3	12.6	26.5	25.1	A	C	B	B	-9.1	-5.1	-4.8	A	3.3	C	-2.4	C	-0.92	AB	4.6
					2020	31.9	15.8	30.1	47.1	A	B	A	A	-1.9	1.1	-0.16	B	0.29	BC	-1.8	AB	1.4	AB	5.3
					2021	31.5	15.3	12.4	36.6	A	B	A	B	-1.8	0.38	-2.4	B	0.23	BC	-1.9	ABC	0.46	CD	0.90
					2022	37.3	18.4	17.2	28.6	A	BC	AB	C	-2.3	-0.87	-2.6	AB	1.0	ABC	-1.4	BC	-0.45	BCD	2.5
%Ephemeroptera	rank	<0.001	<0.001	<0.001	2016	0.979	0	0.149	0	A	B	B	B	-1.6	-1.6	-1.3	BC	baseline	A	- [c]	AB	- [c]	C	baseline
					2017	1.52	0	1.38	0.510	A	B	B	A	-1.4	-0.92	-0.13	AB	0.88	A	- [c]	A	- [c]	A	5.6
					2018	4.71	0	1.10	0	A	C	C	B	-3.3	-3.3	-2.5	AB	6.1	A	- [c]	B	- [c]	AB	4.3
					2019	33.8	0	0.301	0	A	B	B	B	-4.5	-4.5	-4.4	A	53	A	- [c]	AB	- [c]	BC	0.69
					2020	4.94	0	1.95	0	A	B	B	A	-2.1	-2.1	-1.3	AB	6.4	A	- [c]	AB	- [c]	A	8.1
					2021	0.308	0	0	0	A	AB	B	AB	-1.3	-1.3	-1.3	C	-1.1	A	- [c]	B	- [c]	C	-0.67
					2022	14.6	0	0.752	0	A	C	C	B	-1.7	-1.7	-1.6	A	22	A	- [c]	B	- [c]	ABC	2.7
%Plecoptera	log_{10}	<0.001	<0.001	<0.001	2016	13.6	26.3	7.03	31.6	B	A	A	C	0.88	1.1	-0.88	BCD	baseline	A	baseline	B	baseline	D	baseline
					2017	24.3	21.6	14.9	64.5	B	B	A	B	-0.32	2.6	-1.3	AB	0.78	AB	-0.59	A	2.6	BC	1.9
					2018	29.6	18.3	31.9	31.1	A	A	A	A	-3.7	0.37	0.56	A	1.0	ABC	-1.1	B	-0.056	A	3.9
					2019	16.7	10.9	24.8	24.2	AB	B	A	A	-0.78	0.68	0.72	ABCD	0.27	BC	-2.6	B	-0.97	AB	3.2
					2020	10.5	11.0	26.2	45.4	B	B	A	A	0.058	2.0	1.3	CD	-0.34	BC	-2.6	AB	1.3	AB	3.4
					2021	21.2	10.0	11.2	34.2	A	B	A	B	-1.6	1.0	-1.4	ABC	0.59	C	-2.9	AB	0.29	CD	1.2
					2022	9.64	15.9	13.6	27.0	B	AB	A	B	0.85	1.7	0.58	D	-0.46	ABC	-1.5	B	-0.58	BCD	1.7

P-value <0.1.
P-value <0.1 and MOD >2.
P-value <0.1 and MOD < -2.

Notes: MCT = measure of central tendency; MOD = magnitude of difference; % = percent; No. = number; m^2 = square metres; < = less than; g = grams; LPL = lowest practical level; EPT = Ephemeroptera, Plecoptera, and Trichoptera; - = not applicable; > = greater than; SD = standard deviation.
Letters A, B, C, etc. are used to illustrate similarities and differences among areas and years (e.g., areas assigned "A" and "B" letter contrasts have significantly different organism densities).
[a] MOD = $(MCT_{Upstream}-MCT_{GHBP})/SD_{GHBP}$.
[b] MOD = $(MCT_{year}-MCT_{2016})/SD_{2016}$.
[c] MOD could not be calculated because baseline SD = 0.

Table G.18: Comparison of Benthic Invertebrate Community Endpoints Among Treated (RG_GHBP) and Untreated (RG_GHUT, RG_GHNF, and RG_GHFF) Areas of Greenhills Creek, 2016 to 2022

Endpoint	Transformation	P-values			Year	MCT				Area Contrasts							Temporal Contrasts							
										Letter Contrasts				MOD (%) [a]			RG_GHBP		RG_GHUT		RG_GHNF		RG_GHFF	
		Year x Area	Year	Area		RG_GHBP	RG_GHUT	RG_GHFF	RG_GHNF	RG_GHBP	RG_GHUT	RG_GHNF	RG_GHFF	RG_GHUT	RG_GHNF	RG_GHFF	Letter	MOD (%) [b]	Letter	MOD (%) [b]	Letter	MOD (%) [b]	Letter	MOD (%) [b]
%Trichoptera	rank	0.047	0.003	<0.001	2016	12.1	2.14	3.13	0.336	A	BC	C	B	-2.1	-2.4	-1.9	A	baseline	AB	baseline	AB	baseline	A	baseline
					2017	7.95	0.802	2.33	0	A	BC	C	AB	-2.0	-2.2	-1.5	A	-0.86	AC	-0.99	AB	-0.67	A	-0.69
					2018	10.4	0.258	1.32	0	A	B	B	B	-4.1	-4.2	-3.6	A	-0.35	C	-1.4	B	-0.67	A	-1.6
					2019	9.38	1.06	1.22	1.03	A	B	B	B	-1.5	-1.5	-1.5	A	-0.56	ABC	-0.79	AB	1.4	A	-1.6
					2020	12.0	6.17	2.43	1.41	A	B	B	B	-1.5	-2.8	-2.5	A	-0.017	AB	3.0	AB	2.2	A	-0.60
					2021	9.52	5.21	0.838	1.77	A	AB	BC	C	-1.6	-2.9	-3.2	A	-0.53	B	2.3	A	2.9	A	-2.0
					2022	10.3	1.70	2.87	0.216	A	BC	C	B	-3.2	-3.8	-2.8	A	-0.38	ABC	-0.33	AB	-0.24	A	-0.23
%Diptera	rank	<0.001	0.004	<0.001	2016	38.6	61.2	86.8	59.6	C	B	B	A	2.6	2.4	5.6	A	baseline	B	baseline	AB	baseline	A	baseline
					2017	42.9	69.8	77.4	29.7	B	A	B	A	5.2	-2.6	6.7	A	0.50	AB	1.9	C	-2.8	AB	-6.7
					2018	46.2	73.1	64.4	62.2	B	A	A	A	4.1	2.4	2.7	A	0.88	AB	2.7	AB	0.24	C	-16
					2019	26.5	80.3	73.1	68.8	C	A	B	AB	9.0	7.1	7.8	A	-1.4	A	4.3	A	0.85	BC	-9.7
					2020	32.8	76.5	66.4	48.8	B	A	B	A	6.0	2.2	4.6	A	-0.68	A	3.4	BC	-1.0	BC	-14
					2021	18.9	80.2	86.5	62.5	C	A	B	A	8.3	5.9	9.1	A	-2.3	A	4.3	AB	0.27	A	-0.21
					2022	41.8	77.0	77.7	63.2	C	AB	B	A	2.8	1.7	2.9	A	0.37	A	3.5	AB	0.33	AB	-6.5

P-value <0.1.
P-value <0.1 and MOD >2.
P-value <0.1 and MOD < -2.

Notes: MCT = measure of central tendency; MOD = magnitude of difference; % = percent; No. = number; m^2 = square metres; < = less than; g = grams; LPL = lowest practical level; EPT = Ephemeroptera, Plecoptera, and Trichoptera; - = not applicable; > = greater than; SD = standard deviation.
Letters A, B, C, etc. are used to illustrate similarities and differences among areas and years (e.g., areas assigned "A" and "B" letter contrasts have significantly different organism densities).

[a] MOD = $(MCT_{Upstream}-MCT_{GHBP})/SD_{GHBP}$.

[b] MOD = $(MCT_{year}-MCT_{2016})/SD_{2016}$.

[c] MOD could not be calculated because baseline SD = 0.

Table G.19: Comparison of Benthic Invertebrate Community Endpoints for Treated (RG_GHBP) and Untreated (RG_GHUT, RG_GHNF, and RG_GHFF) Areas Before (2016 and 2017) and After (2018 to 2022) Treatment: No Significant Interactions

Endpoint	Term	P-value	MOD [a] between Treated and Untreated, Before and After Treatment
%Trichoptera	BA	0.257	-
	CI	<0.001	-
	BA x CI	0.756	NS
	Year(BA)	0.007	-
	Area(CI)	0.102	-
	Year(BA) x CI	0.240	-
	Area(CI) x BA	0.381	-
	Area(CI) x Year(BA)	0.761	-

P-value for relevant BACI term <0.1.
Treated area decreased relative to treated area.
Treated area increased relative to treated area.

Notes: MOD = Magnitude of Difference; BA = Before-After; - = no data/not applicable; CI = Control-Impact; NS = not significant; SD = standard deviation. MODs not shaded were not significant in the *post hoc* analysis using a p-value of 0.1 and corrected for the number of tests.

[a] MOD = $(AfterYear_{untreated} - AfterYear_{treated}) - (BeforeYear_{untreated} - BeforeYear_{treated}) / SD$.

Table G.20: Comparisons of Benthic Invertebrate Community Endpoints for Treated (RG_GHBP) and Untreated (RG_GHUT, RG_GHNF, and RG_GHFF) Areas Before (2016 and 2017) and After (2018 to 2022) Treatment: Significant Year and Area Interactions

Endpoint	Term	P-value	MOD for Years Before (2016 and 2017) and After (2018 to 2022) Treatment[a]																													
			RG_GHBP versus RG_GHUT										RG_GHBP versus RG_GHNF										RG_GHBP versus RG_GHFF									
			2016					2017					2016					2017					2016					2017				
			2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
Density (No./m^2)	BA	<0.001																														
	CI	0.002																														
	BA x CI	0.004																														
	Year(BA)	<0.001					-										-										-					
	Area(CI)	<0.001																														
	Year(BA) x CI	0.764																														
	Area(CI) x BA	0.129																														
	Area(CI) x Year(BA)	0.015	2.06	1.90	2.45	1.65	0.923	0.198	0.0375	0.591	-0.208	-0.940	1.79	2.23	1.15	2.35	2.65	1.17	1.60	0.526	1.73	2.03	0.953	1.14	1.89	0.668	1.03	0.427	0.618	1.36	0.142	0.502
Total Biomass (g/m^2)	BA	<0.001																														
	CI	<0.001																														
	BA x CI	0.053																														
	Year(BA)	<0.001					-										-										-					
	Area(CI)	0.002																														
	Year(BA) x CI	0.059																														
	Area(CI) x BA	0.556																														
	Area(CI) x Year(BA)	0.010	2.53	1.44	2.65	1.00	0.709	0.607	-0.478	0.728	-0.917	-1.21	1.21	0.966	1.36	0.645	2.17	0.780	0.540	0.938	0.218	1.74	1.75	0.712	2.24	-0.545	0.853	0.834	-0.203	1.33	-1.46	-0.0626
LPL Richness	BA	<0.001																														
	CI	<0.001																														
	BA x CI	0.003																														
	Year(BA)	0.125					-										-										-					
	Area(CI)	0.145																														
	Year(BA) x CI	0.365																														
	Area(CI) x BA	0.091																														
	Area(CI) x Year(BA)	<0.001	0.270	1.03	1.30	2.65	1.30	-1.24	-0.486	-0.216	1.13	-0.216	-0.324	1.03	0.216	2.16	1.04	0.757	2.11	1.30	3.24	2.13	1.62	1.57	1.95	0.919	2.22	1.35	1.30	1.68	0.649	1.95
Family Richness	BA	0.007																														
	CI	<0.001																														
	BA x CI	0.140																														
	Year(BA)	0.218					-										-										-					
	Area(CI)	<0.001																														
	Year(BA) x CI	0.696																														
	Area(CI) x BA	0.103																														
	Area(CI) x Year(BA)	0.020	-0.476	0.0793	0	1.67	0.793	-1.11	-0.555	-0.635	1.03	0.159	-0.397	0.238	-0.0793	0.582	0.661	0.238	0.873	0.555	1.22	1.30	1.67	0.793	1.03	0.476	2.06	1.51	0.635	0.873	0.317	1.90
%EPT	BA	0.610																														
	CI	<0.001																														
	BA x CI	0.002																														
	Year(BA)	0.001					-										-										-					
	Area(CI)	<0.001																														
	Year(BA) x CI	<0.001																														
	Area(CI) x BA	<0.001																														
	Area(CI) x Year(BA)	<0.001	-2.47	-4.64	-1.55	-1.66	-1.89	-1.27	-3.43	-0.350	-0.451	-0.687	-1.56	-3.07	1.04	0.584	-0.787	-4.17	-5.68	-1.58	-2.03	-3.40	0.939	-1.29	1.95	0.0343	0.00907	0.494	-1.73	1.51	-0.411	-0.436

P-value for relevant BACI term <0.1.

Treated area decreased relative to treated area.

Treated area increased relative to treated area.

Notes: MOD = Magnitude of Difference; No. = number; m^2 = square metre; BA = Before-After; < = less than; - = no data/not applicable; CI = Control-Impact; g = gram; LPL = Lowest Practical Level; % = percent; SD = standard deviation. MODs not shaded were not significant in the *post hoc* analysis us

[a] MOD = ($AfterYear_{untreated}$ - $AfterYear_{treated}$)-($BeforeYear_{untreated}$ - $BeforeYear_{treated}$) /SD.

Table G.20: Comparisons of Benthic Invertebrate Community Endpoints for Treated (RG_GHBP) and Untreated (RG_GHUT, RG_GHNF, and RG_GHFF) Areas Before (2016 and 2017) and After (2018 to 2022) Treatment: Significant Year and Area Interactions

Endpoint	Term	P-value	MOD for Years Before (2016 and 2017) and After (2018 to 2022) Treatment[a]																													
			RG_GHBP versus RG_GHUT										RG_GHBP versus RG_GHNF										RG_GHBP versus RG_GHFF									
			2016					2017					2016					2017					2016					2017				
			2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
%Plecoptera	BA	0.020																														
	CI	<0.001																														
	BA x CI	0.487																														
	Year(BA)	<0.001	-										-										-									
	Area(CI)	<0.001																														
	Year(BA) x CI	0.075																														
	Area(CI) x BA	<0.001																														
	Area(CI) x Year(BA)	<0.001	-2.18	-1.92	-1.30	-2.29	-0.620	-0.755	-0.497	0.122	-0.868	0.807	-1.45	-0.479	1.66	0.118	0.302	-3.89	-2.92	-0.784	-2.32	-2.14	1.22	1.65	2.64	-0.185	1.24	1.23	1.66	2.65	-0.177	1.25
%Diptera	BA	0.140																														
	CI	<0.001																														
	BA x CI	0.013																														
	Year(BA)	0.031	-										-										-									
	Area(CI)	<0.001																														
	Year(BA) x CI	<0.001																														
	Area(CI) x BA	<0.001																														
	Area(CI) x Year(BA)	<0.001	0.381	2.69	1.69	2.86	0.857	0.242	2.55	1.55	2.72	0.718	-0.716	1.12	-0.835	0.545	-0.268	2.94	4.78	2.82	4.20	3.39	-3.05	-0.682	-1.88	0.786	-1.30	-1.51	0.858	-0.345	2.33	0.239

P-value for relevant BACI term <0.1.

Treated area decreased relative to treated area.

Treated area increased relative to treated area.

Notes: MOD = Magnitude of Difference; No. = number; m^2 = square metre; BA = Before-After; < = less than; - = no data/not applicable; CI = Control-Impact; g = gram; LPL = Lowest Practical Level; % = percent; SD = standard deviation. MODs not shaded were not significant in the *post hoc* analysis using a p-value of 0.1 and corrected for the number of tests.

[a] MOD = ($AfterYear_{untreated}$ -$AfterYear_{treated}$)-($BeforeYear_{untreated}$ -$BeforeYear_{treated}$) /SD.

Table G.21: Comparison of Benthic Invertebrate Community Endpoints for Treated (RG_GHBP) and Untreated (RG_GHUT, RG_GHNF, and RG_GHFF) Areas Before (2016 and 2017) and After (2018 to 2022) Treatment: Significant Year Interactions

Endpoint	Term	P-value	Treated versus Untreated MOD [a]									
			2016					2017				
			2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
%Ephemeroptera	BA	<0.001	-									
	CI	<0.001										
	BA x CI	<0.001										
	Year(BA)	<0.001										
	Area(CI)	0.191										
	Year(BA) x CI	<0.001	-1.71	-15.8	-2.38	0.274	-6.64	-1.27	-15.3	-1.94	0.721	-6.19
	Area(CI) x BA	0.965	-									
	Area(CI) x Year(BA)	0.988										

P-value for relevant BACI term <0.1.
Treated area decreased relative to treated area.
Treated area increased relative to treated area.
Notes: MOD = Magnitude of Difference; % = percent; BA = Before-After; < = less than; - = no data/not applicable; CI = Control-Impact; SD = standard deviation. MODs not shaded were not significant in the *post hoc* analysis using a p-value of 0.1 and corrected for the number of tests.
[a] MOD = $(AfterYear_{untreated} - AfterYear_{treated}) - (BeforeYear_{untreated} - BeforeYear_{treated}) / SD$.

Table G.22: Summary of Benthic Invertebrate Endpoints Collected by Timed Kick and Sweep Sampling at Greenhills Creek, September 2022[a]

Watercourse	Biological Area Code	Replicate	Abundance	LPL Richness (No. of taxa)	Family Richness	%EPT	%Ephemeroptera	%Plecoptera	%Trichoptera	%Diptera	EPT Abundance	Ephemeroptera Abundance	Plecoptera Abundance	Trichoptera Abundance	Diptera Abundance
Upper Greenhills Creek	RG_GHNF	1	1,637	21	13	61	0.64	58	2.6	37	995	10	942	42	611
		2	344	25	14	35	0	20	14	61	119	0	70	49	211
		3	10,840	18	9.0	16	0	16	0	83	1,700	0	1,700	0	9,020
	RG_GHDT	1	322	24	14	29	0	26	2.2	70	92	0	85	7.0	226
		2	714	22	15	30	0	29	0.56	68	214	0	210	4.0	484
		3	327	30	20	31	0.31	26	4.0	66	100	1.0	86	13	217
Lower Greenhills Creek	RG_GHCKD[b]	1	2,642	21	16	35	8.2	13	14	43	917	217	342	358	1,133
		2	1,543	22	17	33	12	11	9.6	41	505	186	171	148	638
		3	1,957	18	15	42	17	11	13	30	819	338	224	257	590

Notes: LPL = Lowest Practical Level; No. = number; % = percent; EPT = Ephemeroptera, Plecoptera, Trichoptera; CABIN = Canadian Aquatic Biomonitoring Network; RAEMP = Regional Aquatic Effects Monitoring Program.

[a] Samples were collected using three-minute kicks consistent with CABIN protocols. Organism abundances are expressed as no. of organisms/three-minute kick

[b] Biological monitoring area RG_GHCKD is a RAEMP monitoring area

Table G.23: Abundance (No./3-min Kick) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Abundance										
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014				2015				2021	
				RG_GHCKU-1	GREE3-25-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHCKU-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHNF-1	RG_GHNF-2
Clitellata	Tubificida	Naididae	Nais	0	0	50	0	20	0	0	6	1	0	40
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	8	18	1	0	0
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	20	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	20	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	1	20	2	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	1	0	2	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	11	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0	0	0	0	0	1	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	1	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	6	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	1	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	3	0	1	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	3	21	0	0	0	0	17	90
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	21	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	17	22
Insecta	Diptera	Chironomidae	Diamesa	3,156	339	233	331	1,397	8	5	62	17	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	1,155	608	26	0	13	24	37	21	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	9	315
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	91	0	21	15	26	37	1	0	157
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	12	0	26	22
Insecta	Diptera	Chironomidae	Micropsectra	0	11	13	5	317	10	16	0	1	17	900
Insecta	Diptera	Chironomidae	Monodiamesa	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	418	391	1,091	75	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	731	491	83	2,666	0	0	0	0	69	360
Insecta	Diptera	Chironomidae	Pagastia	0	53	0	0	42	13	18	19	0	111	652
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	3	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	21	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	3	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	13	2	42	8	16	12	3	9	135
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	6	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	13	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	21	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	5	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	21	0	0	31	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	39	6	169	18	5	50	15	146	495
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	7	0
Insecta	Diptera	Empididae	Chelifera/Metachela	11	0	25	3	0	13	18	0	4	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	3	0	0	0	0	15	0	0
Insecta	Diptera	Empididae	Neoplasta	0	20	0	0	0	0	0	0	0	0	60
Insecta	Diptera	Empididae	Trichoclinocera	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	10	0	0	220	0	0	76	0	13	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	0	0	0	1	0	0
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	56	60	75	7	120	29	3	82	7	240	723
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	1	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	1	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	1	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	11	141	50	16	0	7	3	0	19	0	0
Insecta	Diptera	Tipulidae	Dicranota	33	10	100	7	60	20	10	6	32	107	301
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	1	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	67	10	50	6	0	0	2	0	3	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	1	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	6	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	20	0	0	40	9	8	0	2	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	2	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	122	60	25	12	80	4	18	6	1	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	2	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	3	0	0
Insecta	Plecoptera	Capniidae	Capniidae	22	180	775	78	700	11	22	382	57	1,168	1,598
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	0	0	0	0	0	0	0	0	0

Notes: No./3-min kick = number of organisms per three minute kick; - = not applicable.

Table G.23: Abundance (No./3-min Kick) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Abundance										
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014				2015				2021	
				RG_GHCKU-1	GREE3-25-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHCKU-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHNF-1	RG_GHNF-2
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	3	0	0	12	6	1	7	20
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	21	61
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	153	570	3	350	62	38	329	7	186	1,527
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	44	380	3	210	11	0	0	0	0	31
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	44	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	1	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	7	60	0	0	29	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	20	125	0	0	22	15	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	117	344
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	50	562	14	240	67	98	0	3	55	40
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	12	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	4	7	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	11	0	112	0	40	0	3	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	22	10	0	6	0	0	14	6	0	0	120
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	11	0	0	7	0	2	3	0	1	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	11	10	0	1	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	153	570	3	350	62	38	329	7	186	1,527
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	44	380	3	210	11	0	0	0	0	31
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	44	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	1	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	7	60	0	0	29	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	20	125	0	0	22	15	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	117	344
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	50	562	14	240	67	98	0	3	55	40
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	12	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	4	7	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	11	0	112	0	40	0	3	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	22	10	0	6	0	0	14	6	0	0	120
-	-	-	-	0	0	0	0	0	0	0	0	0	0	0

Notes: No./3-min kick = number of organisms per three minute kick; - = not applicable.

Table G.23: Abundance (No./3-min Kick) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Abundance			
Higher Level Classification		Family	Lowest Practical Level Identification	2021	2022		
				RG_GHNF-3	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3
Clitellata	Tubificida	Naididae	Nais	15	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	11	0	9
Clitellata	-	Enchytraeidae	Enchytraeus	0	21	0	0
Collembola	Collembola	-	Collembola	10	0	0	2
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	1
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	2
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Stictotarsus	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	6	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	1
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	6	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	57	0	96
Insecta	Diptera	Chironomidae	Limnophyes	6	0	0	2
Insecta	Diptera	Chironomidae	Micropsectra	34	0	0	1
Insecta	Diptera	Chironomidae	Monodiamesa	0	0	0	1
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	56	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	689	68	0	5
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	1
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	91	0	30
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	330	210	0	4
Insecta	Diptera	Chironomidae	Zavrelimyia	0	11	0	7
Insecta	Diptera	Dixidae	Dixa	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	35	120	0	23
Insecta	Diptera	Empididae	Trichoclinocera	0	6	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	11	0	4
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	70	21	0	27
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium/Helodon	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	110	11	0	8
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	11	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	307	468	0	27
Insecta	Plecoptera	Capniidae	Mesocapnia	0	6	0	2

Notes: No./3-min kick = number of organisms per three minute kick; - = not applicable.

Table G.23: Abundance (No./3-min Kick) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Abundance			
Higher Level Classification		Family	Lowest Practical Level Identification	2021	2022		
				RG_GHNF-3	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	67	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	16	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	25	0	0
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	25	0	2
Insecta	Plecoptera	Nemouridae	Zapada columbiana	402	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	31
Insecta	Plecoptera	Perlodidae	Kogotus	164	351	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	8
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	222	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	10	42	0	48
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	1
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	25	0	2
Insecta	Plecoptera	Nemouridae	Zapada columbiana	402	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	31
Insecta	Plecoptera	Perlodidae	Kogotus	164	351	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	8
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	222	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	10	42	0	48
-	-	-	-	0	0	0	0

Notes: No./3-min kick = number of organisms per three minute kick; - = not applicable.

Table G.24: Abundance (No./3-min Kick) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek Based on the Family Level of Taxonomy, 2012 to 2022

Taxon			Abundance														
Higher Level Classification		Family	2012	2014				2015				2021			2022		
			RG_GHCKU-1	GREE3-25-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHCKU-1	GREE3-75-1	GREE4-25-1	GREE4-75-1	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3	RG_GHNF-1	RG_GHNF-2	RG_GHNF-3
Clitellata	Tubificida	Naididae	0	0	50	0	20	0	0	6	1	0	40	15	11	0	9
Clitellata	-	Enchytraeidae	0	0	0	0	0	0	8	18	1	0	0	0	21	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	1	20	2	0	0	0	0	0	0	0	0	2
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	0	1	0	0	0	6	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	3,156	2,309	1,500	456	4,740	507	510	1,359	135	420	3,195	1,120	442	0	149
Insecta	Diptera	Dixidae	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0
Insecta	Diptera	Empididae	11	20	25	5	0	13	18	0	19	0	60	35	126	0	23
Insecta	Diptera	Muscidae	0	10	0	0	220	0	0	76	0	13	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	0	0	0	0	0	0	1	0	0	0	11	0	4
Insecta	Diptera	Psychodidae	56	60	75	8	120	29	3	82	7	240	723	70	21	0	27
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	11	141	50	18	0	7	3	0	19	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	33	10	100	7	60	20	10	6	32	107	301	110	11	0	8
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	67	10	50	6	0	0	2	0	3	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	20	0	0	40	9	8	6	3	0	0	0	11	0	0
Insecta	Ephemeroptera	Heptageniidae	122	60	25	12	80	7	20	6	1	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	22	180	775	78	700	11	22	382	60	1,168	1,598	307	474	0	29
Insecta	Plecoptera	Chloroperlidae	0	0	0	3	0	0	12	6	1	7	20	0	67	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0	0	21	61	16	0	0	0
Insecta	Plecoptera	Nemouridae	0	240	950	6	560	73	38	329	7	186	1,557	402	50	0	2
Insecta	Plecoptera	Peltoperlidae	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0	20	125	7	60	22	15	29	0	117	344	164	351	0	39
Insecta	Plecoptera	Taeniopterygidae	0	50	562	14	240	67	98	0	3	55	40	222	0	0	0
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0	0	0	0	0	4	7	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	11	0	112	0	40	0	3	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	22	10	0	6	0	0	14	6	0	0	120	10	42	0	48
Insecta	Trichoptera	Rhyacophilidae	22	10	0	8	0	2	3	0	1	0	0	0	0	0	1
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	-	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./3-min kick = number of organisms per three minute kick; - = not applicable.

Table G.25: Abundance (No./3-min Kick) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Abundance												
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014	2015		2018	2019	2020	2021			2022		
				RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	GREE1-50-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3
Bivalvia	Veneroida	Pisidiidae	Pisidiidae	20	0	540	167	1,180	590	357	886	1,220	1,580	483	271	471
Clitellata	Lumbriculida	Lumbriculidae	Lumbriculidae	0	0	0	0	0	30	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais	220	180	20	0	80	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	1,300	217	0	0	0	43	60	40	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	360	133	0	0	0	0	0	0	0	0	0
Collembola	Collembola	Hypogastruridae	Hypogastruridae	0	0	0	0	0	0	0	14	0	0	0	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	20	0	0	0	0	14	20	20	17	5	10
Euchelicerata	Trombidiformes	Aturidae	Aturidae	0	0	108	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	Feltria	0	80	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Protzia	0	0	0	0	0	0	14	0	0	0	0	0	13
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	30	20	152	0	100	38	14	14	20	180	25	24	25
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	30	0	0	0	0	12	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	Promenetus	0	0	0	0	0	0	0	0	0	0	0	5	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	10	0	14	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	43	14	0	0	8	5	10
Insecta	Coleoptera	Elmidae	Optioservus	0	0	40	67	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	20	0	0	0	20	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia/ Palpomyia	0	0	20	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Mallochohelea	20	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	129	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	22	20	0	0	0	0	40	0	49
Insecta	Diptera	Chironomidae	Diamesa	0	62	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	220	62	21	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	42	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Labrundinia	0	62	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0	0	0	0	0	0	7	0
Insecta	Diptera	Chironomidae	Micropsectra	5,500	21	1,823	144	426	338	0	40	133	84	13	55	541
Insecta	Diptera	Chironomidae	Orthocladius	0	0	127	21	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	42	0	0	0	20	0	0	44	28	0	7	0
Insecta	Diptera	Chironomidae	Pagastia	0	21	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	112	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	40	0	0	0	0	20	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	42	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	212	21	0	0	0	0	0	0	13	0	0
Insecta	Diptera	Chironomidae	Procladius	0	0	42	82	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	768	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	657	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	21	82	0	0	0	120	178	112	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	21	0	0	0	0	40	0	0	0	7	0
Insecta	Diptera	Empididae	Chelifera/Metachela	80	260	180	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	33	0	0	0	0	20	0	0	5	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	20	33	0	40	0	0	0	0	17	0	0
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	1,260	1,520	880	2,750	1,780	700	714	457	1,240	2,200	800	486	0
Insecta	Diptera	Simuliidae	Simulium	31,900	840	920	150	40	120	614	200	160	20	242	67	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	20	0	0	0
Insecta	Diptera	Tipulidae	Antocha	200	40	0	17	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	120	140	60	33	30	0	0	0	0	0	8	5	0
Insecta	Diptera	Tipulidae	Tipula	0	20	60	0	30	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	40	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	20	560	333	180	1,030	357	43	40	20	217	186	333
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	40	0	0	0	0	14	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	57	14	0	0	0	0	5
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	29	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	80	0	40	17	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	14	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	20	80	280	50	40	30	29	14	40	40	18	20	24
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	20	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Amphinemura	0	0	130	0	0	0	0	0	0	0	44	54	67
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	716	45	122	1,350	799	597	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	300	420	130	1,233	564	145	1,536	1,107	1,681	783	228	88	110

Notes: No./3-min kick = number of organisms per three minute kick; - = not applicable.

Table G.25: Abundance (No./3-min Kick) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2022

Taxon				Abundance												
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014	2015		2018	2019	2020	2021			2022		
				RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	GREE1-50-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	20	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	14	0	0	0	18	10	19
Insecta	Plecoptera	Perlodidae	Skwala	0	20	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Pteronarcyidae	Pteronarcella	0	0	0	17	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	0	14	43	0	100	35	0	5
Insecta	Trichoptera	Brachycentridae	Brachycentrus	20	0	0	0	0	99	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	40	316	50	96	0	73	130	100	230	0	6	6
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	140	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	180	0	26	17	0	0	44	16	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche elsis	0	0	0	0	0	0	15	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptila	0	0	184	0	384	33	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	0	60	0	0	576	165	131	16	20	126	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	20	0	26	267	0	0	29	49	0	0	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	20	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	100	640	237	150	96	44	174	277	300	272	138	30	74
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	360	940	211	167	168	88	349	440	200	251	211	112	177
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila narvae	0	0	0	0	0	0	0	0	0	0	9	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	440	0	67	0	0	0	43	143	100	60	58	90	19
Malacostraca	Amphipoda	Hyalellidae	Hyalella	0	20	33	0	0	0	0	14	0	0	0	0	0
-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: No./3-min kick = number of organisms per three minute kick; - = not applicable.

Table G.26: Abundance (No./3-min Kick) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Family Level of Taxonomy, 2012 to 2022

Taxon			Abundance										Abundance		
Higher Level Classification		Family	2012	2014	2015		2018	2019	2020	2021			2022		
			RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	GREE1-50-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3	RG_GHCKD-1	RG_GHCKD-2	RG_GHCKD-3
Bivalvia	Veneroida	Pisidiidae	20	0	540	167	1,180	590	357	886	1,220	1,580	483	271	471
Clitellata	Lumbriculida	Lumbriculidae	0	0	0	0	0	30	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	220	180	1,320	217	80	0	0	43	60	40	0	0	0
Clitellata	-	Enchytraeidae	0	0	360	133	0	0	0	0	0	0	0	0	0
Collembola	Collembola	Hypogastruridae	0	0	0	0	0	0	0	14	0	0	0	0	0
Euchelicerata	Sarcoptiformes	Hydrozetidae	0	0	20	0	0	0	0	14	20	20	17	5	10
Euchelicerata	Trombidiformes	Aturidae	0	0	108	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	0	80	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	14	0	0	0	0	0	13
Euchelicerata	Trombidiformes	Lebertiidae	30	20	152	0	100	38	14	14	20	180	25	24	25
Euchelicerata	Trombidiformes	Sperchontidae	30	0	0	0	0	12	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	0	0	0	0	0	0	0	0	0	0	0	5	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	10	0	14	0	0	0	0	0
Insecta	Coleoptera	Elmidae	0	0	40	67	0	0	43	14	0	0	8	5	10
Insecta	Coleoptera	Staphylinidae	20	0	0	0	20	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	20	0	20	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	5,800	1,100	3,540	350	560	410	129	200	400	280	67	76	590
Insecta	Diptera	Empididae	80	260	180	33	0	0	0	0	20	0	0	5	0
Insecta	Diptera	Pelecorhynchidae	0	0	20	33	0	40	0	0	0	0	17	0	0
Insecta	Diptera	Psychodidae	1,260	1,520	880	2,750	1,780	700	714	457	1,240	2,200	800	486	0
Insecta	Diptera	Simuliidae	31,900	840	920	150	40	120	614	200	160	20	242	67	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	20	0	0	0
Insecta	Diptera	Tipulidae	320	200	120	50	60	0	0	0	0	0	8	5	0
Insecta	Ephemeroptera	Ameletidae	0	0	40	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	20	560	333	180	1,030	357	43	40	20	217	186	333
Insecta	Ephemeroptera	Ephemerellidae	0	0	40	0	0	0	57	29	0	0	0	0	5
Insecta	Ephemeroptera	Heptageniidae	80	0	40	17	0	0	0	29	0	0	0	0	0
Insecta	Plecoptera	Capniidae	0	0	0	0	0	0	14	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	20	80	280	50	40	30	29	14	40	40	18	20	24
Insecta	Plecoptera	Leuctridae	0	0	20	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	300	420	260	1,233	1,280	190	1,657	2,457	2,480	1,380	272	142	176
Insecta	Plecoptera	Peltoperlidae	0	20	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0	20	0	0	0	0	14	0	0	0	18	10	19
Insecta	Plecoptera	Pteronarcyidae	0	0	0	17	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	14	43	0	100	35	0	5
Insecta	Trichoptera	Brachycentridae	20	40	316	50	96	99	73	130	100	230	0	6	6
Insecta	Trichoptera	Hydropsychidae	320	0	26	17	0	0	58	16	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	0	0	184	0	384	33	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	60	0	0	576	165	131	16	20	126	0	0	0
Insecta	Trichoptera	Limnephilidae	20	0	26	267	0	0	29	49	0	0	0	0	0
Insecta	Trichoptera	Phryganeidae	20	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	460	1,580	447	317	264	132	523	717	500	524	358	142	251
Malacostraca	Amphipoda	Gammaridae	440	0	67	0	0	0	43	143	100	60	58	90	19
Malacostraca	Amphipoda	Hyalellidae	0	20	33	0	0	0	0	14	0	0	0	0	0

Table G.27: Supporting Measures Associated with Petite Ponar Benthic Invertebrate Community Sampling at Greenhills Creek Sedimentation Pond (RG_GHP), September 2022

Waterbody		**Greenhills Creek Sedimentation Pond**											
Biological Area Code		**RG_GHP**											
Station ID		**RG_GHP-1**		**RG_GHP-2**		**RG_GHP-3**		**RG_GHP-4**		**RG_GHP-5**		**RG_GHP-6**	
Measurement Location		**Top**	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**
Date Sampled		44824		44823		44823		44823		44823		44824	
UTMs (NAD83, Zone 11U) - Easting		653444		653650		653458		653680		653480		653692	
UTMs (NAD83, Zone 11U) - Northing		5546035		5546034		5545996		5545997		5545945		5545952	
Station Depth (m)		2.4		1.7		4.7		3.6		5.5		4.5	
Habitat Characteristics													
Temperature (°C)		11.1	11	12.1	11.7	12.2	11.2	12.1	11.7	12	11.4	11.4	11.3
DO (mg/L)		9.5	9.2	9.6	9.2	9.3	9.8	9.3	9.2	9.1	9.5	9.2	9.2
DO (% sat)		87	84.1	89.9	85	86.8	89.4	87	85.2	85.3	87.5	84.4	83.9
pH		8.03	8.03	8.03	7.98	8.01	8.02	7.98	7.98	7.97	8.01	8.07	8.09
Specific Conductance (µS/cm)		1572	1572	1567	1569	1568	1580	1571	1576	1568	1579	1571	1572
Secchi Depth (m)		2.4		1.7		2.5		3.6		2.75		2.37	
Water Colour, Clarity		clear to a bit of brown/ black		murky brown/ black		murky brown/ black		murky brown/ black		little brown to clear		-	
Benthic Invertebrate Sampling [a]													
Number of Jars		1		3		1		1		1		1	
Substrate (in sampler)	% Cobble	0		0		0		0		0		0	
	% Gravel	0		0		0		0		0		0	
	% Sand & finer	10		10		10		10		15		10	
	% Organics	90		90		90		90		85		90	
Macrophytes (in sampler)		N		A		N		N		N		N	
Algae (in sampler)		A		N		N		C		N		SP	
Comments		Better visibility than 19-Sep-22.		Foggy - poor visibility.								-	

Notes: ID = identifier; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; °C = degrees Celsius; DO = dissolved oxygen; mg/L = milligrams per litre; % sat = percent saturation; µS/cm = microSiemens per centimetre; m = metre; - = no data/not recorded; N = none; A = abundant; C = common; S = sparse; cm = centimetre.

[a] A Petite Ponar was used to collect samples from Greenhills Creek Sedimentation Pond. Each sample was comprised of n = 5 grabs from the top 2 cm of substrate.

Table G.28: Summary of Benthic Invertebrate Community Endpoints Associated with Petite Ponar Sampling in Greenhills Creek Sedimentation Pond, September 2022

Biological Area Code	Replicate	Density (No. org/m^2)	Biomass (g/m^2)	LPL Richness (No. of taxa)	Family Richness	%EPT	%Ephemeroptera	%Plecoptera	%Trichoptera	%Diptera	%Bivalvia	%Gastropoda
RG_GHP	1	1,728	6.9	18	10	4.6	4.6	0	0	59	12	5.6
	2	4,096	7.7	13	7.0	0.39	0.39	0	0	15	54	20
	3	2,404	7.6	7.0	4.0	0	0	0	0	43	57	0
	4	2,060	9.1	12	6.0	2.3	2.3	0	0	18	72	1.2
	5	1,136	4.4	8.0	5.0	0	0	0	0	32	67	0.18
	6	1,732	5.8	9.0	5.0	0.12	0	0	0.12	37	62	0

Notes: No. org/m^2 = number of organisms per square metre; g/m^2 = grams per square metre; LPL = lowest practical level; % = percent; EPT = Ephemeroptera, Plecoptera, and Trichoptera.

Table G.29: Densities (No./m²) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond Based on the Lowest Practical Level (LPL) of Taxonomy, 2018 to 2022

Taxon				2018						2019					
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	13,844	13,982	10,000	36,677	1,000	10,000	10,000	4,339	10,000	10,779	1,980	10,000
Clitellata	Hirudinida	Erpobdellidae	Erpobdellidae	0	0	0	0	0	20	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	100	0	30	30	0	30	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0	0	100	0	0	0	0
Euchelicerata	Trombidiformes	Mideopsidae	Mideopsis	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Pionidae	Pionidae	0	0	0	0	0	20	100	0	20	0	0	0
Gastropoda	Basommatophora	Planorbidae	Gyraulus	0	276	0	0	0	0	30	1,515	0	30	0	0
Insecta	Coleoptera	Dytiscidae	Hydroporus	0	0	0	0	0	0	0	100	0	0	0	0
Insecta	Coleoptera	Haliplidae	Haliplus	100	0	0	30	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	0	0	0	0	100	0	103	100	9	0	0	0
Insecta	Diptera	Chaoboridae	Chaoboridae	0	0	30	0	100	0	0	0	0	0	146	0
Insecta	Diptera	Chironomidae	Ablabesmyia	1,000	4,684	177	103	0	20	218	1,309	100	212	0	100
Insecta	Diptera	Chironomidae	Apsectrotanypus	0	0	0	0	0	0	40	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	1,000	100	1,000	413	10,000	2,789	145	1,515	115	212	1,000	451
Insecta	Diptera	Chironomidae	Cryptochironomus	100	276	0	30	100	0	0	0	0	0	9	0
Insecta	Diptera	Chironomidae	Dicrotendipes	0	100	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	0	0	40	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	100	100	0	30	30	0	40	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	100	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Procladius	245	276	2,366	3,650	1,000	10,000	145	138	2,008	1,695	1,000	3,677
Insecta	Diptera	Chironomidae	Psectrocladius	1,000	138	177	0	0	0	400	100	100	1,000	0	0
Insecta	Diptera	Chironomidae	Sergentia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stictochironomus	0	100	0	0	30	0	0	0	20	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	100	100	459	138	428	314	291	207	1,163	141	1,145	1,000
Insecta	Ephemeroptera	Baetidae	Callibaetis	207	1,000	1,000	1,000	30	293	241	1,000	155	30	9	344
Insecta	Ephemeroptera	Caenidae	Caenis	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Hemiptera	Corixidae	Corixidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Odonata	Coenagrionidae	Coenagrionidae	0	215	0	0	0	0	0	100	9	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	0	0	0	0	0	0	0	30	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	103	30	20	121	276	100	146	387	30	138
Malacostraca	Amphipoda	Hyalellidae	Hyalella	413	1,171	103	1,000	258	413	207	1,929	30	1,068	9	100

Note: - = not applicable.

Table G.29: Densities (No./m²) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond Based on the Lowest Practical Level (LPL) of Taxonomy, 2018 to 2022

Taxon				2020						2021					
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	10,000	10,000	4,069	4,502	2,900	10,000	10,000	10,000	10,000	4,831	10,000	10,000
Clitellata	Hirudinida	Erpobdellidae	Erpobdellidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	1,000	0	0	0	0	9
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0	0	0	9	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0	0	0	0	0	0	9
Euchelicerata	Trombidiformes	Mideopsidae	Mideopsis	0	0	0	0	0	0	0	0	0	0	0	9
Euchelicerata	Trombidiformes	Pionidae	Pionidae	139	0	0	100	0	9	0	0	0	0	0	9
Gastropoda	Basommatophora	Planorbidae	Gyraulus	139	13,160	0	139	30	0	1,000	10,000	9	0	0	30
Insecta	Coleoptera	Dytiscidae	Hydroporus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Haliplidae	Haliplus	277	0	0	0	0	0	0	100	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	277	0	0	0	0	0	139	0	0	0	0	0
Insecta	Diptera	Chaoboridae	Chaoboridae	0	0	0	30	20	9	0	0	20	225	182	190
Insecta	Diptera	Chironomidae	Ablabesmyia	1,000	416	20	146	0	0	208	416	0	20	0	0
Insecta	Diptera	Chironomidae	Apsectrotanypus	0	0	40	0	9	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	292	3,602	1,502	1,000	1,768	1,000	416	277	100	0	1,000	199
Insecta	Diptera	Chironomidae	Cryptochironomus	0	0	0	0	0	9	100	416	100	139	43	20
Insecta	Diptera	Chironomidae	Dicrotendipes	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	146	0	0	0	0	0	0	100	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Procladius	292	139	421	1,000	40	100	1,000	139	251	1,000	130	1,255
Insecta	Diptera	Chironomidae	Psectrocladius	1,024	0	100	1,607	40	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Sergentia	0	139	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stictochironomus	0	0	0	0	0	0	0	139	9	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	146	139	183	183	131	20	139	0	100	100	182	459
Insecta	Ephemeroptera	Baetidae	Callibaetis	0	1,801	139	208	0	9	416	1,000	0	312	0	9
Insecta	Ephemeroptera	Caenidae	Caenis	0	0	0	0	0	0	100	0	0	0	0	0
Insecta	Hemiptera	Corixidae	Corixidae	0	0	0	0	0	0	0	0	9	0	0	0
Insecta	Odonata	Coenagrionidae	Coenagrionidae	0	0	0	0	0	0	100	100	0	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	139	0	0	9	0	9	0	0	0	0	9
Malacostraca	Amphipoda	Gammaridae	Gammarus	1,000	1,000	234	1,000	43	225	100	407	147	450	139	173
Malacostraca	Amphipoda	Hyalellidae	Hyalella	416	139	20	242	0	0	100	2,078	0	20	0	30

Note: - = not applicable.

Table G.29: Densities (No./m²) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond Based on the Lowest Practical Level (LPL) of Taxonomy, 2018 to 2022

Taxon				2022					
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	208	2,208	1,360	1,480	1,000	1,082
Clitellata	Hirudinida	Erpobdellidae	Erpobdellidae	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	40	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Mideopsidae	Mideopsis	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Pionidae	Pionidae	20	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	Gyraulus	100	1,000	0	20	2	0
Insecta	Coleoptera	Dytiscidae	Hydroporus	0	0	0	0	0	0
Insecta	Coleoptera	Haliplidae	Haliplus	8	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	0	0	0	0	0	0
Insecta	Diptera	Chaoboridae	Chaoboridae	0	0	4	0	2	30
Insecta	Diptera	Chironomidae	Ablabesmyia	171	320	0	100	0	2
Insecta	Diptera	Chironomidae	Apsectrotanypus	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	447	100	1,000	106	114	103
Insecta	Diptera	Chironomidae	Cryptochironomus	20	100	100	20	30	49
Insecta	Diptera	Chironomidae	Dicrotendipes	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	8	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	0	20	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Procladius	106	48	160	20	141	229
Insecta	Diptera	Chironomidae	Psectrocladius	100	30	0	20	0	0
Insecta	Diptera	Chironomidae	Sergentia	8	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stictochironomus	49	48	0	8	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	146	0	20	131	100	225
Insecta	Ephemeroptera	Baetidae	Callibaetis	100	20	0	48	0	0
Insecta	Ephemeroptera	Caenidae	Caenis	0	0	0	0	0	0
Insecta	Hemiptera	Corixidae	Corixidae	0	0	0	0	0	0
Insecta	Odonata	Coenagrionidae	Coenagrionidae	8	20	0	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	0	0	0	0	2
Malacostraca	Amphipoda	Gammaridae	Gammarus	192	100	4	132	4	6
Malacostraca	Amphipoda	Hyalellidae	Hyalella	100	336	0	8	0	0

Note: - = not applicable.

Table G.30: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond Based on the Lowest Practical Level of Taxonomy, 2018 to 2022

Taxon				2018						2019					
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	80.7	62.4	55.4	86.0	6.29	36.3	80.9	35.8	58.1	71.4	44.3	58.9
Clitellata	Hirudinida	Erpobdellidae	Erpobdellidae	0	0	0	0	0	0.116	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0.308	0	0.0807	0.340	0	0.290	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0	0	0.568	0	0	0	0
Euchelicerata	Trombidiformes	Mideopsidae	Mideopsis	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Pionidae	Pionidae	0	0	0	0	0	0.116	0.580	0	0.189	0	0	0
Gastropoda	Basommatophora	Planorbidae	Gyraulus	0	1.23	0	0	0	0	0.290	12.5	0	0.228	0	0
Insecta	Coleoptera	Dytiscidae	Hydroporus	0	0	0	0	0	0	0	0.568	0	0	0	0
Insecta	Coleoptera	Haliplidae	Haliplus	0.402	0	0	0.0807	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	0	0	0	0	0.510	0	0.870	0.568	0.0943	0	0	0
Insecta	Diptera	Chaoboridae	Chaoboridae	0	0	0.306	0	0.680	0	0	0	0	0	3.28	0
Insecta	Diptera	Chironomidae	Ablabesmyia	3.34	20.9	1.57	0.242	0	0.117	1.84	10.8	0.579	1.40	0	0.542
Insecta	Diptera	Chironomidae	Apsectrotanypus	0	0	0	0	0	0	0.306	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	5.72	0.308	8.78	0.969	75.1	18.7	1.22	12.5	1.25	1.40	12.5	3.52
Insecta	Diptera	Chironomidae	Cryptochironomus	0.477	1.23	0	0.0807	0.689	0	0	0	0	0	0.193	0
Insecta	Diptera	Chironomidae	Dicrotendipes	0	0.308	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	0	0	0.306	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	0.477	0.308	0	0.0807	0.345	0	0.306	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0.308	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Procladius	1.43	1.23	21.0	8.56	8.45	36.9	1.22	1.14	22.0	11.2	12.9	28.7
Insecta	Diptera	Chironomidae	Psectrocladius	3.34	0.615	1.57	0	0	0	3.37	0.568	0.868	3.51	0	0
Insecta	Diptera	Chironomidae	Sergentia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stictochironomus	0	0.308	0	0	0.345	0	0	0	0.193	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0.477	0.308	4.08	0.323	4.22	2.11	2.45	1.70	12.7	0.936	25.6	4.06
Insecta	Ephemeroptera	Baetidae	Callibaetis	1.20	4.00	5.50	1.29	0.340	1.97	2.03	6.25	1.70	0.228	0.193	2.69
Insecta	Ephemeroptera	Caenidae	Caenis	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Hemiptera	Corixidae	Corixidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Odonata	Coenagrionidae	Coenagrionidae	0	0.961	0	0	0	0	0	0.568	0.0943	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	0	0	0	0	0	0	0	0.283	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0.917	0.0807	0.170	0.810	2.32	0.568	1.60	2.57	0.771	1.08
Malacostraca	Amphipoda	Hyalellidae	Hyalella	2.41	5.23	0.917	2.26	2.55	2.78	1.74	15.9	0.377	7.07	0.193	0.538

Note: - = not applicable.

Table G.30: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond Based on the Lowest Practical Level of Taxonomy, 2018 to 2022

Taxon				2020						2021					
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	65.0	22.3	61.0	48.1	58.3	83.7	70.5	41.1	89.0	70.8	85.2	74.3
Clitellata	Hirudinida	Erpobdellidae	Erpobdellidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	4.90	0	0	0	0	0.0926
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0	0	0	0.145	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0	0	0	0	0	0	0.0926
Euchelicerata	Trombidiformes	Mideopsidae	Mideopsis	0	0	0	0	0	0	0	0	0	0	0	0.0926
Euchelicerata	Trombidiformes	Pionidae	Pionidae	1.03	0	0	0.741	0	0.123	0	0	0	0	0	0.0926
Gastropoda	Basommatophora	Planorbidae	Gyraulus	1.03	50.5	0	1.48	0.522	0	4.90	39.0	0.145	0	0	0.278
Insecta	Coleoptera	Dytiscidae	Hydroporus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Haliplidae	Haliplus	2.06	0	0	0	0	0	0	0.293	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	2.06	0	0	0	0	0	1.23	0	0	0	0	0
Insecta	Diptera	Chaoboridae	Chaoboridae	0	0	0	0.370	0.348	0.123	0	0	0.290	3.30	2.29	2.04
Insecta	Diptera	Chironomidae	Ablabesmyia	5.44	1.60	0.274	1.56	0	0	1.84	1.76	0	0.254	0	0
Insecta	Diptera	Chironomidae	Apsectrotanypus	0	0	0.549	0	0.188	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	2.18	13.8	22.5	8.59	35.5	11.3	3.68	1.17	1.45	0	6.31	2.13
Insecta	Diptera	Chironomidae	Cryptochironomus	0	0	0	0	0	0.125	0.613	1.76	1.16	2.03	0.544	0.185
Insecta	Diptera	Chironomidae	Dicrotendipes	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	1.09	0	0	0	0	0	0	0.293	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Procladius	2.18	0.532	6.31	6.64	0.751	0.996	4.90	0.587	4.21	11.4	1.63	13.4
Insecta	Diptera	Chironomidae	Psectrocladius	7.62	0	0.823	17.2	0.751	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Sergentia	0	0.532	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stictochironomus	0	0	0	0	0	0	0	0.587	0.145	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	1.09	0.532	2.74	1.95	2.63	0.249	1.23	0	0.871	0.761	2.29	4.91
Insecta	Ephemeroptera	Baetidae	Callibaetis	0	6.91	2.08	2.22	0	0.123	3.68	2.64	0	4.57	0	0.0926
Insecta	Ephemeroptera	Caenidae	Caenis	0	0	0	0	0	0	0.613	0	0	0	0	0
Insecta	Hemiptera	Corixidae	Corixidae	0	0	0	0	0	0	0	0	0.145	0	0	0
Insecta	Odonata	Coenagrionidae	Coenagrionidae	0	0	0	0	0	0	0.613	0.330	0	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	0.532	0	0	0.174	0	0.0766	0	0	0	0	0.0926
Malacostraca	Amphipoda	Gammaridae	Gammarus	6.19	2.13	3.50	8.52	0.870	3.21	0.613	1.72	2.47	6.60	1.74	1.85
Malacostraca	Amphipoda	Hyalellidae	Hyalella	3.09	0.532	0.259	2.59	0	0	0.613	8.80	0	0.254	0	0.278

Note: - = not applicable.

Table G.30: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond Based on the Lowest Practical Level of Taxonomy, 2018 to 2022

Taxon				2022					
Higher Level Classification		Family	Lowest Practical Level Identification	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	12.0	53.9	56.6	71.8	67.1	62.5
Clitellata	Hirudinida	Erpobdellidae	Erpobdellidae	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	2.31	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Mideopsidae	Mideopsis	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Pionidae	Pionidae	0.926	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	Gyraulus	5.56	19.9	0	1.17	0.176	0
Insecta	Coleoptera	Dytiscidae	Hydroporus	0	0	0	0	0	0
Insecta	Coleoptera	Haliplidae	Haliplus	0.463	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	0	0	0	0	0	0
Insecta	Diptera	Chaoboridae	Chaoboridae	0	0	0.166	0	0.176	1.96
Insecta	Diptera	Chironomidae	Ablabesmyia	9.88	7.81	0	3.57	0	0.117
Insecta	Diptera	Chironomidae	Apsectrotanypus	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	25.9	1.95	32.1	5.16	10.0	5.97
Insecta	Diptera	Chironomidae	Cryptochironomus	1.41	1.56	3.33	0.794	2.90	2.81
Insecta	Diptera	Chironomidae	Dicrotendipes	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	0.470	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	0	0.391	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Procladius	6.11	1.17	6.66	0.794	12.4	13.2
Insecta	Diptera	Chironomidae	Psectrocladius	3.29	0.781	0	0.794	0	0
Insecta	Diptera	Chironomidae	Sergentia	0.470	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stictochironomus	2.82	1.17	0	0.397	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	8.47	0	0.998	6.35	6.87	13.0
Insecta	Ephemeroptera	Baetidae	Callibaetis	4.63	0.391	0	2.33	0	0
Insecta	Ephemeroptera	Caenidae	Caenis	0	0	0	0	0	0
Insecta	Hemiptera	Corixidae	Corixidae	0	0	0	0	0	0
Insecta	Odonata	Coenagrionidae	Coenagrionidae	0.463	0.391	0	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	0	0	0	0	0.115
Malacostraca	Amphipoda	Gammaridae	Gammarus	11.1	2.34	0.166	6.41	0.352	0.346
Malacostraca	Amphipoda	Hyalellidae	Hyalella	3.70	8.20	0	0.388	0	0

Note: - = not applicable.

Table G.31: Densities (No./m²) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond Based on the Family Level of Taxonomy, 2018 to 2022

Taxon			2018						2019					
Higher Level Classification		Family	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Bivalvia	Veneroida	Pisidiidae	13,844	13,982	10,000	36,677	1,000	10,000	10,000	4,339	10,000	10,779	1,980	10,000
Clitellata	Hirudinida	Erpobdellidae	0	0	0	0	0	20	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	100	0	30	30	0	30	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0	0	100	0	0	0	0
Euchelicerata	Trombidiformes	Mideopsidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Pionidae	0	0	0	0	0	20	100	0	20	0	0	0
Gastropoda	Basommatophora	Planorbidae	0	276	0	0	0	0	30	1,515	0	30	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	100	0	0	0	0
Insecta	Coleoptera	Haliplidae	100	0	0	30	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	100	0	103	100	9	0	0	0
Insecta	Diptera	Chaoboridae	0	0	30	0	100	0	0	0	0	0	146	0
Insecta	Diptera	Chironomidae	2,617	10,000	4,167	4,374	10,000	10,000	1,309	3,237	3,435	2,789	2,290	4,718
Insecta	Ephemeroptera	Baetidae	207	1,000	1,000	1,000	30	293	241	1,000	155	30	9	344
Insecta	Ephemeroptera	Caenidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Hemiptera	Corixidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Odonata	Coenagrionidae	0	215	0	0	0	0	0	100	9	0	0	0
Insecta	Trichoptera	Phryganeidae	0	0	0	0	0	0	0	0	30	0	0	0
Malacostraca	Amphipoda	Gammaridae	0	0	103	30	20	121	276	100	146	387	30	138
Malacostraca	Amphipoda	Hyalellidae	413	1,171	103	1,000	258	413	207	1,929	30	1,068	9	100

Note: - = not applicable.

Table G.31: Densities (No./m²) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond Based on the Family Level of Taxonomy, 2018 to 2022

Taxon			2020						2021					
Higher Level Classification		Family	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Bivalvia	Veneroida	Pisidiidae	10,000	10,000	4,069	4,502	2,900	10,000	10,000	10,000	10,000	4,831	10,000	10,000
Clitellata	Hirudinida	Erpobdellidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	1,000	0	0	0	0	9
Clitellata	-	Enchytraeidae	0	0	0	0	0	0	0	0	9	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0	0	0	0	0	0	9
Euchelicerata	Trombidiformes	Mideopsidae	0	0	0	0	0	0	0	0	0	0	0	9
Euchelicerata	Trombidiformes	Pionidae	139	0	0	100	0	9	0	0	0	0	0	9
Gastropoda	Basommatophora	Planorbidae	139	13,160	0	139	30	0	1,000	10,000	9	0	0	30
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Haliplidae	277	0	0	0	0	0	0	100	0	0	0	0
Insecta	Diptera	Ceratopogonidae	277	0	0	0	0	0	139	0	0	0	0	0
Insecta	Diptera	Chaoboridae	0	0	0	30	20	9	0	0	20	225	182	190
Insecta	Diptera	Chironomidae	2,632	4,433	2,216	3,359	1,983	1,000	1,385	1,455	468	1,000	1,000	1,931
Insecta	Ephemeroptera	Baetidae	0	1,801	139	208	0	9	416	1,000	0	312	0	9
Insecta	Ephemeroptera	Caenidae	0	0	0	0	0	0	100	0	0	0	0	0
Insecta	Hemiptera	Corixidae	0	0	0	0	0	0	0	0	9	0	0	0
Insecta	Odonata	Coenagrionidae	0	0	0	0	0	0	100	100	0	0	0	0
Insecta	Trichoptera	Phryganeidae	0	139	0	0	9	0	9	0	0	0	0	9
Malacostraca	Amphipoda	Gammaridae	1,000	1,000	234	1,000	43	225	100	407	147	450	139	173
Malacostraca	Amphipoda	Hyalellidae	416	139	20	242	0	0	100	2,078	0	20	0	30

Note: - = not applicable.

Table G.31: Densities (No./m²) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond Based on the Family Level of Taxonomy, 2018 to 2022

Taxon			2022					
Higher Level Classification		Family	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Bivalvia	Veneroida	Pisidiidae	208	2,208	1,360	1,480	1,000	1,082
Clitellata	Hirudinida	Erpobdellidae	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	40	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Mideopsidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Pionidae	20	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	100	1,000	0	20	2	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0
Insecta	Coleoptera	Haliplidae	8	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0
Insecta	Diptera	Chaoboridae	0	0	4	0	2	30
Insecta	Diptera	Chironomidae	1,016	1,000	1,036	368	366	1,000
Insecta	Ephemeroptera	Baetidae	100	20	0	48	0	0
Insecta	Ephemeroptera	Caenidae	0	0	0	0	0	0
Insecta	Hemiptera	Corixidae	0	0	0	0	0	0
Insecta	Odonata	Coenagrionidae	8	20	0	0	0	0
Insecta	Trichoptera	Phryganeidae	0	0	0	0	0	2
Malacostraca	Amphipoda	Gammaridae	192	100	4	132	4	6
Malacostraca	Amphipoda	Hyalellidae	100	336	0	8	0	0

Note: - = not applicable.

Table G.32: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond Based on the Family Level of Taxonomy, 2018 to 2022

Taxon			2018						2019					
Higher Level Classification		Family	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Bivalvia	Veneroida	Pisidiidae	80.7	62.4	55.4	86.0	6.29	36.3	80.9	35.8	58.1	71.4	44.3	58.9
Clitellata	Hirudinida	Erpobdellidae	0	0	0	0	0	0.116	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0.308	0	0.0807	0.340	0	0.290	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0	0	0.568	0	0	0	0
Euchelicerata	Trombidiformes	Mideopsidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Pionidae	0	0	0	0	0	0.116	0.580	0	0.189	0	0	0
Gastropoda	Basommatophora	Planorbidae	0	1.23	0	0	0	0	0.290	12.5	0	0.228	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0.568	0	0	0	0
Insecta	Coleoptera	Haliplidae	0.402	0	0	0.0807	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0.510	0	0.870	0.568	0.0943	0	0	0
Insecta	Diptera	Chaoboridae	0	0	0.306	0	0.680	0	0	0	0	0	3.28	0
Insecta	Diptera	Chironomidae	15.3	25.8	37.0	10.2	89.1	57.9	11.0	26.7	37.6	18.5	51.2	36.8
Insecta	Ephemeroptera	Baetidae	1.20	4.00	5.50	1.29	0.340	1.97	2.03	6.25	1.70	0.228	0.193	2.69
Insecta	Ephemeroptera	Caenidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Hemiptera	Corixidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Odonata	Coenagrionidae	0	0.961	0	0	0	0	0	0.568	0.0943	0	0	0
Insecta	Trichoptera	Phryganeidae	0	0	0	0	0	0	0	0	0.283	0	0	0
Malacostraca	Amphipoda	Gammaridae	0	0	0.917	0.0807	0.170	0.810	2.32	0.568	1.60	2.57	0.771	1.08
Malacostraca	Amphipoda	Hyalellidae	2.41	5.23	0.917	2.26	2.55	2.78	1.74	15.9	0.377	7.07	0.193	0.538

Note: - = not applicable.

Table G.32: **Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond Based on the Family Level of Taxonomy, 2018 to 2022**

Taxon			2020						2021					
Higher Level Classification		Family	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Bivalvia	Veneroida	Pisidiidae	65.0	22.3	61.0	48.1	58.3	83.7	70.5	41.1	89.0	70.8	85.2	74.3
Clitellata	Hirudinida	Erpobdellidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	4.90	0	0	0	0	0.0926
Clitellata	-	Enchytraeidae	0	0	0	0	0	0	0	0	0.145	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0	0	0	0	0	0	0.0926
Euchelicerata	Trombidiformes	Mideopsidae	0	0	0	0	0	0	0	0	0	0	0	0.0926
Euchelicerata	Trombidiformes	Pionidae	1.03	0	0	0.741	0	0.123	0	0	0	0	0	0.0926
Gastropoda	Basommatophora	Planorbidae	1.03	50.5	0	1.48	0.522	0	4.90	39.0	0.145	0	0	0.278
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Haliplidae	2.06	0	0	0	0	0	0	0.293	0	0	0	0
Insecta	Diptera	Ceratopogonidae	2.06	0	0	0	0	0	1.23	0	0	0	0	0
Insecta	Diptera	Chaoboridae	0	0	0	0.370	0.348	0.123	0	0	0.290	3.30	2.29	2.04
Insecta	Diptera	Chironomidae	19.6	17.0	33.2	35.9	39.8	12.7	12.3	6.16	7.84	14.5	10.8	20.6
Insecta	Ephemeroptera	Baetidae	0	6.91	2.08	2.22	0	0.123	3.68	2.64	0	4.57	0	0.0926
Insecta	Ephemeroptera	Caenidae	0	0	0	0	0	0	0.613	0	0	0	0	0
Insecta	Hemiptera	Corixidae	0	0	0	0	0	0	0	0	0.145	0	0	0
Insecta	Odonata	Coenagrionidae	0	0	0	0	0	0	0.613	0.330	0	0	0	0
Insecta	Trichoptera	Phryganeidae	0	0.532	0	0	0.174	0	0.0766	0	0	0	0	0.0926
Malacostraca	Amphipoda	Gammaridae	6.19	2.13	3.50	8.52	0.870	3.21	0.613	1.72	2.47	6.60	1.74	1.85
Malacostraca	Amphipoda	Hyalellidae	3.09	0.532	0.259	2.59	0	0	0.613	8.80	0	0.254	0	0.278

Note: - = not applicable.

Table G.32: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond Based on the Family Level of Taxonomy, 2018 to 2022

Taxon			2022					
Higher Level Classification		Family	RG_GHP-1	RG_GHP-2	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Bivalvia	Veneroida	Pisidiidae	12.0	53.9	56.6	71.8	67.1	62.5
Clitellata	Hirudinida	Erpobdellidae	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	2.31	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Mideopsidae	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Pionidae	0.926	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	5.56	19.9	0	1.17	0.176	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0
Insecta	Coleoptera	Haliplidae	0.463	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0
Insecta	Diptera	Chaoboridae	0	0	0.166	0	0.176	1.96
Insecta	Diptera	Chironomidae	58.8	14.8	43.1	17.9	32.2	35.1
Insecta	Ephemeroptera	Baetidae	4.63	0.391	0	2.33	0	0
Insecta	Ephemeroptera	Caenidae	0	0	0	0	0	0
Insecta	Hemiptera	Corixidae	0	0	0	0	0	0
Insecta	Odonata	Coenagrionidae	0.463	0.391	0	0	0	0
Insecta	Trichoptera	Phryganeidae	0	0	0	0	0	0.115
Malacostraca	Amphipoda	Gammaridae	11.1	2.34	0.166	6.41	0.352	0.346
Malacostraca	Amphipoda	Hyalellidae	3.70	8.20	0	0.388	0	0

Note: - = not applicable.

APPENDIX H
BIOLOGICAL TRIGGERS

APPENDIX H BIOLOGICAL TRIGGERS

H1 INTRODUCTION

H1.1 Overview of Biological Triggers

Biological triggers for potential monitoring and management action are required as part of Teck Coal Limited's (Teck's) Adaptive Management Plan (AMP; Teck 2018, 2021). Generally, triggers are intended as a simple way to identify and communicate potentially unexpected monitoring results that may require management action. Additionally, information obtained from the analysis of biological triggers may lead to responses under the AMP response framework, if necessary, and as such would be reported within the annual AMP report.

Draft biological triggers were developed in consultation with the Environmental Monitoring Committee (EMC) for a subset of biological monitoring endpoints that are effective indicators of changes at the ecosystem level. Development of the triggers was completed under Management Question (MQ) 5 of the 2018 AMP (Teck 2018). The biological triggers were finalized in 2021, prior to the December 15, 2021 AMP update (Teck 2021). The methods applied in this report reflect the finalized biological triggers (Teck 2021). However, it is important to note that the process and/or biological triggers may be adjusted over time, given that the purpose of the biological triggers is to reflect not only changes in the Elk River watershed, but also the current state of knowledge for the area.

The finalized biological triggers include three measurement endpoints (Teck 2021):

- percent Ephemeroptera, Plecoptera, and Trichoptera (%EPT);
- selenium concentrations in benthic invertebrate tissues; and
- selenium concentrations in westslope cutthroat trout (WCT; *Oncorhynchus clarkia lewisi*) muscle.

The biological trigger endpoint for %EPT is based on three-minute (Canadian Aquatic Biomonitoring Network [CABIN] protocol) kicks (i.e., timed kicks) and typically three replicates per location per sampling event. For selenium concentrations in benthic invertebrate tissues, there are generally several replicates collected per location per sampling event, and each replicate is a composite-taxa tissue sample.[1] For WCT, the biological trigger can be applied to selenium concentrations in individual muscle tissue samples.

[1] Composite-taxa samples containing annelids were excluded from the biological triggers analysis for selenium concentrations in benthic invertebrate tissues.

Evaluation of these three biological trigger endpoints is complementary to the fulsome evaluation of biological endpoints that is integrated into the Regional Aquatic Effects Monitoring Program (RAEMP) and Local Aquatic Effects Monitoring Program (LAEMP) reports, as appropriate. The more fulsome evaluation of biological endpoints in the overarching monitoring program reports is used to answer specific study questions through the consideration of not only the endpoints used in the biological trigger evaluation, but also a full suite of additional biological, chemical, and physical endpoints. Biological triggers do not provide information on cause and effect or report on trends. Instead, the biological triggers act to flag areas for further evaluation; these evaluations would then take place under existing monitoring programs, through the development of supporting studies, or through the response framework, as necessary.

The 2022 Greenhills Creek Aquatic Effects Assessment and Monitoring Program (GC LAEMP) represents the third time that biological triggers have been evaluated and reported (i.e., implemented) as part of focused monitoring on Lower Greenhills Creek (Minnow 2021a, 2022a). The year 2022 is also the second year during which biological triggers were applied to Upper Greenhills Creek. To date, biological triggers have not been applied to Gardine Creek.

H1.2 Application of Biological Triggers to Greenhills Creek

As outlined in Section H1.1, analyses for biological triggers are meant to be complementary to other analyses completed to address the study questions for the GC LAEMP, as well as analyses presented in the other LAEMP and RAEMP reports. The biological trigger analyses for 2022 included two of the three measurement endpoints: %EPT and selenium concentrations in benthic invertebrate tissues. No WCT tissue chemistry sampling was completed within the Greenhills Creek watershed in 2022 (i.e., as part of planned monitoring or in response to incidental mortalities) in an effort to minimize fish handling stress and potential risks to WCT. Therefore, biological triggers pertaining to selenium concentrations in WCT muscle could not be evaluated.

For Upper Greenhills Creek, biological triggers for %EPT and selenium concentrations in composite-taxa benthic invertebrate tissue samples were assessed based on the 2022 data for one location, RG_GHNF.[2] This biological monitoring area is located upstream from the current (i.e., since November 2022) antiscalant addition system (AAS) location. For the purposes of the biological triggers analysis, predictions were based on projected water

[2] Three timed kick samples were collected from RG_GHNF, in addition to the area-based kick samples typical of the GC LAEMP, to support comparisons to biological triggers for %EPT (Minnow 2022b).

quality rather than measured water quality. The assessment is designed in this manner so the triggers should detect biological results that were unexpected, regardless of whether those results are due to unexpected water quality or due to unexpected relationships between water quality and biological endpoints. Water quality projections for routine water quality monitoring station GH_HWGH_BRB, which is located on Upper Greenhills Creek, upstream from the confluence with Gardine Creek but downstream from the current AAS location, were used.[3]

The use of water quality projections from GH_HWGH_BRB represents a deviation from the 2022 study design (Minnow 2022b). The study team planned to pair RG_GHNF with projections for GH_USAAS, which, like RG_GHNF, is located upstream from the current (i.e., since November 2022) AAS location on Upper Greenhills Creek. However, no projections were available for GH_USAAS. Consequently, biological data for RG_GHNF were paired with projections from GH_HWGH_BRB, consistent with the 2021 GC LAEMP report (Minnow 2022a).

For Lower Greenhills Creek, the evaluations of biological triggers for %EPT and selenium concentrations in benthic invertebrate tissues were based on water quality projections for routine water quality monitoring station GH_GH1.[4] Station GH_GH1 is the permitted water quality station downstream from the Greenhills Creek Sedimentation Pond and the Stilling Basin V-notch but upstream from the historical (i.e., October 2017 to August 2022) AAS location. This station was the only location on Lower Greenhills Creek that had water quality projections. The projections for GH_GH1 were used in conjunction with benthic invertebrate community and tissue chemistry data from RG_GHCKD and benthic invertebrate tissue chemistry data from RG_GHBP. Monitoring area RG_GHCKD is a long-term monitoring location that has been evaluated as part of the RAEMP since 2012 (Minnow 2014, 2020a, 2021b) and is located approximately 285 metres (m) downstream from routine water quality monitoring station GH_GH1. Monitoring area RG_GHBP is co-located with RG_GHCKD and is routinely monitored as part of the GC LAEMP (Minnow 2018, 2019, 2020b, 2021a, 2022a).[5]

Other monitoring areas on Greenhills and Gardine creeks were not used to evaluate biological triggers because nearby water quality projections were unavailable and/or the methods for

[3] The projections for GH_HWGH_BRB are from the 2022 Implementation Plan Adjustment (IPA) (Teck 2022).

[4] The projections for GH_GH1 are from the 2022 (nickel) or 2019 (all other constituents) IPA (Teck 2019).

[5] The 2022 benthic invertebrate community data for RG_GHCKD was used because the sampling method for RG_GHCKD is consistent with the method that underlies the %EPT biological trigger (i.e., timed kicks characteristic of CABIN sampling). Benthic invertebrate community sampling at RG_GHBP is area-based and is therefore inconsistent with the method underlying the %EPT biological trigger.

assessing benthic invertebrate communities were incompatible with the methods underlying the %EPT predictions. Due to excessive calcite formation in Greenhills and Gardine creeks and a focus on invertebrate densities and biomass in the system, a modified CABIN method is used (i.e., the sampler kicks within a fixed area of 1/3 square metres [m^2], rather than collecting samples using timed kicks).[6] Additionally, the greater within-area variability that is typical of fixed-area samples relative to travelling samples was not accounted for in the habitat model used to generate the predictions for %EPT. By using timed kick data for RG_GHNF and RG_GHCKD, it was possible to make a more accurate assessment of the %EPT biological trigger, which relies on comparisons to the habitat-adjusted normal range for %EPT and expectations based on the predicted Aquatic Data Integration Tool (ADIT) score. Although data for monitoring areas other than RG_GHNF and RG_GHCKD/RG_GHBP could not been included in in the evaluations of biological triggers for %EPT and selenium concentrations in benthic invertebrate tissues, data for these areas were assessed in detail through other aspects of the 2022 monitoring program report.

[6] For further details regarding the benthic invertebrate community sampling completed as part of the GC LAEMP, see Section 2.4.1 of the main report.

H2 METHODS

H2.1 Percent Ephemeroptera, Plecoptera, and Trichoptera

Proportions of EPT in the timed kick and sweep benthic invertebrate community samples collected from RG_GHNF (n = 3) and RG_GHCKD (n = 3) in 2022 were compared to the lower limits (i.e., the 2.5th percentiles) of site-specific habitat-adjusted normal ranges and expectations based on the predicted ADIT scores for these locations. The process for deriving habitat-adjusted normal ranges is described in detail in Appendix J of the 2020 RAEMP report and is based on consideration of more than 30 habitat, substrate, Geographic Information Systems (GIS), and cover variables (Minnow 2020a). Predicted ADIT scores correspond to potential effects on benthic invertebrate community endpoints, based on relationships between water quality projections (for nitrate, sulphate, and cadmium) and invertebrate toxicity endpoints originally developed for the Elk Valley Water Quality Plan (EVWQP; Teck 2014). A predicted ADIT score of 3 corresponds to 50 percent (%) or greater reduction in reproduction of the water flea *Ceriodaphnia dubia*, 2 corresponds to a 20 to 50% reduction, 1 corresponds to a 10 to 20% reduction, and 0 corresponds to a reduction of 10% or less. Once %EPT is measured, the measured results are converted to a measured ADIT score in relation to the habitat adjusted normal range as follows:

- an ADIT score of 0 corresponds to expected %EPT greater than or equal to (≥) the 10th percentile of the habitat adjusted normal range;
- an ADIT score of 1 corresponds to expected %EPT between the 10th percentile and the 2.5th percentile of the habitat-adjusted normal range (and is therefore identical in application to the lower limit of normal range);
- an ADIT score of 2 corresponds to expected %EPT between the 2.5th percentile and half of the 2.5th percentile of the habitat-adjusted normal range; and
- an ADIT score of 3 corresponds to expected %EPT less than or equal to (≤) half of the 2.5th percentile and ≥ 0.

In summary, this component of the biological trigger for %EPT indicates whether the measured ADIT score (calculated based on measured %EPT relative to normal ranges) is greater than the ADIT score that was predicted based on water quality projections.

H2.2 Benthic Invertebrate Tissue Selenium

Selenium concentrations in composite-taxa benthic invertebrate tissue samples collected from RG_GHNF (Upper Greenhills Creek) and RG_GHCKD and RG_GHBP (Lower Greenhills Creek) in 2022 were compared to the regional reference area normal range and expectations based on the lotic bioaccumulation model that was updated by Golder Associates (Golder) in 2020 (Golder 2014, 2020). The reference area normal range represents the 2.5th and 97.5th percentiles of the reference area data set for selenium concentrations in benthic invertebrate tissues (Minnow 2020a). In the case of biological triggers, the upper boundary of the reference area normal range is the primary point of comparison (i.e., "Is the concentration within or above the regional reference area normal range?").

Expectations associated with the bioaccumulation model focus on the upper limit of the 95% prediction interval for the water to benthic invertebrate tissue bioaccumulation model. The model was originally developed for the EVWQP (Golder 2014; Teck 2014) and was updated in 2020 as follows (Golder 2020):

$$log_{10}[Se]_{benthic\ invertebrate} = 0.720 + 0.071 \times log_{10}[Se]_{aqueous}$$

Prediction intervals were estimated for selenium concentrations in individual replicate samples. Benthic invertebrate tissue selenium data collected from RG_GHBP in February 2022 were included in the biological trigger analysis, although normal range information is based on fall (September) sampling. Although effects benchmarks are not part of the trigger for selenium concentrations in benthic invertebrate tissues, they are relevant for interpreting potential biological significance and responses. Consequently, the EVWQP Level 1, 2 and 3 Benchmarks for the most sensitive receptor (juvenile fish via dietary exposure; 11, 18, and 26 milligrams per kilogram dry weight [mg/kg dw], respectively) were included in relevant plots.

H3 RESULTS

H3.1 Percent Ephemeroptera, Plecoptera, and Trichoptera

For the benthic invertebrate community samples collected from RG_GHNF and RG_GHCKD (three samples per area) in 2022, %EPT was consistently lower than habitat-adjusted normal ranges and predicted ADIT values (Appendix Figure H.1; Appendix Table H.1). The only exception was one sample from RG_GHNF (i.e., RG_GHNF-1) that had a %EPT value (61%) that was less than the 2.5th percentile of the habitat-adjusted normal range but higher than the predicted ADIT value (41%) (Appendix Figure H.1; Appendix Table H.1). Overall, it can be concluded that biological triggers were exceeded at both RG_GHNF and RG_GHCKD on Greenhills Creek in 2022.

H3.2 Benthic Invertebrate Tissue Selenium

None of the composite-taxa benthic invertebrate tissue selenium samples collected from Upper Greenhills Creek in 2022 exceeded the biological trigger, but all of the annelid-free composite-taxa benthic invertebrate tissue selenium samples from Lower Greenhills Creek (i.e., n = 3 at RG_GHBP in February 2022 and n = 1 each at RG_GHCKD and RG_GHBP in September 2022) exceeded the biological trigger (Appendix Figure H.2; Appendix Table H.2). The high frequency and magnitude of exceedances for Lower Greenhills Creek are likely attributed to sampling locations being downstream from the Greenhills Creek Sedimentation Pond discharge. Processes within the pond environment can enhance formation of organoselenium species and there can be elevated bioavailable selenium in lotic habitats immediately downstream (Golder 2021). As indicated in the main report, combined concentrations of dimethylselenoxide and methylseleninic acid were highest in the Greenhills Creek Sedimentation Pond and downstream at RG_GHBP in 2022 and likely contributed to enhanced selenium bioaccumulation (ADEPT et al. 2023).

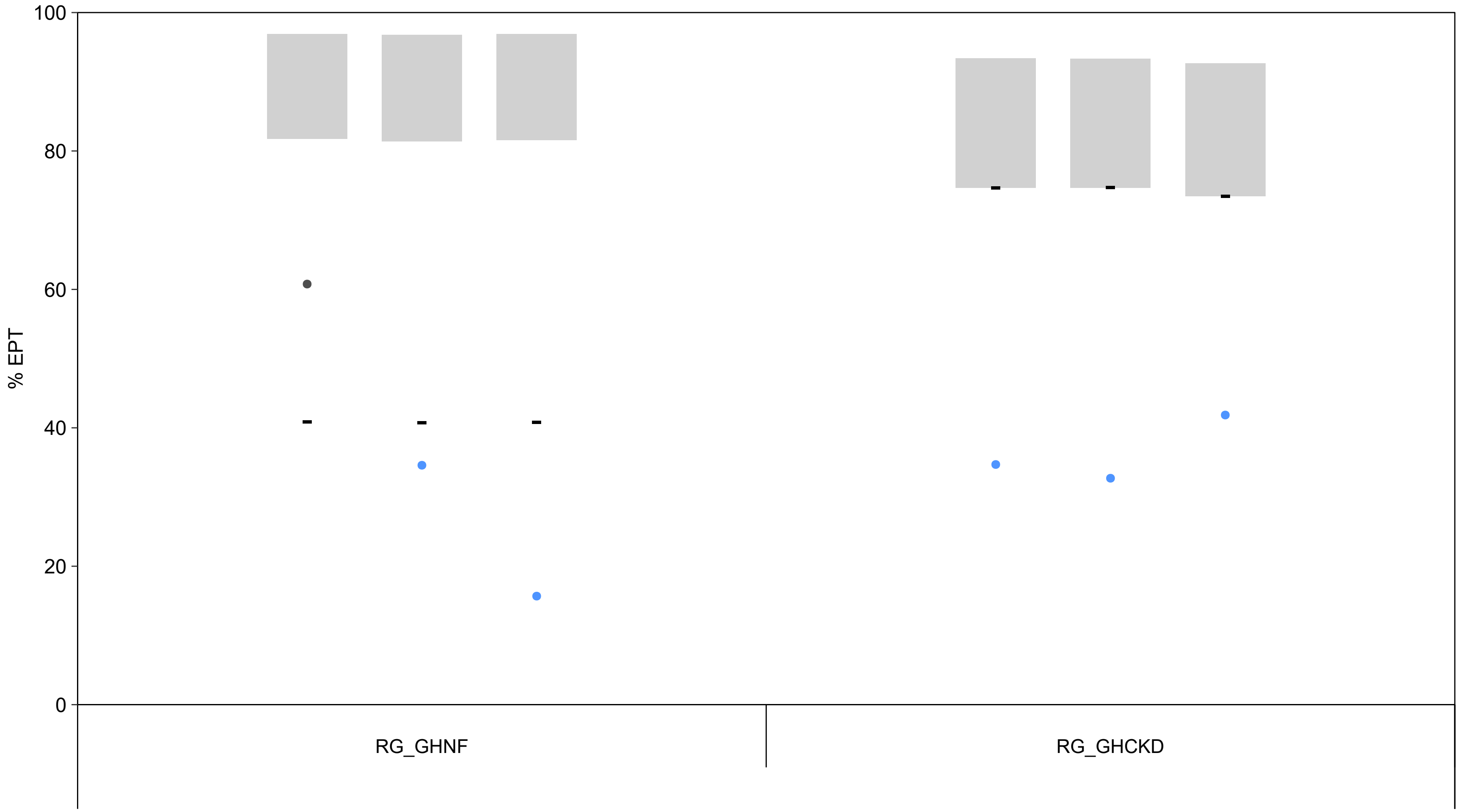

Figure H.1: Measured Proportions of Ephemeroptera, Plecoptera, and Trichoptera Combined (%EPT) Relative to Predictions, Upper (RG_GHNF) and Lower (RG_GHCKD) Greenhills Creek, 2022

Notes: Grey shading represents the habitat-adjusted normal range for each replicate. Black bars indicate the lower limit of the predicted Aquatic Data Integration Tool (ADIT) score for the location. Blue dots represent values exceeding the biological trigger (i.e., values below the 2.5th percentile of the habitat-adjusted normal range and the lower limit of the predicted ADIT score).

Table H.1: Biological Trigger Analysis for Combined Proportions of Ephemeroptera, Plecoptera, and Trichoptera (%EPT) in Benthic Invertebrate Community Samples from Greenhills Creek, September 2022

Watercourse	Biological Monitoring Area	Replicate	Reported Value	ADIT Value	Lower 2.5th Percentile of the Habitat Adjusted Normal Range
Upper Greenhills Creek	RG_GHNF	1	60.8	40.9	81.8
		2	34.6	40.7	81.4
		3	15.7	40.8	81.6
Lower Greenhills Creek	RG_GHCKD	1	34.7	74.7	74.7
		2	32.7	74.7	74.7
		3	41.9	73.5	73.5

Shaded cells signify individual replicates that were associated with a biological trigger (i.e., %EPT was lower than both the ADIT value [as based on predicted water quality] and the lower 2.5th percentile of habitat-adjusted normal range).

Note: ADIT = Aquatic Data Integration Tool.

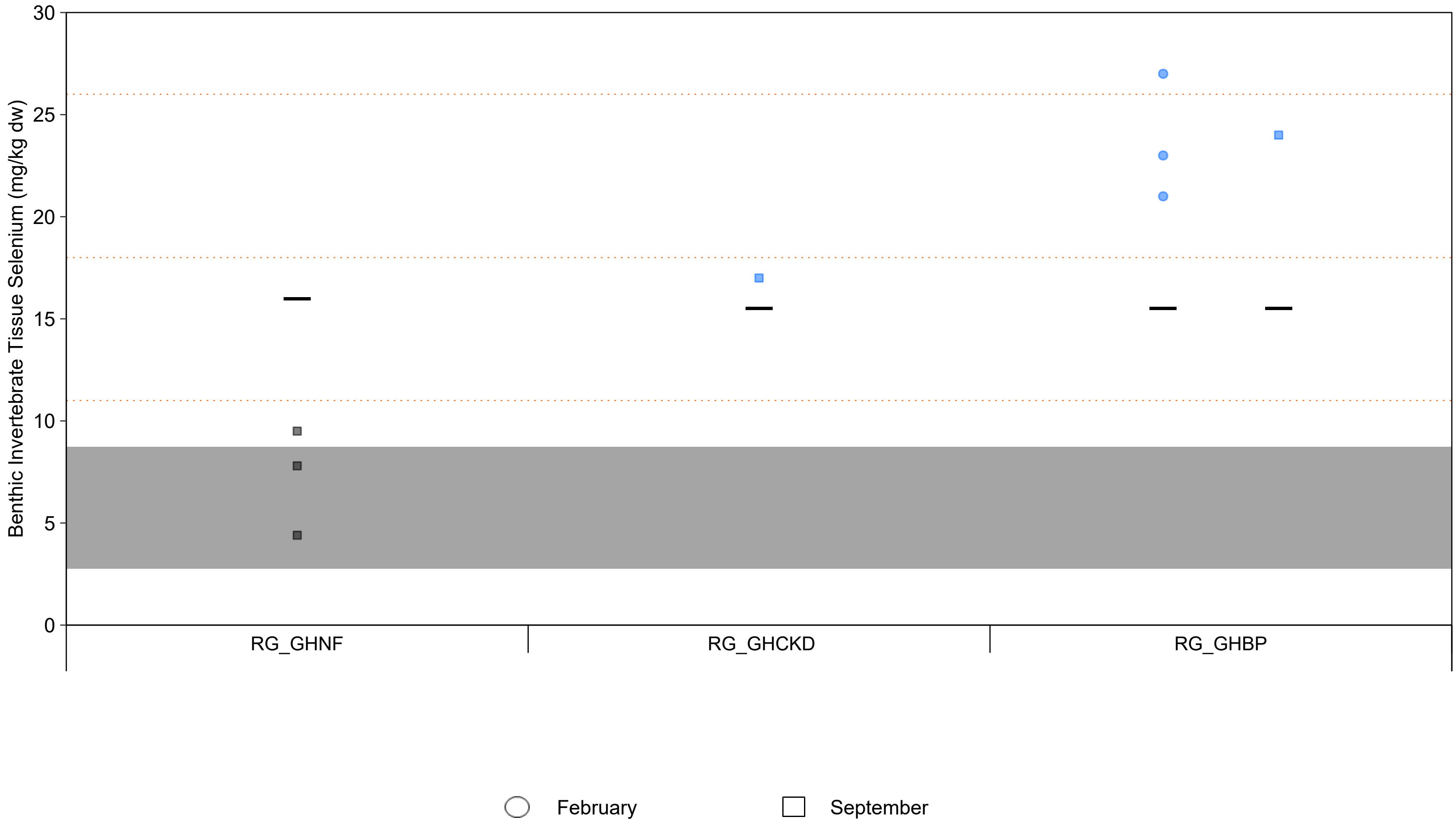

Figure H.2: Measured Selenium Concentrations in Composite-taxa Benthic Invertebrate Tissue Samples Relative to Predictions for Upper (RG_GHNF) and Lower (RG_GHCKD and RG_GHBP) Greenhills Creek, 2022

Notes: Grey shading represents the reference area normal range defined as the 2.5th and 97.5th percentiles of the distribution of reference area data (pooled 1996 to 2019 data) from the Regional Aquatic Effects Monitoring Program (RAEMP). Black bars indicate the upper 95% prediction interval of the bioaccumulation model. Blue dots or squares represent values exceeding the biological trigger (i.e., values above the 97.5th percentile of the reference area normal range and above upper 95% prediction interval). Dotted lines indicate Elk Valley Water Quality Plan (EVWQP) benchmarks (11, 18, and 26 milligrams per kilogram dry weight [mg/kg dw], respectively) for dietary effects to juvenile fish.

Table H.2: Biological Trigger Analysis for Selenium Concentrations in Composite-taxa Benthic Invertebrate Tissue Samples from Greenhills Creek, 2022 [a]

Watercourse	Biological Monitoring Area	Date	Predicted Selenium Water Concentration (mg/L)	Benthic Invertebrate Tissue Selenium		
				Upper 95% Prediction Limit (mg/kg dw)	Upper 97.5th Percentile of Normal Range (mg/kg dw)	Reported Concentration (mg/kg dw)
Upper Greenhills Creek	RG_GHNF	9-Sep-22	327	16.0	8.7	4.4
		10-Sep-22	327	16.0	8.7	9.5
			327	16.0	8.7	7.8
Lower Greenhills Creek	RG_GHCKD	15-Sep-22	215	15.5	8.7	17.0
	RG_GHBP	28-Feb-22	215	15.5	8.7	23.0
			215	15.5	8.7	27.0
			215	15.5	8.7	21.0
		12-Sep-22	215	15.5	8.7	24.0

Shaded cells signify individual replicates that were associated with a biological trigger (i.e. higher than both the upper 95% prediction limit [as based on predicted water quality] and the upper 97.5th percentile of the normal range).

Notes: mg/L = milligrams per litre; % = percent; mg/kg dw = milligrams per kilogram dry weight.

[a] Annelid-containing samples (including composite-taxa samples with annelids) were excluded from the assessment.

H4 SUMMARY

Biological triggers for %EPT were exceeded at Upper and Lower Greenhills Creek in 2022, whereas biological triggers for selenium concentrations in benthic invertebrate tissues were only exceeded within Lower Greenhills Creek. Specifically, the biological trigger for %EPT was exceeded in two and three of the replicate samples (total n = 3 per area) from RG_GHNF and RG_GHCKD, respectively. Selenium concentrations in all five composite-taxa benthic invertebrate tissue chemistry samples collected from Lower Greenhills Creek in 2022 exceeded the biological trigger, and this was likely attributed to enhanced generation of organoselenium species upstream in the Greenhills Creek Sedimentation Pond.

Overall, current biological triggers were sufficient to identify monitoring areas where biological responses are occurring, and no additional triggers are recommended at this time. The results of the biological trigger evaluations are generally consistent with the findings of the overarching GC LAEMP. However, uncertainty remains around the cause of the observed %EPT response in two of the three samples from RG_GHNF on Upper Greenhills Creek and each of the three samples from RG_GHCKD on Lower Greenhills Creek. Efforts to resolve uncertainty around the combined and individual effects of water quality, habitat, and other mine-related stressors on benthic invertebrate communities in lotic habitats of the Elk River watershed are underway. Minnow Environmental Inc. (Minnow) is developing a predictive model for benthic invertebrate community endpoints. Additionally, monitoring, or potential management responses will continue to be assessed through Teck's adaptive management framework.

H5 REFERENCES

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APPENDIX I

BENTHIC INVERTEBRATE TISSUE CHEMISTRY

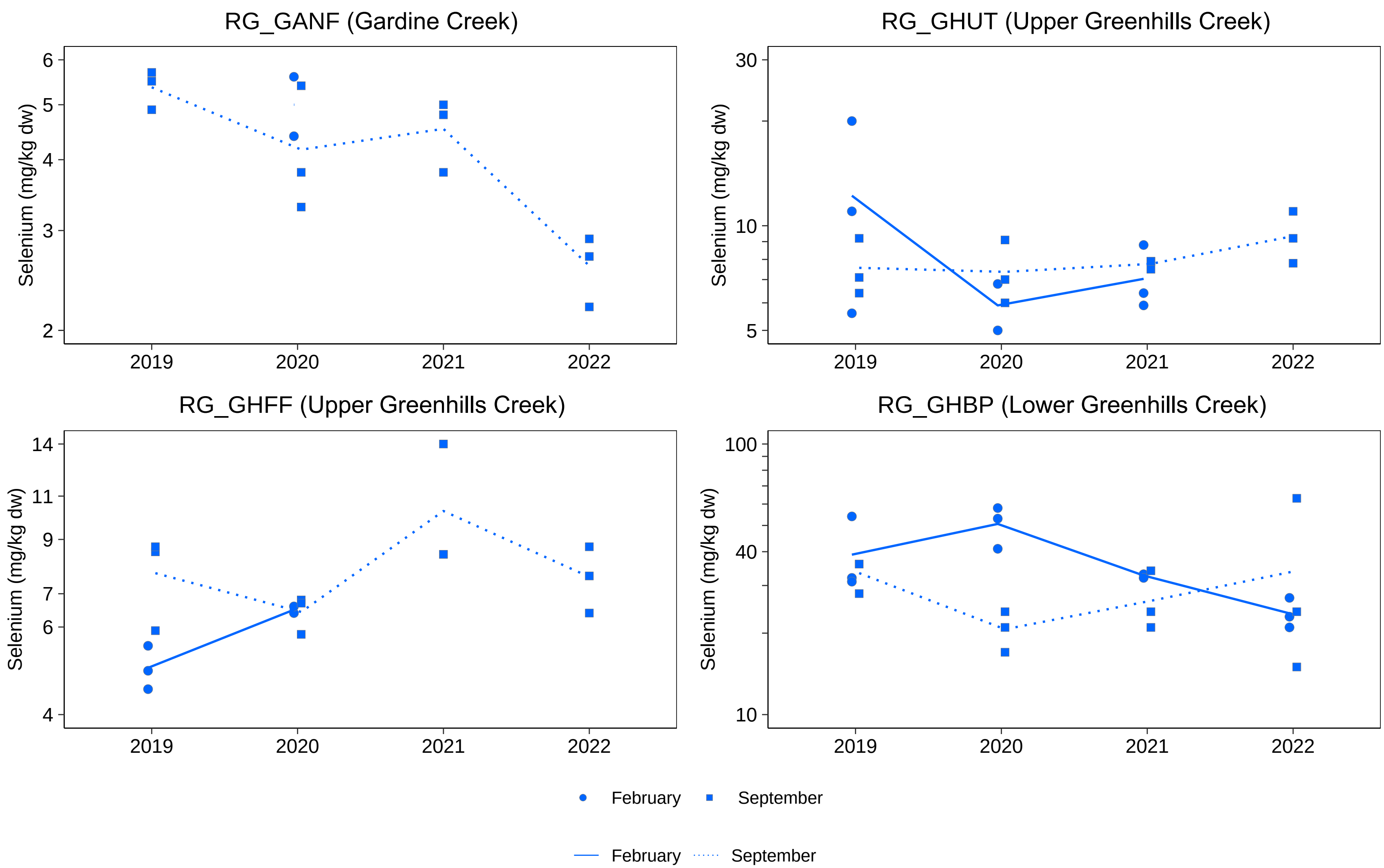

Figure I.1: Comparisons of Selenium Concentrations in Composite−taxa Benthic Invertebrate Tissue Samples Collected in February and September, Greenhills and Gardine Creeks, 2019 to 2022

Notes: Solid lines connect means. Y−axes were plotted on $\log_{10}$−transformed scale. Only areas that had both Feburary and September samples were included in the analyses.

Table I.1: Chemistry Data for Benthic Invertebrate Tissue Samples Collected from Greenhills and Gardine Creeks, February and September 2022

Constituent	Units	Gardine Creek						Upper Greenhills Creek								
		RG_GAUT			RG_GANF			RG_GHUT			RG_GHNF			RG_GHDT		
		Composite-taxa			Composite-taxa			Composite-taxa			Composite-taxa			Composite-taxa		
		RG_GAUT-1	**RG_GAUT-3**	**RG_GAUT-5**	**RG_GANF-1**	**RG_GANF-3**	**RG_GANF-5**	**RG_GHUT-1**	**RG_GHUT-3**	**RG_GHUT-5**	**RG_GHNF-1**	**RG_GHNF-3**	**RG_GHNF-5**	**RG_GHDT-1**	**RG_GHDT-3**	**RG_GHDT-5**
		14-Sep-22	**14-Sep-22**	**14-Sep-22**	**13-Sep-22**	**13-Sep-22**	**13-Sep-22**	**15-Sep-22**	**15-Sep-22**	**15-Sep-22**	**09-Sep-22**	**10-Sep-22**	**10-Sep-22**	**16-Sep-22**	**16-Sep-22**	**16-Sep-22**
% Moisture	%	84.3	77.4	81.4	77.6	79.1	75.3	83.3	83.8	83.4	83.8	83.9	84.9	78.2	80.5	82.1
Aluminum (Al)	mg/kg dw	12,497	21,316	11,064	3,197	3,193	4,057	4,068	3,984	5,446	1,692	1,337	3,922	2,782	1,986	3,631
Antimony (Sb)	mg/kg dw	0.379	0.759	0.405	0.113	0.123	0.134	0.153	0.145	0.188	0.095	0.085	0.139	0.110	0.104	0.136
Arsenic (As)	mg/kg dw	1.5	3.1	1.6	<0.431	0.741	0.860	0.898	1.1	0.957	0.630	0.56	1.2	0.910	1.0	1.1
Barium (Ba)	mg/kg dw	190	321	192	59	66	112	63	53	71	36	31	66	55	45	69
Boron (B)	mg/kg dw	13	23	11	3.1	3.0	3.8	3.2	2.7	3.9	1.3	1.4	3.0	3.3	2.6	4.5
Cadmium (Cd)	mg/kg dw	3.1	1.6	1.4	0.307	0.284	0.331	6.9	8.5	6.1	1.0	2.4	5.0	1.3	1.2	1.4
Calcium (Ca)	mg/kg dw	5,451	6,405	4,114	8,589	18,424	13,761	19,492	10,735	15,755	14,686	14,101	22,457	16,241	16,204	20,817
Chromium (Cr)	mg/kg dw	70	241	88	13	17	18	23	26	28	15	22	25	25	22	24
Cobalt (Co)	mg/kg dw	2.9	13	4.0	0.670	0.815	1.5	2.3	2.3	2.6	1.1	1.0	2.1	1.1	1.7	2.0
Copper (Cu)	mg/kg dw	25	35	28	16	16	19	19	18	27	7.5	24	14	20	21	21
Iron (Fe)	mg/kg dw	3,941	9,639	4,454	883	1,098	1,388	1,313	1,657	1,662	645	735	1,313	1,194	947	1,423
Lead (Pb)	mg/kg dw	2.2	5.4	2.4	0.772	0.551	0.705	1.5	1.4	1.8	0.559	0.614	1.3	0.905	0.745	1.3
Lithium (Li)	mg/kg dw	5.2	11	5.4	1.7	1.9	2.6	2.5	2.8	2.6	0.931	1.7	2.6	1.9	1.8	2.7
Magnesium (Mg)	mg/kg dw	2,182	2,987	2,081	1,798	2,761	2,516	2,310	2,432	2,725	1,323	2,608	2,768	2,814	2,433	2,678
Manganese (Mn)	mg/kg dw	117	169	127	36	30	41	63	75	62	23	46	74	55	49	62
Mercury (Hg)	mg/kg dw	0.237	0.173	0.179	0.069	0.064	0.075	0.076	0.111	0.123	0.052	0.111	0.062	0.090	0.090	0.090
Molybdenum (Mo)	mg/kg dw	1.7	1.1	0.712	0.448	0.211	0.395	0.383	0.371	0.406	0.116	0.464	0.325	0.534	0.209	0.255
Nickel (Ni)	mg/kg dw	113	307	124	22	33	32	48	49	52	27	44	47	65	54	61
Phosphorus (P)	mg/kg dw	9,035	10,073	10,654	9,093	11,555	8,285	18,262	19,084	14,728	5,697	20,272	16,341	14,709	15,294	14,584
Potassium (K)	mg/kg dw	12,773	18,525	13,101	9,576	12,870	10,659	15,492	12,728	11,504	3,384	15,082	14,037	11,673	13,434	13,188
Selenium (Se)	mg/kg dw	7.3	5.8	5.2	2.9	2.2	2.7	9.2	11	7.8	4.4	9.5	7.8	13	11	7.3
Silver (Ag)	mg/kg dw	0.261	0.412	0.268	0.165	0.117	0.213	0.067	0.105	0.093	0.105	0.099	0.105	0.148	0.140	0.198
Sodium (Na)	mg/kg dw	3,655	4,131	3,096	3,245	3,983	2,465	6,433	6,259	4,212	1,091	6,843	5,623	4,582	5,149	5,169
Strontium (Sr)	mg/kg dw	21	29	18	12	16	24	11	9.3	12	7.4	7.1	12	10	9.7	13
Thallium (Tl)	mg/kg dw	0.083	0.155	0.081	0.021	0.013	0.028	0.112	0.154	0.130	0.059	0.091	0.119	0.081	0.066	0.084
Tin (Sn)	mg/kg dw	0.870	1.4	0.886	0.388	0.490	0.470	0.548	0.626	1.0	0.498	0.832	0.871	0.621	0.363	0.875
Titanium (Ti)	mg/kg dw	914	1,682	885	608	208	338	312	286	376	110	81.0	257	188	129	246
Uranium (U)	mg/kg dw	0.339	0.596	0.309	0.106	0.154	0.239	0.33	0.196	0.309	0.191	0.200	0.339	0.302	0.222	0.291
Vanadium (V)	mg/kg dw	20	49	24	5.4	4.7	9.3	7.6	7.5	9.6	3.3	2.5	7.3	4.8	4.0	6.9
Zinc (Zn)	mg/kg dw	225	241	257	98.0	108	101	191	195	216	104	187	141	168	179	153

- Selenium concentration exceeds the 41 mg/kg dw Level 3 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
- Selenium concentration exceeds the 27 mg/kg dw Level 3 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
- Selenium concentration exceeds the 26 mg/kg dw Level 3 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
- Selenium concentration exceeds the 22 mg/kg dw Level 2 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
- Selenium concentration exceeds the 20 mg/kg dw Level 2 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
- Selenium concentration exceeds the 18 mg/kg dw Level 2 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
- Selenium concentration exceeds the 15 mg/kg dw Level 1 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
- Selenium concentration exceeds the 13 mg/kg dw Level 1 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
- Selenium concentration exceeds the 11 mg/kg dw Level 1 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
- Selenium concentration exceeds the 8.74 mg/kg dw 97.5th percentile reference concentration (i.e., the upper boundary of the normal range) used to identify a difference from reference (Minnow 2020b).

Notes: % = percent; mg/kg dw = milligrams per kilogram dry weight; < = less than; EVWQP = Elk Valley Water Quality Plan.

Table I.1: Chemistry Data for Benthic Invertebrate Tissue Samples Collected from Greenhills and Gardine Creeks, February and September 2022

Constituent	Units	Upper Greenhills Creek			Lower Greenhills Creek								
		RG_GHFF			RG_GHBP								
		Composite-taxa			Composite-taxa			Annelid-only	Composite-taxa	Composite-taxa with Annelids		Annelid-only	
		RG_GHFF-1	RG_GHFF-3	RG_GHFF-5	RG_GHBP-1	RG_GHBP-3	RG_GHBP-5	RG_GHBP-5	RG_GHBP-3	RG_GHBP-1	RG_GHBP-5	RG_GHBP-1	RG_GHBP-5
		08-Sep-22	09-Sep-22	09-Sep-22	28-Feb-22	28-Feb-22	28-Feb-22	28-Feb-22	12-Sep-22	12-Sep-22	12-Sep-22	12-Sep-22	12-Sep-22
% Moisture	%	79.8	78.3	81.8	83.8	85.7	82.9	83.2	82.0	78.3	81.1	73.9	68.3
Aluminum (Al)	mg/kg dw	2,677	1,950	1,957	6,600	1,737	1,199	10,483	1,494	10,772	817	7,501	6,987
Antimony (Sb)	mg/kg dw	0.119	0.103	0.112	0.122	0.091	0.061	0.292	0.073	0.399	0.050	0.335	0.305
Arsenic (As)	mg/kg dw	0.548	<0.431	0.630	1.2	0.814	0.458	8.9	0.817	4.1	0.723	5.1	6.4
Barium (Ba)	mg/kg dw	76	57	65	124	69	38	112	76	196	33	125	139
Boron (B)	mg/kg dw	3.0	1.8	2.4	6.9	3.2	1.8	7.9	2.2	13	1.3	8.5	7.2
Cadmium (Cd)	mg/kg dw	0.908	2.2	0.838	0.654	0.606	0.510	11	1.8	2.2	0.733	4.3	7.4
Calcium (Ca)	mg/kg dw	24,230	19,765	26,079	26,453	28,068	6,252	7,302	22,831	20,645	11,965	10,506	19,057
Chromium (Cr)	mg/kg dw	20	13	26	19	6.9	2.4	25	13	25	8.4	27	21
Cobalt (Co)	mg/kg dw	1.6	1.1	1.1	1.7	0.815	0.568	4.8	2.1	2.8	0.917	3.9	4.4
Copper (Cu)	mg/kg dw	14	16	23	27	24	19	13	35	22	25	14	15
Iron (Fe)	mg/kg dw	1,120	826	999	1,470	448	247	2,325	691	3,843	376	3,395	2,605
Lead (Pb)	mg/kg dw	1.4	0.796	0.774	1.2	0.589	0.425	1.6	0.600	2.5	0.334	2	2.4
Lithium (Li)	mg/kg dw	1.6	1.3	1.7	2.6	1.0	0.731	2.8	2.3	6.3	1.4	3.7	3.4
Magnesium (Mg)	mg/kg dw	2,144	1,745	2,912	2,763	2,453	2,168	1,672	2,515	3,158	1,239	2,923	2,678
Manganese (Mn)	mg/kg dw	36	24	32	109	100	91	69	66	104	33	87	104
Mercury (Hg)	mg/kg dw	0.076	0.080	0.080	0.098	0.101	0.098	0.624	0.102	0.211	0.071	0.277	0.376
Molybdenum (Mo)	mg/kg dw	0.278	0.186	0.487	0.487	0.442	0.261	0.902	0.348	1.3	0.186	0.923	0.858
Nickel (Ni)	mg/kg dw	46	32	54	43	26	13	51	29	61	16	73	62
Phosphorus (P)	mg/kg dw	12,280	11,775	16,394	12,342	12,250	12,728	12,041	11,912	8,694	8,950	8,666	9,523
Potassium (K)	mg/kg dw	10,134	9,140	13,932	10,870	8,693	9,410	10,735	10,234	11,354	8,943	11,778	11,191
Selenium (Se)	mg/kg dw	7.6	6.4	8.7	23	27	21	248	24	63	15	97	111
Silver (Ag)	mg/kg dw	0.157	0.157	0.174	0.257	0.238	0.104	0.479	0.314	0.316	0.134	0.179	0.262
Sodium (Na)	mg/kg dw	3,837	3,226	4,950	5,111	5,014	3,920	2,909	4,665	2,535	4,537	2,599	2,813
Strontium (Sr)	mg/kg dw	16	11	14	32	29	8.4	11	26	30	12	15	19
Thallium (Tl)	mg/kg dw	0.063	0.041	0.056	0.148	0.057	0.047	0.261	0.073	0.105	0.047	0.086	0.283
Tin (Sn)	mg/kg dw	1.5	0.749	0.587	0.957	0.735	0.538	1.6	0.294	0.606	0.201	0.510	0.942
Titanium (Ti)	mg/kg dw	206	126	153	478	95	66	690	104	777	55	626	493
Uranium (U)	mg/kg dw	0.255	0.206	0.265	0.359	0.232	0.121	0.529	0.141	0.760	0.067	0.470	0.426
Vanadium (V)	mg/kg dw	5.6	3.8	3.9	7.8	2.2	1.3	10	2.8	19	1.4	13	13
Zinc (Zn)	mg/kg dw	92.0	131	137	165	163	152	156	171	178	120	247	180

Selenium concentration exceeds the 41 mg/kg dw Level 3 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 27 mg/kg dw Level 3 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 26 mg/kg dw Level 3 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 22 mg/kg dw Level 2 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 20 mg/kg dw Level 2 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 18 mg/kg dw Level 2 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 15 mg/kg dw Level 1 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 13 mg/kg dw Level 1 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 11 mg/kg dw Level 1 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 8.74 mg/kg dw 97.5th percentile reference concentration (i.e., the upper boundary of the normal range) used to identify a difference from reference (Minnow 2020b).

Notes: % = percent; mg/kg dw = milligrams per kilogram dry weight; < = less than; EVWQP = Elk Valley Water Quality Plan.

Table I.2: Comparisons Among Areas for Selenium Concentrations in Composite-taxa Benthic Invertebrate Tissue Samples from Greenhills and Gardine Creeks, September 2018 to 2022

ANOVA Model				Spatial *Post Hoc* Comparisons						
Transformation	Station	Year	Station:Year	Area 1	Area 2	MOD [a] 2018	2019	2020	2021	2022
log_{10}	<0.001	0.045	<0.001	RG_GAUT	RG_GANF	-	ns	ns	ns	-57.2
				RG_GHUT	RG_GAUT	-	-52.8	ns	-45.1	ns
					RG_GANF	-	ns	ns	ns	-72.1
					RG_GHNF	150	ns	ns	ns	ns
					RG_GHDT	-	-	-	-	ns
					RG_GHFF	ns	ns	ns	ns	ns
				RG_GHNF	RG_GAUT	-	-73.9	ns	-58.7	ns
					RG_GANF	-	-56.0	-63.0	-56.4	-55.9
					RG_GHDT	-	-	-	-	ns
					RG_GHFF	-56.4	ns	ns	ns	ns
				RG_GHDT	RG_GAUT	-	-	-	-	ns
					RG_GANF	-	-	-	-	-74.5
					RG_GHFF	-	-	-	-	ns
				RG_GHFF	RG_GAUT	-	-58.1	ns	-57.2	ns
					RG_GANF	-	ns	ns	-54.8	-65.6
				RG_GHBP	RG_GAUT	-	-90.4	-76.0	-83.5	-78.7
					RG_GANF	-	-83.8	-80.1	-82.5	-90.9
					RG_GHUT	-71.7	-79.6	-68.3	-69.9	-67.3
					RG_GHNF	ns	-63.3	ns	-60.0	-79.3
					RG_GHDT	-	-	-	-	-64.2
					RG_GHFF	-69.1	-77.1	-68.6	-61.4	-73.5

P-value <0.05.
Significant increase relative to Area 1.
Significant decrease relative to Area 1.

Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; < = less than; ns = not significant; - = no data; MCT = Measure of Central Tendency (back-transformed estimated marginal means).

[a] MOD = $(MCT_{Area\ 2} - MCT_{Area\ 1})/MCT_{Area\ 1} * 100$.

Table I.3: Comparisons Among Years for Selenium Concentrations in Composite-taxa Benthic Invertebrate Tissue Samples from Greenhills and Gardine Creeks, September 2018 to 2022

ANOVA Model				Area	Temporal *Post Hoc* Comparisons to 2018 (or base year)			
					MOD [a]			
Transformation	Station	Year	Station:Year		2019	2020	2021	2022
$\log_{10}$	<0.001	0.045	<0.001	RG_GAUT	Base Year	ns	ns	89.9
				RG_GANF	Base Year	ns	ns	-51.8
				RG_GHUT	ns	ns	ns	ns
				RG_GHNF	ns	ns	-42.8	-67.5
				RG_GHFF	ns	ns	ns	ns
				RG_GHBP	ns	ns	ns	ns

P-value <0.05. (grey)
Significant increase relative to 2018 or base year. (blue)
Significant decrease relative to 2018 or base year. (green)

Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; < = less than; ns = not significant; MCT = Measure of Central Tendency (back-transformed estimated marginal means).

[a] MOD = $(MCT_{Examined\ Year} - MCT_{Base\ Year})/MCT_{Base\ Year} * 100$.

Table I.4: **Mean Observed and Predicted Benthic Invertebrate Tissue Selenium Concentrations for Lotic Sampling Areas, Greenhills and Gardine Creeks, 2018 to 2022** [a]

Watercourse	Biological Monitoring Area	Year	Month	Tissue Selenium (mg/kg dw)	Prediction Interval (mg/kg dw)		
					Lower	Mean	Upper
Gardine Creek	RG_GAUT	2019	September	3.5	2.6	5.1	10
				3.4			
				2.7			
		2020	September	4.3	2.5	5.0	9.8
				5.0			
				5.5			
		2021	September	3.9	2.6	5.1	9.9
				5.1			
				3.9			
		2022	September	7.3	2.6	5.2	10
				5.8			
				5.2			
	RG_GANF	2019	September	5.5	2.9	5.6	11
				4.9			
				5.7			
		2020	February	4.4	3.0	5.9	12
				5.6			
		2020	September	3.8	2.8	5.4	11
				5.4			
				3.3			
		2021	September	4.8	3.0	5.9	12
				3.8			
				5.0			
		2022	September	2.9	3.1	6.0	12
				2.2			
				2.7			
Upper Greenhills Creek	RG_GHUT	2018	September	7.2	4.0	7.9	15
				7.3			
				7.1			
		2019	February	5.6	4.0	7.8	15
				11			
				20			
			September	6.4	4.0	7.8	15
				9.2			
				7.1			
		2020	February	6.8	4.0	7.7	15
				5.0			
			September	9.1	4.0	7.9	15
				6.0			
				7.0			
		2021	February	8.8	4.0	7.9	15
				6.4			
				5.9			
			September	7.9	4.0	7.8	15
				7.5			
				7.9			
		2022	September	9.2	4.0	7.8	15
				11			
				7.8			
	RG_GHNF	2018	September	17	4.0	7.9	15
				15			
				23			
		2019	September	15	3.9	7.7	15
				10			
				12			
		2020	September	9.9	4.0	7.9	15
				9.5			
				11			
		2021	September	10	4.0	7.7	15
				11			
				10			
		2022	September	4.4	4.0	7.8	15
				9.5			
				7.8			
	RG_GHDT	2022	September	13	3.9	7.7	15
				11			
				7.3			

Mean selenium concentration exceeds the upper predicted limit.
Mean selenium concentration is less than the lower predicted limit.

Notes: mg/kg dw = milligrams per kilogram dry weight; % = percent.

[a] Data are for composite-taxa benthic invertebrate tissue chemistry samples unless otherwise indicated.

[b] This sample is an annelid-only sample.

[c] This sample is an annelid-only sample whereas annelids were removed from the remaining samples in that sampling period.

[d] This sample is a composite sample with annelids intentionally included because they represented more than 5% of the biomass in the parent sample.

Table I.4: Mean Observed and Predicted Benthic Invertebrate Tissue Selenium Concentrations for Lotic Sampling Areas, Greenhills and Gardine Creeks, 2018 to 2022 [a]

Watercourse	Biological Monitoring Area	Year	Month	Tissue Selenium (mg/kg dw)	Prediction Interval (mg/kg dw)		
					Lower	Mean	Upper
Upper Greenhills Creek	RG_GHFF	2018	September	8.8	3.9	7.6	15
				8.8			
				6.3			
		2019	February	5.5	3.8	7.5	15
				4.9			
				4.5			
			September	5.9	3.8	7.5	15
				8.5			
				8.7			
		2020	February	6.4	3.8	7.5	15
				6.6			
			September	6.8	3.9	7.6	15
				6.7			
				5.8			
		2021	September	14	3.9	7.6	15
				8.4			
				8.4			
				13 [b]			
		2022	September	7.6	3.9	7.6	15
				6.4			
				8.7			
Lower Greenhills Creek	GH_GH1_AS	2020	September	16	3.8	7.5	15
				14			
	RG_GHBP	2018	September	25	3.8	7.5	15
				30			
				22			
		2019	February	54	3.8	7.5	15
				32			
				31			
			September	36	3.7	7.3	14
				36			
				28			
		2020	February	58	3.8	7.4	15
				53			
				41			
			September	88 [c]	3.9	7.6	15
				17			
				24			
				21			
		2021	February	33	3.9	7.6	15
				33			
				32			
			September	21	3.8	7.5	15
				34			
				24			
		2022	February	248 [c]	3.8	7.5	15
				27			
				21			
				23			
		2022	September	111 [b]	3.8	7.5	15
				97 [b]			
				63 [d]			
				24			
				15 [d]			

Mean selenium concentration exceeds the upper predicted limit.
Mean selenium concentration is less than the lower predicted limit.

Notes: mg/kg dw = milligrams per kilogram dry weight; % = percent.

[a] Data are for composite-taxa benthic invertebrate tissue chemistry samples unless otherwise indicated.

[b] This sample is an annelid-only sample.

[c] This sample is an annelid-only sample whereas annelids were removed from the remaining samples in that sampling period.

[d] This sample is a composite sample with annelids intentionally included because they represented more than 5% of the biomass in the parent sample.

Table I.5: Comparison of Selenium Concentrations Measured in Benthic Invertebrate Tissues and Concentrations Predicted Using the Selenium Species Bioaccumulation Tool, 2022 [a]

Watercourse/ Waterbody	Biological Monitoring Area	B-tool Prediction		Field Measurements	
		Water Sample Date	Predicted Selenium Concentration in Benthic Invertebrate Tissues (mg/kg dw)	Tissue Sample Date	Mean Selenium Concentrations in Benthic Invertebrate Tissues [b] (mg/kg dw)
Gardine Creek	RG_GAUT	14-Sep-22	4.14	14-Sep-22	6.10
	RG_GANF	13-Sep-22	3.53	13-Sep-22	2.60
Upper Greenhills Creek	RG_GHUT	15-Sep-22	7.40	15-Sep-22	9.33
	RG_GHNF	09-Sep-22	9.89	09-Sep-22	7.23
	RG_GHDT	16-Sep-22	8.98	16-Sep-22	10.4
	RG_GHFF	08-Sep-22	8.74	09-Sep-22	7.57
Greenhills Creek Sedimentation Pond	RG_GHP	19-Sep-22	24.6	19-Sep-22	19.5
Lower Greenhills Creek	RG_GHBP	28-Feb-22	15.0	28-Feb-22	23.7
		12-Sep-22	23.1	12-Sep-22	34.0

Mean benthic invertebrate tissue selenium concentration is higher than predicted.

Notes: B-tool = Selenium Speciation Bioaccumulation Tool, mg/kg dw = milligrams per kilogram dry weight.

[a] Predictions of benthic invertebrate tissue selenium concentrations were derived using aqueous selenium speciation data and sulphate concentrations for each area and sampling event (February or September 2022) (de Bruyn and Luoma 2021).

[b] Mean selenium concentrations are for composite-taxa benthic invertebrate samples only (i.e., the annelid-only and bivalve-only samples collected from RG_GHBP and RG_GHP, respectively, in September 2022 are not included).

Table I.6: Comparison of Selenium Concentrations in Composite-taxa Benthic Invertebrate Tissue Samples Collected from Greenhills and Gardine Creeks in February Versus September, 2019 to 2022

ANOVA Model [a]							Area	Do February samples differ from September samples within a given year? MOD [b]			
Area	Year	Month	Area:Year	Area:Month	Year:Month	Area:Year:Month		2019	2020	2021	2022
<0.001	0.063	0.181	0.078	0.010	0.034	0.027	RG_GANF	-	ns	-	-
							RG_GHUT	ns	ns	ns	-
							RG_GHFF	ns	ns	-	-
							RG_GHBP	ns	145	ns	ns

P-value <0.05.
Concentration in February is significantly higher relative to September within a given year.
Concentration in February is significantly lower relative to September within a given year.

Notes: ANOVA = Analysis of Variance; MOD = Magnitude of Difference; < = less than; ns = not significant; - = no data; MCT = Measure of Central Tendency (back-transformed estimated marginal means).

[a] The ANOVA was performed on $\log_{10}$-transformed data and only areas that had both February and September samples within a given year were included in the analyses. *Post hoc* tests were conducted to compare February and September samples within a given year only.

[b] MOD = $(MCT_{February} - MCT_{September})/MCT_{September} * 100$.

Table I.7: **Chemistry Data for Benthic Invertebrate Tissue Samples Collected from Greenhills Creek Sedimentation Pond, September 2022**

Constituent	Unit	Greenhills Creek Sedimentation Pond				
		RG_GHP				
		Composite-taxa		Bivalve-only		
		RG_GHP-3	RG_GHP-5	RG_GHP-3	RG_GHP-5	RG_GHP-6
		19-Sep-22	19-Sep-22	19-Sep-22	19-Sep-22	19-Sep-22
% Moisture	%	74.4	68.5	74.4	68.5	62.1
Aluminum (Al)	mg/kg dw	17,565	12,097	5,346	13,719	17,305
Antimony (Sb)	mg/kg dw	0.513	0.299	0.135	0.376	0.507
Arsenic (As)	mg/kg dw	2.70	4.90	0.758	1.60	2.00
Barium (Ba)	mg/kg dw	395	332	115	186	309
Boron (B)	mg/kg dw	27.0	13.0	6.80	12.0	21.0
Cadmium (Cd)	mg/kg dw	3.90	0.965	0.835	0.408	0.482
Calcium (Ca)	mg/kg dw	34,842	84,225	226,246	174,784	182,701
Chromium (Cr)	mg/kg dw	54.0	13.0	14.0	30.0	21.0
Cobalt (Co)	mg/kg dw	5.50	3.30	1.50	3.60	3.10
Copper (Cu)	mg/kg dw	60.0	40.0	12.0	23.0	12.0
Iron (Fe)	mg/kg dw	6,754	3,316	2,016	3,206	4,835
Lead (Pb)	mg/kg dw	5.10	2.70	1.40	2.50	5.90
Lithium (Li)	mg/kg dw	9.00	5.80	2.40	4.50	6.60
Magnesium (Mg)	mg/kg dw	3,989	3,623	783	1,387	1,269
Manganese (Mn)	mg/kg dw	225	273	55.0	116	67.0
Mercury (Hg)	mg/kg dw	0.373	0.0920	0.0750	0.0360	0.0570
Molybdenum (Mo)	mg/kg dw	1.10	0.761	0.363	0.865	0.870
Nickel (Ni)	mg/kg dw	110	36.0	27.0	62.0	38.0
Phosphorus (P)	mg/kg dw	7,805	19,706	1,702	1,993	1,010
Potassium (K)	mg/kg dw	9,435	5,535	2,550	4,091	6,122
Selenium (Se)	mg/kg dw	27	12	5.30	6.80	4.90
Silver (Ag)	mg/kg dw	0.582	1.30	0.144	0.306	0.140
Sodium (Na)	mg/kg dw	3,835	1,328	1,592	1,337	838
Strontium (Sr)	mg/kg dw	52.0	95.0	119	83.0	97.0
Thallium (Tl)	mg/kg dw	0.329	0.239	0.0800	0.192	0.265
Tin (Sn)	mg/kg dw	1.80	1.10	0.394	0.449	0.913
Titanium (Ti)	mg/kg dw	2,109	1,117	465	1,275	1,941
Uranium (U)	mg/kg dw	0.888	0.618	0.205	0.447	0.617
Vanadium (V)	mg/kg dw	44.0	23.0	10.0	25.0	44.0
Zinc (Zn)	mg/kg dw	153	81.0	36.0	41.0	36.0

Selenium concentration exceeds the 41 mg/kg dw Level 3 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 27 mg/kg dw Level 3 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 26 mg/kg dw Level 3 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 22 mg/kg dw Level 2 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 20 mg/kg dw Level 2 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 18 mg/kg dw Level 2 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 15 mg/kg dw Level 1 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 13 mg/kg dw Level 1 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 11 mg/kg dw Level 1 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 8.74 mg/kg dw 97.5th percentile reference concentration (i.e., the upper boundary of the normal range) used to identify a difference from reference (Minnow 2020c).

Notes: % = percent; mg/kg dw = milligrams per kilogram dry weight; < = less than; EVWQP = Elk Valley Water Quality Plan.