Teck Coal Limited
Water Quality Management
P.O. Box 1777
421 Pine Avenue
Sparwood, B.C. Canada V0B 2G0

+1 250 425 8086 Tel
www.teck.com

Technical Report Overview

Report: 2021 Greenhills and Gardine Creek Aquatic Effects Monitoring Program (GGCAMP) Report

Overview: This report presents the 2021 results of Greenhills and Gardine Creeks aquatic monitoring program. The 2021 program was designed to monitor current aquatic health and collect information for assessing future changes that may result from rehabilitation activities planned within the watershed.

This report was prepared for Teck by Minnow Environmental Inc.

For More Information

If you have questions regarding this report, please:

- Phone toll-free to 1.855.806.6854
- Email **feedbackteckcoal@teck.com**

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

minnow environmental inc.
A Trinity Consultants Company

2021 Greenhills and Gardine Creeks Aquatic Monitoring Program Report

Prepared for:
Teck Coal Limited
Sparwood, British Columbia

Prepared by:
Minnow Environmental Inc.
Saskatoon, Saskatchewan

June 2022

2021 Greenhills and Gardine Creeks Aquatic Monitoring Program Report

Prepared for:

Teck Coal Limited
Sparwood, British Columbia

Prepared by:

Minnow Environmental Inc.
Saskatoon, Saskatchewan

June 2022

2021 Greenhills and Gardine Creeks Aquatic Monitoring Program Report

Amy Wiebe, M.Sc., R.P.Bio.
Project Manager

Pierre Stecko, M.Sc., R.P.Bio., EP
Senior Project Advisor

EXECUTIVE SUMMARY

This report presents the results of the 2021 Greenhills and Gardine Creeks Aquatic Monitoring Program (GGCAMP), which is intended to address the influences and mitigation projects that are expected to interact with Greenhills and Gardine creeks, as well as the Greenhills Creek Sedimentation Pond. Teck Coal Limited (Teck) is committed to improving the environmental conditions in Greenhills Creek through several mitigation projects and initiatives. Calcite management (i.e., antiscalant addition) began in Lower Greenhills Creek in 2017 and has proven successful at preventing further calcite deposition. Consequently, Teck intends to relocate the antiscalant addition facility to Upper Greenhills Creek in 2022. Other rehabilitation projects are also proposed within the watershed.

Data collected as part of the program are expected 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, specifically?*

This report summarizes the 2021 results for the GGCAMP. Sampling in 2021 consisted of a sixth year of monitoring on Upper Greenhills Creek, a third year of monitoring on Gardine Creek, a fourth year of sampling in Greenhills Creek Sedimentation Pond, and a fourth 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 conditions within Greenhills and Gardine creeks in 2021.

Aqueous concentrations of most mine-related constituents with Early Warning Triggers (EWTs) were below water quality guidelines, benchmarks, and screening values in 2021, except for total dissolved solids (TDS); nitrate; sulphate; total nickel, selenium, uranium, and dissolved cadmium.[1] Water quality was generally better in Gardine Creek than in Greenhills Creek and the Greenhills Creek Sedimentation Pond. Additionally, concentrations of

[1] Mine-related constituents with EWTs include 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.

organoselenium species tended to increase with distance downstream in Greenhills Creek in 2021. Aqueous selenium species were consistently dominated by selenate.

In 2021, calcite was present throughout Greenhills Creek and in the section of Gardine Creek within and downstream from the seeps from the Greenhills Operations (GHO) east spoil. Of these areas, Lower Greenhills Creek had the lowest proportional calcite presence scores. Concretion and calcite indices generally decreased with increasing distance downstream in Greenhills Creek.

Sediment concentrations of arsenic and manganese were highest at upper Gardine Creek and concentrations of cadmium, nickel, selenium, and most polycyclic aromatic hydrocarbons (PAHs) were highest at Lower Greenhills Creek. Sediment Quality Indices (SQI) were generally indicative of poor sediment quality and the Greenhills Creek Sedimentation Pond had the lowest SQI in 2021, followed by Lower Greenhills Creek. Overall, exceedances of upper British Columbia Working Sediment Quality Guidelines (BC WSQG) or the alert concentration for selenium in 2021 were identified for nickel, selenium, silver, acenaphthene, acenaphthylene, benzo(a)anthracene, chrysene, dibenz(a,h)anthracene, fluorene, 2-methylnaphthalene, naphthalene, and phenanthrene. Concentrations of arsenic, cadmium, iron, manganese, zinc, benzo(a)pyrene, benzo(g,h,i)perylene, fluoranthene, and pyrene exceeded the lower, but not upper, BC WSQG in at least one sample. However, concentrations of arsenic, cadmium, and iron in sediments were within reference area normal ranges. As expected, calcium concentrations were consistently higher at areas with calcified substrates.

Sequential Extraction Analysis (SEA) indicated that the distribution of metals among the potentially mobile sediment fractions (i.e., fractions 1 to 4) and fraction 5 (residual metals) was fairly consistent among sediment sampling areas. Additionally, guideline exceedances based on the potentially mobile, and therefore potentially bioavailable[2], sediment fractions (fractions 1 to 4) were limited to cadmium, manganese, nickel, and selenium in 2021.

Benthic invertebrate abundances, densities, Lowest Practical Level (LPL) richness, and proportions (%) of Ephemeroptera and Plecoptera in 2021 were generally similar among the biological monitoring areas on Greenhills Creek. However, the significantly higher benthic invertebrate biomass on Lower Greenhills Creek suggests the availability of food for fish may have been better in Lower Greenhills Creek in 2021.

Benthic invertebrate densities were higher at lower Gardine Creek, relative to upper Gardine Creek, and biomass was similar between the two areas. The higher %Diptera in the samples

[2] 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.

from lower Gardine Creek, downstream from the seeps and within the area of heavily calcified substrates, likely reflects this taxonomic group's ability to tolerate a wider range of environmental conditions.

The highest selenium concentrations in composite-taxa benthic invertebrate tissues collected from the study area in 2021 were for Lower Greenhills Creek. The higher concentrations are likely due to enhanced generation of organoselenium species in the Greenhills Creek Sedimentation Pond and carry-over effects downstream. Mean selenium concentrations in February and September 2021 exceeded Elk Valley Water Quality Plan (EVWQP) Level 3 Benchmarks for effects to invertebrates and juvenile fish and birds. Additionally, selenium concentrations in each of the nine samples collected from Lower Greenhills Creek exceeded the biological trigger. Mean selenium concentrations in composite-taxa benthic invertebrate tissues from Upper Greenhills Creek and the Greenhills Creek Sedimentation Pond only occasionally exceeded the lowest benchmarks and concentrations in Upper Greenhills Creek did not exceed the biological trigger. Benthic invertebrate tissue samples collected from Gardine Creek had selenium concentrations that were within the reference area normal range and lower than applicable benchmarks.

In 2021, estimates of westslope cutthroat trout (WCT; *Oncorhynchus clarkii lewisi*) fish abundance, density, and biomass, were higher at lower Gardine Creek than at biological monitoring areas on Upper and Lower Greenhills Creek. Additionally, there was no indication that WCT densities within Upper Greenhills Creek increased with increasing distance downstream and proximity to the Greenhills Creek Sedimentation Pond.

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 unexpected changes over time.

Aqueous concentrations of most mine-related constituents with EWTs remained stable or decreased over time (i.e., nickel) on Greenhills and Gardine creeks. Decreases over time are attributed to stabilization of the GHO east spoil (post-2014 failure) and cessation of pumping from the Cougar Phase 3 Pit after 2018.

In Lower Greenhills Creek, an 89% decrease in calcite concretion relative to 2017 (pre-treatment) was observed in 2021. Concretion was also lower relative to all other treatment years (2018 to 2020). These results are consistent with expectations or desired outcomes of water treatment to prevent further calcite concretion.

In general, sediment texture and constituent concentrations in samples from Lower Greenhills Creek, Gardine Creek, and the Greenhills Creek Sedimentation Pond did not show consistent trends over time. Key exceptions include nickel and zinc, which generally showed increasing concentrations over time. Additionally, concentrations of manganese, selenium, and 12 PAHs in sediments from Lower Greenhills Creek were higher throughout the period of antiscalant addition (2018 to 2021) relative to before (2017). However, it remains unclear whether observed increases are attributable to water treatment or some (other) combination of factors. Results of the SEA have been consistent year after year, which highlights the need to reassess the utility of annual sampling for SEA.

Few notable temporal changes in benthic invertebrate community endpoints were identified. Subtle shifts from more sensitive (e.g., Ephemeroptera, Plecoptera, and Trichoptera [collectively referred to as EPT]) to more tolerant (e.g., Diptera) taxa at some areas on Upper Greenhills Creek are not surprising given the changes in calcite conditions. Apparent increases in %EPT and %Ephemeroptera at lower Gardine Creek 2021 were likely explained by delayed emergence and higher numbers of *Baetis* in some of the samples.

Selenium concentrations in benthic invertebrate tissues from Lower Greenhills Creek were consistently and substantially higher than those collected from Upper Greenhills and Gardine creeks. Additionally, tissue selenium concentrations for Lower Greenhills Creek were higher than expected, based on the lotic bioaccumulation model, throughout 2018 to 2021.

Densities, abundances, and biomass for WCT in Upper and Lower Greenhills Creek were generally lower in 2021 than in previous years. The fork lengths of WCT captured from Upper and Lower Greenhills and Gardine creeks in 2021 were consistent with previous years. However, condition (weight-at-length) of WCT captured from Upper Greenhills Creek (26% decrease relative to 2017) and upper Gardine Creek (14% decrease relative to 2019) was lower. These results may be attributable to some regional factor(s) that depressed fish condition within the isolated population in 2021. Additionally, higher fish densities in the isolated pools at upper Gardine Creek in 2021 versus 2019 may have contributed to the reduced fish condition observed in 2021. Fish condition in the Upper Fording River WCT population, which has access to habitats in Lower Greenhills Creek, was near (2019 and 2020) or above average (2021) in recent years.

Question 3 ("*Can observed changes be linked to antiscalant addition in Lower Greenhills Creek, specifically*?") 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 in water quality in Lower Greenhills Creek; differences in aqueous concentrations of mine-related constituents upstream and downstream of treatment in 2021 did not differ significantly from pre-treatment. Total and dissolved molybdenum were the only exceptions, but molybdenum is a component of the antiscalant compound (i.e., these results are expected) and concentrations were still far lower than guidelines. 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 or processes within the creek itself.

The 89% decrease in calcite concretion in Lower Greenhills Creek from 2017 to 2021 is primarily attributed to successful water treatment. Overall, it appears water treatment has prevented further calcification of the stream bed.

Benthic invertebrate biomass and LPL and family richness have not changed significantly in Lower Greenhills Creek, relative to Upper Greenhills Creek, since the initiation of antiscalant addition in 2017. In 2021, differences in %Diptera between treated and untreated areas were larger relative to 2017, due to a decrease in %Diptera at the treated area in Lower Greenhills Creek.

The absence of change over time for selenium concentrations in benthic invertebrate tissues from Lower Greenhills Creek suggests that tissue selenium concentrations associated with that area are likely unrelated to antiscalant addition.

The WCT captured from Lower Greenhills Creek in 2021 were in good condition and good external health. Therefore, it is concluded that antiscalant addition was not negatively impacting these endpoints in 2021. The lower fry and juvenile densities, as well as lower estimates of abundance and biomass, on Lower Greenhills Creek in 2021 relative to previous years is also not likely attributed to antiscalant addition. Conditions of water quality, calcite concretion, and food availability have remained unchanged or improved relative to pre-treatment.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

AB – Alberta

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

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

B-tool – Selenium Speciation Bioaccumulation Tool

CABIN – Canadian Aquatic Biomonitoring Network

$CaCO_3$ – Calcium Carbonate

CALA – Canadian Association for Laboratory Accreditation Inc.

C_c – Calcite Concretion Score

CCME – Canadian Council of Ministers of the Environment

CCMS – Collision Cell Mass Spectrophotometry

CI – Calcite Index

CI' – Calcite Index Prime

CMm – Coal Mountain Operation

COPC – Contaminant of Potential Concern

Cordillera – Cordillera Consulting

C_p – Calcite Presence Score

C_p' – Calcite Presence Score Prime

CRC-ICPMS – Collision Reaction Cell Inductively Coupled Plasma-Mass Spectrophotometry

CRM – Certified Reference Material

CSSS – Canadian Society of Soil Science

CVAAS – Cold Vapour Atomic Absorption Spectroscopy

DC – Direct Current

DELT – Deformities, Erosion, Lesion, and Tumor

DO – Dissolved Oxygen

DQR – Data Quality Review

ECCC – Environment and Climate Change Canada

eDNA – Environmental DNA

EMC – Environmental Monitoring Committee

EMM – Estimated Marginal Mean

EPA – United States Environmental Protection Agency

EPT – Ephemeroptera, Plecoptera, and Trichoptera

EVO – Elkview Operation

EVWQP – Elk Valley Water Quality Plan

EWT – Early Warning Triggers

GC/MS – Gas Chromatography with Mass Spectrometric Detection

GGCAMP – Greenhills and Gardine Creeks Aquatic Monitoring Program

GHO – Greenhills Operation

GPS – Global Positioning System

HSD – Honestly Significant Difference

IC-ICP-CRC-MS – Ion Chromatography Inductively Coupled Plasma Collision Reaction Cell Mass Spectrometry

ISQG – Interim Sediment Quality Guideline

KNC – Ktunaxa National Council

KU – Key Uncertainty

LAEMP – Local Aquatic Effects Monitoring Program

LA-ICPMS – Laser Ablation Inductively Coupled Plasma Mass Spectrometry

Lotic – Lotic Environmental Ltd.

LPL – Lowest Practical Level

LRL – Laboratory Reporting Limit

MCT – Measure of Central Tendency

MEMPR – Ministry of Energy, Mines, and Petroleum Resources

MFLNRORD – Ministry of Forests, Lands, Natural Resource Operations, and Rural Development

Minnow – Minnow Environmental Inc.

MOD – Magnitude of Difference

MQ – Management Question

NELAP – National Environmental Laboratory Accreditation Program

PAH – Polycyclic Aromatic Hydrocarbon

PIT – Passive Integrated Transponder

QA/QC – Quality Assurance/ Quality Control

QC – Quality Control

RAEMP – Regional Aquatic Effects Monitoring Program

SD – Standard Deviation

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

UTM – Universal Transverse Mercator

WCT – Westslope Cutthroat Trout

ZEAS – Zeas Inc.

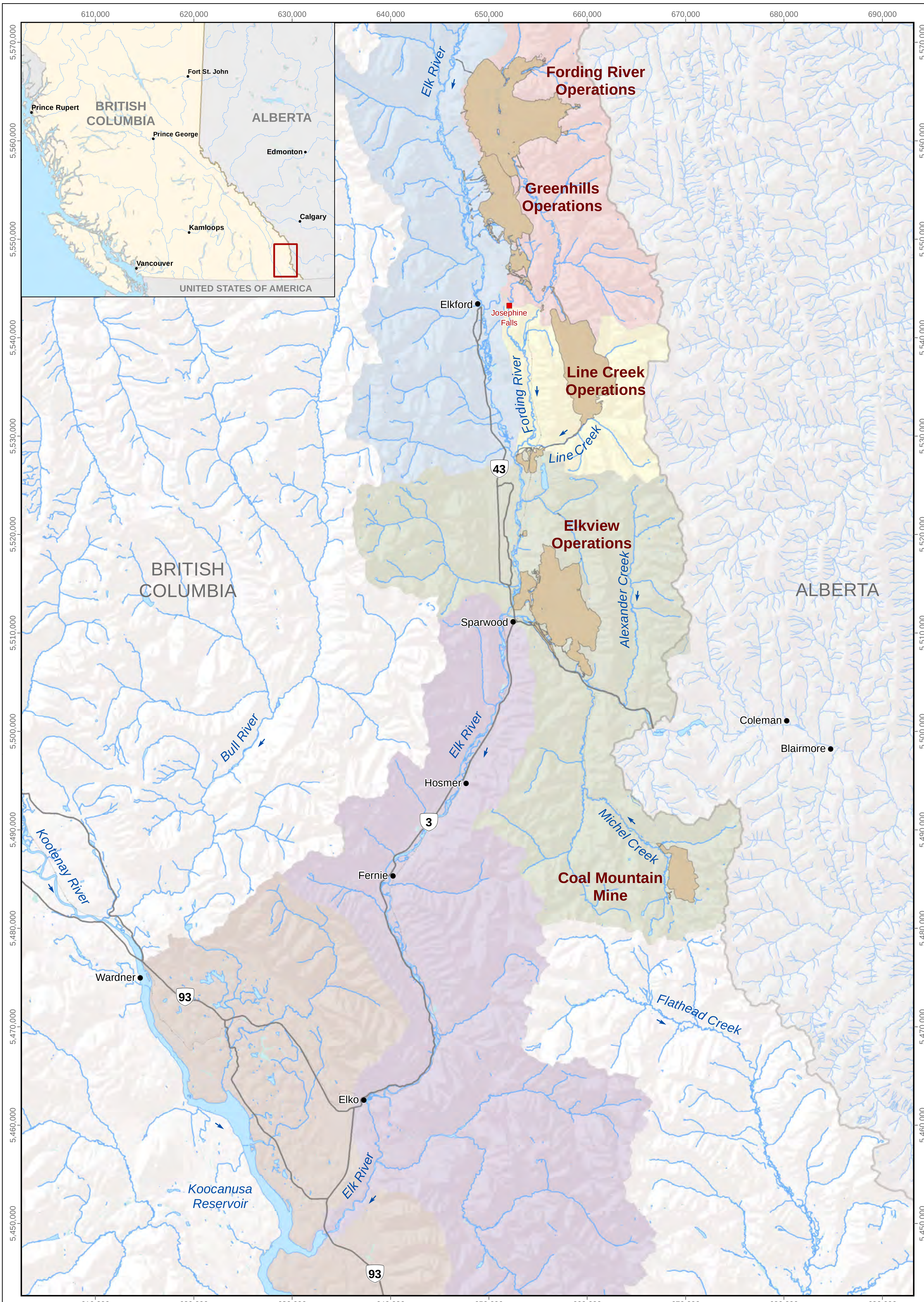
1 INTRODUCTION

1.1 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). Permits 107517 (*Environmental Management Act*) and 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 aquatic environmental studies were initiated in Greenhills Creek in 2016 to characterize the existing environment and support the evaluation of potential effects associated with the 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. Gardine Creek, a tributary to Greenhills Creek, was identified as a priority stream for potential calcite management in July 2019 (Teck 2019a). Gardine Creek receives inputs from groundwater seeps originating from the GHO east spoil, downstream of which calcite has been documented. Focused studies were initiated upstream and downstream from the documented seeps in 2019 to characterize existing conditions and support decision-making around the implementation of calcite management/water treatment in Gardine Creek (Minnow 2020a,b, 2021a,b). The pre-treatment 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). Following completion of the 2020 monitoring and reporting cycle (i.e., effective in 2021), the program was renamed as the Greenhills and Gardine Creeks Aquatic Monitoring Program (GGCAMP).

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 Fording River confluence (Minnow 2019a). As such, Teck proposed implementing calcite management via antiscalant addition within Upper Greenhills



LEGEND

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

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

0 5 10 20 km

N W E S

Projection: North American Datum 1983 UTM Zone 11U
Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Date: June 2022
Project 227202.0016

minnow environmental inc.

Figure 1.1

Creek in October 2019. The plan was to relocate the antiscalant addition facility from Lower Greenhills Creek to approximately 4.9 kilometres (km) upstream from the Greenhills Creek Sedimentation Pond. The intention was to prevent further calcite deposition throughout the full 5.65 km section of Greenhills Creek. In 2018, however, comparisons of projected water quality data to benchmarks/screening values for metal[3] contaminants of potential concern (COPCs; i.e., cadmium, cobalt, manganese, nickel, selenium, and zinc) resulted in uncertainty in the conclusion that prevention could be safely carried out without the potential for adverse aquatic effects. Modelled predictions indicated prevention of calcite precipitation could eliminate a meaningful mechanism of metal sequestration, resulting in unacceptable higher aqueous metal concentrations (i.e., could result in seasonal exceedances for cadmium that would not be expected to occur without antiscalant addition, as well as an overall increase in nickel concentrations, which were already above the interim screening value that has not been proven to be protective of the aquatic environment). In 2020 and present day, modelling predicted water quality changes following antiscalant addition is conservatively executed based on the assumption that 100 percent (%) of the metal attenuation observed is due to calcite precipitation. Currently, there is no way to address the conservatism in this modelling method. Consequently, the Upper Greenhills Creek Calcite Management Project was suspended. In 2020, as part of the Upper Greenhills Creek Calcite Remediation Trial and Antiscalant Addition Project, Teck proposed to relocate the antiscalant addition facility from Lower Greenhills Creek 2.25 km upstream to a location 500 m upstream from the Greenhills Creek and Gardine Creek confluence. Projected changes to water quality within the approximately 3 km management area were conservatively predicted to be safe.

In 2021, the Calcite Remediation Trial and relocation of the antiscalant addition facility were deferred for a year to provide time for engagement with the Ktunaxa Nation Council (KNC), who had expressed concerns regarding the proposed remediation trial location. In 2022, the Calcite Remediation Trial component of the project was further deferred in response to inability to address KNC's opposition to completing calcite remediation in Greenhills Creek. Currently, under the *Mines Act* C-137 Permit and *Water Sustainability Act* Water License amendments received May 2022, Teck is completing the powerline construction required to support relocation of the antiscalant addition facility. Teck is also awaiting finalized *Environmental Management Act* Permit 107571 and Effluent Permit amendments and a *Fisheries Act Authorization* before complete site preparation and infrastructure installation within the riparian zone, infrastructure installation within the creek, and commissioning and operation of the facility. The antiscalant addition facility on

[3] Throughout this report, metals, metalloids, and non-metals typically included in a multi-element scan are collectively referred to as "metals".

Upper Greenhills Creek is predicted to result in a safe, yet measurable change in aqueous concentrations of cadmium, cobalt, manganese, and zinc. It is anticipated that the water quality monitoring data collected to confirm the potential environmental effects predicted from the operation of this facility will provide a line of evidence to address the conservatism in the current modelling method.

As indicated previously, Gardine Creek, which flows into Upper Greenhills Creek, was also identified as a priority stream for potential calcite management in July 2019 (Teck 2019a). Initially, relocation of the antiscalant addition facility to support the Upper Greenhills Creek Calcite Remediation Trial and Antiscalant Addition Project was intended to manage both Gardine and Greenhills creeks. It was hoped that the benefits of antiscalant addition would be realized from the Gardine Creek/Upper Greenhills Creek confluence down to the Fording River. However, in the winter of 2019/2020 it was identified that flow within Gardine Creek is intermitted during low flow periods and it was ultimately decided that Teck would not proceed with antiscalant addition downstream from the seeps on Gardine Creek (Ferguson 2021, pers. comm.). However, because Gardine Creek is used by fish and influences water quality and other conditions in Greenhills Creek, Gardine Creek will continue to be monitored as part of the GGCAMP.

Teck is committed to improving the environmental conditions in Greenhills Creek. The Greenhills Creek Rehabilitation Program is a holistic management approach that integrates environmental management of water quality, aquatic habitat, and water usage throughout the Greenhills Creek watershed. There are several mitigation projects and regional initiatives currently planned or being implemented in the Greenhills Creek drainage to support the objectives of the EVWQP and compliance with *Environmental Management Act* Permit 107517, and the Environment and Climate Change Canada (ECCC) Directive. The intended output of the program would be a rehabilitation plan, including the establishment of a road map of mitigation projects to improve Greenhills Creek water quality, aquatic habitat, and fish connectivity with the Upper Fording River in a coordinated and logically sequenced manner. Work is progressing on this initiative in parallel to other projects and further engagement with external stakeholders is anticipated throughout late 2022 and into 2023. Current proposed rehabilitation projects in the Greenhills Creek watershed under the Greenhills Creek Watershed Rehabilitation Program include:

- the Calcite Remediation Trial;
- selenium treatment in Greenhills Creek;
- the Greenhills Creek water management project;
- a geosynthetic cover trial; and

- the Greenhills Creek reconnection project.

Until 2021, the scope of the GGCAMP focused on the collection of pre-treatment data from Upper Greenhills and Gardine creeks, as well as aquatic effects monitoring in Lower Greenhills Creek. However, starting in 2021, the scope of the monitoring program was updated to address the proposed mitigation projects within the watershed that are expected to interact with the aquatic environments in Greenhills and Gardine creeks. The updated scope of the GGCAMP is reflected in the Key Questions (Section 1.2), which were reviewed and revised for 2021.

The 2021 GGCAMP was administered by Teck based on advice from the Environmental Monitoring Committee (EMC). The EMC consists of representatives from Teck, British Columbia Ministry of Environment and Climate Change Strategy (BCMOECCS/ENV[4]), the Ministry of Energy, Mines, and Petroleum Resources (MEMPR), the KNC, Interior Health Authority, and an Independent Scientist.[5] Components of the 2021 study design were presented to the EMC on May 5, 2021. Feedback received from the EMC during the meeting and in the form of written input and advice were integrated into the 2021 study design, which was finalized in July 2021. On May 27, 2022, results of the monitoring completed in 2021 were presented to the EMC, along with proposed plans for the 2022 monitoring program. The advice and input received from the EMC during and after the May 2022 meeting have been integrated into this monitoring program report and will be integrated in the 2022 study design, as appropriate.

This report is submitted to satisfy the requirement outlined in Appendix 5B section 5B3 of Permit 107517 (amended December 1, 2021):

The Greenhills Creek Aquatic Effects Assessment and Monitoring Program annual report 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 by June 30.

1.2 Key Questions

Focused pre-treatment studies to support decision-making regarding antiscalant addition were conducted in 2016 and 2017 (Upper and Lower Greenhills Creek), 2018 (Upper Greenhills Creek), and 2019 to 2021 (Upper Greenhills and Gardine creeks). Sampling continued in Lower Greenhills Creek in 2018 to 2021 following the initiation of antiscalant addition in October 2017 to

4 The abbreviation “ENV” is commonly used to refer to representatives from BCMOECCS who participate in the EMC.

5 To date, ECCC has not been called on to participate in engagement with the EMC. However, ECCC has agreed to provide its perspectives on matters related to Permit 107517 and the EMC’s activities on a case-by-case basis and when requested to do so by the EMC.

confirm the environmental effects predictions made for the Lower Greenhills Creek Calcite Management Project.

From 2016 to the end of 2020, the Key Questions for the GGCAMP focused on calcite management and were identified as follows:

1. *Will the prevention of calcite by water treatment (e.g., antiscalant addition) cause adverse effects on aquatic health (based on specific metrics outlined below) in Upper Greenhills Creek and Gardine Creek?*

2. *Has addition of antiscalant prevented further calcification of substrate without causing adverse effects on aquatic health (based on specific metrics outlined below) in Lower Greenhills Creek?*

Answering these Key Questions required the characterization of conditions at various locations throughout Greenhills and Gardine creeks. Characterization was based on a suite of monitoring components including water quality, selenium speciation, substrate conditions (i.e., calcite indices [CI], sediment characteristics, and sediment quality) and aquatic organism health (i.e., benthic invertebrate community structure, benthic invertebrate biomass, benthic invertebrate tissue chemistry, fish numbers, health, and tissue chemistry).[6] These metrics were used to describe current conditions within Upper Greenhills and Gardine creeks, support comparisons of pre-treatment and post-treatment (i.e., after initiation of antiscalant addition) conditions in Lower Greenhills Creek, and identify potential temporal trends.

As indicated in Section 1.1, the Key Questions were revised by the study team in early 2021 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 revised Key Questions were presented to Teck's EMC on May 5, 2021 and were included in the 2021 study design for the GGCAMP (Minnow 2021b). The Key Questions for 2021 were 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?*

[6] Selenium speciation sampling was not initiated until September 2020 (Minnow 2020b,c) and no westslope cutthroat trout (WCT; *Oncorhynchus clarkii lewisi*) population monitoring was completed in 2020 as a proactive response to the reported population decline in Management Unit 1 (Cope 2020).

3. *Can observed changes be linked to antiscalant addition in Lower Greenhills Creek, specifically?*

These Key Questions were addressed by characterizing existing conditions within Greenhills and Gardine creeks in 2021 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).[7] Endpoints related to water quality, selenium speciation, substrate conditions (i.e., CI and calcite index prime [CI'], sediment characteristics, and sediment quality), and aquatic organism health (i.e., benthic invertebrate community structure, benthic invertebrate biomass, benthic invertebrate tissue chemistry, and fish numbers and health) were evaluated, as data allowed. Fish tissue chemistry sampling and fish tagging were not completed in 2021 to minimize fish handling stress and potential risks to westslope cutthroat trout (WCT; *Oncorhynchus clarkii lewisi*) (see Sections 2.6 and 3.5). Relevant data (e.g., flows and water temperatures, calcite indices) collected as part of other monitoring programs (e.g., the Regional Calcite Monitoring Program) were integrated into this 2021 report for the GGCAMP, as appropriate, to address the Key Questions.

1.3 Objectives

The broader objective of the GGCAMP is to monitor and evaluate site-specific indicators of aquatic ecosystem conditions within Greenhills and Gardine creeks (including Greenhills Creek Sedimentation Pond). However, the program is designed with a primary focus on monitoring aquatic health to support assessment of effects (e.g., of ongoing antiscalant addition in Lower Greenhills Creek) and provide benchmarks for assessing future changes that may result from activities planned within the watershed (e.g., relocation of the antiscalant addition facility, decommissioning of Greenhills Creek Sedimentation Pond). Additionally, the 2021 GGCAMP is expected to support the Regional Aquatic Effects Monitoring Program (RAEMP) and the Adaptive Management Plan (AMP) by assessing site-specific conditions on a more focused basis. This includes helping to answer questions around effective management of calcite and achievement of site performance objectives (SPOs), as well as broader questions around mine-related changes in aquatic ecosystem conditions.

1.4 Linkages to Adaptive Management

As required in Permit 107517 Section 10, Teck has developed an AMP. The purpose of the AMP is to support implementation of the EVWQP through attainment of water quality and calcite

[7] "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.

targets, the protection of human health and the environment, and continuous improvement of water quality in the Elk Valley (Teck 2021a). Following an adaptive management framework, the AMP identifies six Management Questions (MQ) that are re-evaluated at regular intervals as part of AMP updates throughout EVWQP implementation. Data from the RAEMP (Minnow 2018a, 2020d, 2021c), Local Aquatic Effects Monitoring Programs (LAEMPs), and the GGCAMP feed into the adaptive management process. The data address the MQ that collectively address the environmental management objectives of the AMP (Teck 2021a) and the EVWQP (Teck 2014). The AMP also identifies Key Uncertainties (KU) that need to be reduced to fill gaps in current understanding of mine-related effects to the aquatic environment and support achievement of the EVWQP objectives.

The GGCAMP provides supportive information to help answer AMP MQ #4 ("*Is calcite being managed effectively to meet site SPOs and to protect the aquatic ecosystem?*"). Answering MQ #4 is accomplished by addressing KU 4.1 through 4.3 ("*Are the calcite SPOs protective of fish and aquatic life?"*; "*What are the most effective management methods for calcite?*"; and "*Are there interrelationships with calcite and select constituents of interest in surface water that need to be considered for calcite management?*"). These KU need to be reduced to fill gaps in current understanding and support the attainment of the EVWQP objectives. The MQ are re-evaluated and adjusted at regular intervals as part of AMP updates throughout EVWQP implementation and after relevant investigations.

Additionally, the 2021 GGCAMP will contribute to the RAEMP, which is designed to evaluate AMP MQ #5 *("Does monitoring indicate that mine-related changes in aquatic ecosystem conditions are consistent with expectations?")*. During the development of the AMP, a number of uncertainties related to MQ #5 were identified that were summarized as KU 5.1 (i.e., *"How will monitoring data be used to identify potentially important mine-related effects on the aquatic ecosystem?")*. Teck is working with its consultants and the EMC to address KU 5.1 and its underlying uncertainties prior to submission of the next RAEMP report in 2023. Progress on reducing these uncertainties, and associated learnings, is described in Annual AMP Reports (e.g., Teck 2021b).

The evaluation of biological triggers for potential management action is a requirement of Permit 107517 and is incorporated as part of MQ #5 of the AMP (Teck 2021a). Biological triggers were developed in consultation with the EMC for a subset of the biological monitoring endpoints that are considered effective indicators of changes at the ecosystem level. Generally, the biological triggers are intended as a simple way to flag potentially unexpected monitoring results that may require management action. For the 2021 GGCAMP, comparisons to the biological triggers for proportions (expressed as %) of Ephemeroptera (mayflies), Plecoptera (stoneflies), and

Trichoptera (caddisflies) (collectively referred to as EPT) in benthic invertebrate community samples and selenium concentrations in benthic invertebrate tissues and WCT muscle were made. Comparisons included data collected from biological monitoring areas that have supporting water quality projections (Minnow 2021b,c; Teck 2021a).

The third annual AMP report was submitted on July 31, 2021 and included data from 2020 (Teck 2021b). This report indicated that selenium concentrations in fish tissues, selenium bioaccumulation, and fish habitat quality in Greenhills Creek were less favorable than previously expected, based on predictive tools and conceptual model assumptions for the Elk River watershed. Additionally, results of biological monitoring completed downstream of Greenhills Creek Sedimentation Pond were not as expected. Selenium concentrations in benthic invertebrate and fish tissues were higher than anticipated given the measured water concentrations. Actions associated with the AMP responses to these issues focused on further investigations and adjustments, as outlined in detail in the 2020 AMP report (Teck 2021b). Examples include initiation of a Greenhills Creek Rehabilitation Program, a sulphate removal pilot program, the Greenhills Creek Sediment Pond Bypass, continuation of permitting activities for the Greenhills Creek Calcite Remediation Field Trial and Antiscalant Addition Project, and the completion of additional pre-treatment monitoring in Upper Greenhills Creek.

For more information on the adaptive management framework, the MQ, the KU, the Response Framework[8], Continuous Improvement, linkages between the AMP and other EVWQP programs, and AMP reporting, refer to the AMP update (Teck 2021a) and the 2020 annual AMP report (Teck 2021b).

[8] A response framework was opened for Greenhills Creek based on the unexpected conditions for selenium concentrations in benthic invertebrate tissues.

2 METHODS

2.1 Design Overview

Aquatic monitoring completed in 2021 to support the GGCAMP included the following core technical components (Table 2.1):

1. Water quality monitoring, including sampling for determination of selenium speciation, upstream and downstream from the existing antiscalant addition location on Lower Greenhills Creek, upstream and downstream of the future location of the antiscalant addition facility on Upper Greenhills Creek[9], 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 east spoil;
3. Calcite index measurements throughout Greenhills and Gardine creeks[10];
4. Sediment quality monitoring in depositional areas in Lower Greenhills Creek and throughout Gardine Creek, as well as in Greenhills Creek Sedimentation Pond;
5. Benthic invertebrate community and biomass sampling (i.e., area-based kick and sweep sampling) at areas (six stations per area) throughout Greenhills and Gardine creeks;
6. Timed benthic invertebrate community sampling at one biological monitoring area (three stations) on Upper Greenhills Creek (i.e., three-minute kick and sweep)[11];
7. Benthic invertebrate community sampling at six depositional stations within Greenhills Creek Sedimentation Pond;
8. Benthic invertebrate tissue chemistry sampling at areas (three stations per area) throughout Greenhills and Gardine creeks and within Greenhills Creek Sedimentation Pond;
9. WCT fry and juvenile surveys to support assessments of fish presence, density, and biomass in Upper Greenhills and Gardine creeks; and

[9] The antiscalant addition facility was scheduled to be relocated from Lower Greenhills Creek to Upper Greenhills Creek in August to early October 2021, but this project has been postponed to 2022 (Hillman 2021a,b, pers. comm.).

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

[11] Benthic invertebrate community data for the timed kick sampling site on Lower Greenhills Creek (i.e., RG_GHCKD; Greenhills Creek downstream of the Greenhills Creek Sedimentation Pond), which is sampled as part of the RAEMP, was also included in the evaluation of biological triggers (see Section 2.4.3).

Table 2.1: Overview of the 2021 Greenhills and Gardine Creeks Aquatic Monitoring Program

Location	Monitoring Area	Approximate UTMs (NAD 83, 11U)		River Kilometre (km) [a]	Area Description	Teck - Routine Water Quality	February 2021				September 2021							
							Water Quality			Benthic Invertebrates	Water Quality			Calcite Index Measurements	Sediment Quality	Benthic Invertebrates		Fish Population
		Easting	Northing				Chemistry	Selenium Speciation	*In situ* Quality	Composite-taxa Tissue Chemistry	Chemistry	Selenium Speciation	*In situ* Quality			Community Structure	Composite-taxa Tissue Chemistry	
Upper Greenhills Creek	RG_GHUT	654134	5549945	5.20	Biological Monitoring Area in Reach 10 of Upper Greenhills Creek Upstream from Proposed Antiscalant Addition Facility	-	1 (concurrent with tissue chemistry monitoring)	1 (concurrent with tissue chemistry 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)	-	6 stations	3 stations	3 closed stations
	GREE4-75	654152	5549910	5.20	Regional Calcite Monitoring Program Station in Reach 10 of Upper Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-	-
	GH_CTF	654165	5549540	4.86	Permitted Water Quality Station in Reach 10 of Upper Greenhills Creek	✓	Teck - routine	-	Teck - routine	-	Teck - routine	-	Teck - routine	-	-	-	-	-
	RG_GHNF	654367	5549052	4.26	Biological Monitoring Area in Reach 9 of Upper Greenhills Creek Downstream from Proposed Antiscalant Addition Facility	-	1 (concurrent with tissue chemistry monitoring)	1 (concurrent with tissue chemistry 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)	-	6 stations (area-based); 3 stations (CABIN)	3 stations	3 closed stations
	GREE4-50	654336	5549133	4.36	Regional Calcite Monitoring Program Station in Reach 9 of Upper Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-	-
	GREE4-25	654512	5548365	3.52	Regional Calcite Monitoring Program Station in Reach 8 of Upper Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-	-
	GH_HWGH_BRB	654435	5548079	3.18	Water Quality Station in Reach 7 of Upper Greenhills Creek	✓	Teck - routine	-	Teck - routine	-	Teck - routine	-	Teck - routine	-	-	-	-	-
	GREE3-75	654172	5547243	2.51	Regional Calcite Monitoring Program Station in Reach 6 of Upper Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-	-
	RG_GHFF	654135	5547185	2.28	Biological Monitoring Area in Reach 6 of Upper Greenhills Creek Downstream from Gardine Creek	-	1 (concurrent with tissue chemistry monitoring)	1 (concurrent with tissue chemistry 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)	-	6 stations	3 stations	3 closed stations
	GREE3-50	653990	5546883	1.81	Regional Calcite Monitoring Program Station in Reach 6 of Upper Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-	-
	GREE3-25	653918	5546481	1.36	Regional Calcite Monitoring Program Station in Reach 5 of Upper Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-	-
	GH_GH1B	653740	5546142	0.95	Permitted Water Quality Station at the Inlet of Greenhills Sediment Pond	✓	Teck - routine	-	Teck - routine	-	Teck - routine	-	Teck - routine	-	-	-	-	-
Greenhills Pond	RG_GHP	653445	5546033	-	Greenhills Sediment Pond - Depositional Area	-	-	-	-	-	1 or 2 (concurrent with biological monitoring) [b]	1 or 2 (concurrent with biological monitoring) [b]	6 (concurrent with biological monitoring) and a profile at the deepest area of the pond	-	6 stations	6 stations	3 stations	-

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

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

[b] If no stratification was observed at the time of sampling, a single surface grab was collected from RG_GHP. If stratification was observed, then two water samples were collected (i.e., one above and one below the thermocline).

[c] Monitoring area GH_DSAF (Downstream of Antiscalant Facility; see Figure 2.2) was excluded from the table because it was only sampled one year (2018) and for calcite indices only.

[d] Data are collected from this location as part of the RAEMP and are used, as appropriate, to support the Greenhills and Gardine Creeks Aquatic Monitoring Program.

Table 2.1: Overview of the 2021 Greenhills and Gardine Creeks Aquatic Monitoring Program

Location	Monitoring Area	Approximate UTMs (NAD 83, 11U)		River Kilometre (km) [a]	Area Description	Teck - Routine Water Quality	February 2021				September 2021							
							Water Quality			Benthic Invertebrates	Water Quality			Calcite Index Measurements	Sediment Quality	Benthic Invertebrates		Fish Population
		Easting	Northing				Chemistry	Selenium Speciation	*In situ* Quality	Composite-taxa Tissue Chemistry	Chemistry	Selenium Speciation	*In situ* Quality			Community Structure	Composite-taxa Tissue Chemistry	
Lower Greenhills Creek [c]	**GH_GH1**	653577	5545871	0.62	Permitted Water Quality Station Downstream from Greenhills Sediment Pond and the Stilling Basin V-notch (Upstream of Antiscalant Addition)	✓	Teck - routine	-	Teck - routine	-	Teck - routine	-	Teck - routine	-	-	-	-	-
	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	-	-	-	-
	RG_GHCKD [d]	653537	5545602	0.38	Greenhills Creek Downstream from the Greenhills Creek Sedimentation Pond	-	-	-	-	-	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	1 (concurrent with biological monitoring)	-	1 station	1 station	-
	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 tissue chemistry monitoring)	1 (concurrent with tissue chemistry 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	-
	GREE1-50	653494	5545590	0.27	Regional Calcite Monitoring Program Station in Reach 2 of Lower Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-	-
	GREE1-25	653386	5545504	0.12	Regional Calcite Monitoring Program Station in Reach 1 of Lower Greenhills Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-	-
	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	-	-	-	-	-
Gardine Creek	**GARD1-75**	653316	5549076	1.85	Regional Calcite Monitoring Program Station in Reach 5 of Gardine Creek	-	-	-	-	-	-	-	-	1 as part of regional calcite monitoring	-	-	-	-
	RG_GAUT	653451	5548928	1.79	Biological Monitoring Area in Reach 4 of Gardine Creek Upstream from GHO East Spoil Seeps	-	1 (concurrent with tissue chemistry monitoring)	1 (concurrent with tissue chemistry 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	3 closed 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 East Spoil Seeps	-	1 (concurrent with tissue chemistry monitoring)	1 (concurrent with tissue chemistry 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	3 closed 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	-	-	-	-	-

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

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

[b] If no stratification was observed at the time of sampling, a single surface grab was collected from RG_GHP. If stratification was observed, then two water samples were collected (i.e., one above and one below the thermocline).

[c] Monitoring area GH_DSAF (Downstream of Antiscalant Facility; see Figure 2.2) was excluded from the table because it was only sampled one year (2018) and for calcite indices only.

[d] Data are collected from this location as part of the RAEMP and are used, as appropriate, to support the Greenhills and Gardine Creeks Aquatic Monitoring Program.

10. A survey of external anomalies (e.g., tumors, fin erosion, parasites) on captured WCT, consistent with the RAEMP methods (Minnow 2021c).

The 2021 field programs were implemented according to the 2021 study design (Minnow 2021b) and sampling was completed in February and September 2021. Results from other projects and monitoring programs (e.g., the Regional Calcite Monitoring Program and the Upper Fording River WCT Population Monitoring Program) have been integrated into this report, where appropriate, to support interpretation of data collected as part of the GGCAMP.

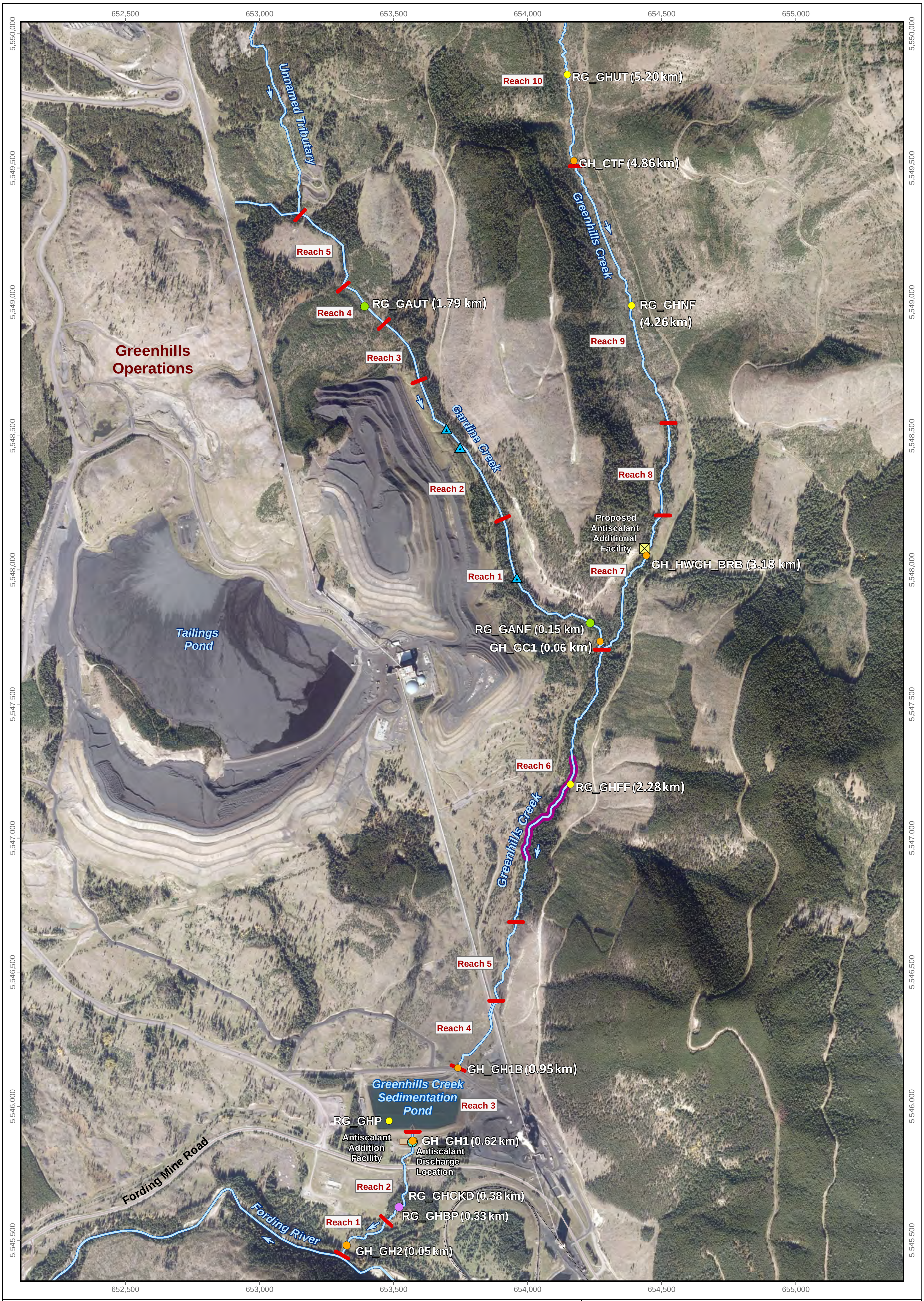
2.2 Water Quality

2.2.1 Field Sampling

Data for water chemistry samples collected by Teck under Permit 107517 were used, as appropriate, to support interpretation of the GGCAMP data. Water quality is routinely monitored by Teck at three stations on Upper Greenhills Creek, two stations on Lower Greenhills Creek, and one station on Gardine Creek (Figure 2.1; Table 2.1). The stations in Reach 10 (GH_CTF) and Reach 7 (GH_HWGH_BRB) of Upper Greenhills Creek are approximately 4.86 and 3.18 km, respectively, upstream from where Greenhills Creek flows into the Upper Fording River (Figure 2.1; Table 2.1). The third Upper Greenhills Creek station is at the inlet to Greenhills Creek Sedimentation Pond (GH_GH1B) (i.e., 0.95 km from the Greenhills Creek mouth; Figure 2.1). The Lower Greenhills Creek stations are located downstream from Greenhills Creek Sedimentation Pond at the outfall for the Stilling Basin (GH_GH1; 0.62 km from the Greenhills Creek mouth) and close to the confluence with the Fording River (GH_GH2; Figure 2.1). Teck's routine water quality monitoring station on Gardine Creek (GH_GC1) is located 0.06 km upstream of the confluence with Upper Greenhills Creek (Figure 2.1; Table 2.1).

As required under Permit 107517, water samples are collected monthly at each of Teck's routine monitoring stations (and weekly for certain analytes at GH_GH1 from March 15 to July 31). Monthly samples are analyzed for total and dissolved metals, nutrients, major ions, and other conventional analytes (i.e., total suspended and dissolved solids, and total and dissolved organic carbon; Table 2.2). Additional weekly samples from GH_GH1 are analyzed for turbidity and total suspended solids (TSS) only. *In situ* water quality measurements including temperature, dissolved oxygen (DO), pH, specific conductance, and turbidity are also taken concurrent with each water sample.

In addition to the routine water sampling completed by Teck, water quality monitoring was completed in February and September 2021, concurrent with benthic invertebrate tissue chemistry and benthic invertebrate community sampling, respectively. In February 2021, RG_GHUT, RG_GHNF, and RG_GHFF on Upper Greenhills Creek, RG_GHBP on Lower



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
- Proposed Antiscalant Addition Facility Location (2022)
- Antiscalant Discharge Location
- Seep
- Remediation Site Selected (2023)
- Reach Break
- Antiscalant Addition Facility

Water Quality Monitoring and Selenium Speciation Sampling Locations

0 0.25 0.5 1
Kilometers

N E S W

Projection: North American Datum 1983 UTM Zone 11U
Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Date: June 2022
Project 227202.0016

minnow environmental inc.

Figure 2.1

Document Path: C:\Users\capol\Trinity Consultants, Inc\Teck - 227202.0016 - 2022 GGCAMP\D - GIS\2021 GGCAMP Report\22-16 Figure 2.1 WQ Monitoring and Selenium Speciation Sampling.mxd

Table 2.2: Analytical Methods for Water Samples

Analyte	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	Watson et al. 2005
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	APHA 4500-NORG D.
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 Phosphorous
Orthophosphate	mg/L	Colourimetrically	APHA 4500-P Phosphorous (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 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

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.

Greenhills Creek, and RG_GAUT and RG_GANF on Gardine Creek were targeted for water chemistry and selenium speciation sampling (Figure 2.1; Table 2.1). The same sampling areas were targeted for water chemistry and selenium speciation sampling again in September 2021, along with RG_GHP in Greenhills Creek Sedimentation Pond (Figure 2.1; Table 2.1).

Additional selenium speciation data from Greenhills Creek Sedimentation Pond and Lower Greenhills Creek were collected as part of Teck's Selenium Speciation Monitoring Program, which was implemented starting in 2021 (Golder 2021a; ADEPT 2022).[12] Sampling to support this program was completed by field personnel from Teck and Minnow Environmental Inc. (Minnow). Relevant information from the 2021 Selenium Speciation Monitoring Program annual report was included in the interpretation of the GGCAMP data, as appropriate, to address the KU (Section 1.2).

Chemistry and aqueous selenium speciation samples collected from lotic habitats consisted of grabs from just below the water surface. *In situ* water quality measurements including temperature, DO, pH, and specific conductance were taken concurrent with all water chemistry and selenium speciation samples collected from lotic habitats in February and September 2021. A calibrated YSI ProDSS (handheld multi-parameter meter equipped with Digital Sampling System sensors; YSI Inc., Yellow Springs, Ohio) was used to collect *in situ* water quality data.

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 confirm if stratification was present. Profile measurements (temperature, DO, pH, and specific conductance) were taken at 1 m intervals. A Van Dorn or beta bottle sampler was used to collect separate surface and bottom water samples from the deepest area of the pond if stratification was observed.[13] If stratification was not present, then only a single grab sample from just below the water surface was required.

Quality assurance and 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 A).

[12] Aqueous selenium speciation data collected to directly support the GGCAMP in 2021 were included in the 2021 annual report for the Selenium Speciation Monitoring Program (ADEPT 2022).

[13] I.e., if distinct "layers" of water with differing temperature (e.g., an upper, warmer layer over a deeper, colder layer), DO, pH, or specific conductance were evident from the profile measurements, then the water in Greenhills Creek Sedimentation Pond was considered "stratified".

2.2.2 Laboratory Analysis

Water chemistry samples were analyzed by ALS Environmental (ALS) in Calgary, Alberta (AB), which is a third-party analytical laboratory that is 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 Environmental Laboratory Methods Manual" (Austin 2020) per Permit 107517 requirements (see also Table 2.2). Laboratory QA/QC included an assessment of the laboratory sensitivity (i.e., an evaluation of laboratory reporting limits [LRLs] and blank samples), accuracy (matrix spikes, laboratory control samples, and certified reference materials [CRM]), and precision (laboratory duplicates; see Appendices A and B).

Selenium speciation samples collected as part of the GGCAMP in February and September 2021 were submitted to Brooks Applied Labs in Bothell, Washington for analysis. Concentrations of total selenium, dissolved selenium, and 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). Laboratory QA/QC included an assessment of laboratory sensitivity (i.e., an evaluation of LRLs and blank samples), accuracy (matrix spikes, blank spikes, and CRM) and precision (laboratory duplicates and matrix spike duplicates) (see Appendices A and B). 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 for samples collected in February and September 2021 (Appendix A). Data quality information associated with Teck's routine water sampling and other consultant reports are provided elsewhere (e.g., in annual reports for Permits 107517 and 6248).

2.2.3 Data Analysis

Concentrations of mine-related constituents were compared among Teck's routine water quality monitoring stations along Greenhills and Gardine creeks to address the following general questions:

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

Q2: Have 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: Have concentrations of mine-related constituents 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)?

Data analyses included comparisons to EVWQP benchmarks, interim screening values, and British Columbia Water Quality Guidelines (BC WQG; BCMOECCS 2021a,b) for constituents without site-specific benchmarks (Table 2.3). Constituents with Early Warning Triggers (EWTs; Azimuth 2018; Teck 2018, 2021a; i.e., total dissolved solids [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) were plotted with applicable benchmarks, screening values, and BC WQG to allow for qualitative comparisons among Teck's routine monitoring stations. The assessment of water chemistry data from Teck's routine monitoring stations was based on comparisons of monthly mean concentrations. Water chemistry and selenium speciation data collected from biological monitoring areas in February and September 2021 were screened relative to benchmarks, screening values, and BC WQG, as appropriate, but were not subject to statistical analyses due to limited sample sizes. As indicated in Section 2.2.1, selenium speciation data collected as part of the Selenium Speciation Monitoring Program were used, as appropriate, to support data interpretation.

Question 1 was addressed by comparing water chemistry data among Teck's routine monitoring stations on Greenhills and Gardine creeks to evaluate potential mine-related influences on water quality. Statistical analyses of the 2021 water chemistry data focused on the constituents for which EWTs have been established and comparisons among stations were completed using an Analysis of Variance (ANOVA). Interpretation focused on identifying spatial patterns, such as upstream-to-downstream differences in concentrations or dilution effects like those observed for some constituents in Greenhills Creek downstream of Gardine Creek (Minnow 2021a).

Question 2 was addressed by evaluating differences in concentrations of mine-related constituents among years for each one of Teck's routine monitoring stations. Data collected from 2016 to 2021 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. This statistical analysis also focused on the constituents for which EWTs have been established.

The differences in monthly mean concentrations over the years for each station were tested using an approach similar to that of the most recent RAEMP report (Minnow 2020d). 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:

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

Table 2.3: British Columbia Water Quality Guidelines, Site-specific Elk Valley Water Quality Plan Benchmarks, and Screening Values Relevant to the Greenhills and Gardine Creeks Aquatic Monitoring Program, 2021

Parameter			Units	British Columbia Water Quality Guidelines [a]				Site-specific Benchmark [b]	Relevant Screening Values [b]
				Long-term Average	Short-term Maximum	Year	Status		
Non-Metals		Total Alkalinity	mg/L	For dissolved calcium = <4mg/L, WQG = <10 For dissolved calcium = 4 to 8 mg/L, WQG = 10 to 20 For dissolved calcium = >8 mg/L, WQG >20	-	2015	Working	-	-
Non-Metals		Ammonia	mg/L	pH and temperature-dependent	pH and temperature-dependent	2009	Approved	-	-
Non-Metals		Chloride	mg/L	150	600	2003	Approved	-	-
Non-Metals		Fluoride	mg/L	-	For hardness ≤10 mg/L, WQG = 0.4 For hardness >10 mg/L, WQG = [-51.73 + 92.57 × $\log_{10}$(hardness)]×0.01 Maximum applicable hardness = 385 mg/L	2011	Approved	-	-
Non-Metals		Nitrate (as N)	mg/L	3	32.8	2009	Approved	$10^{1.0003[\log(\text{hardness})]-1.52}$ Maximum applicable hardness = 500 mg/L	-
Non-Metals		Nitrite (as N) [c]	mg/L	0.020 to 0.20	0.060 to 0.60	2009	Approved	-	$10^{0.829[\log(\text{chloride})]-1.49}$
Non-Metals		Dissolved Oxygen	mg/L	For buried embryo/alevin life stages, WQG (water column) ≥11 WQG (interstitial) ≥8 For other life stages, WQG (water column) ≥8	For buried embryo/alevin life stages, WQG (water column) ≥9 WQG (interstitial) ≥6 For other life stages, WQG (water column) ≥5	1997	Approved	-	-
Non-Metals		pH [d]	pH units	6.5 to 9.0		1991	Approved	-	-
Non-Metals		Sulphate [e]	mg/L	128 to 429 Maximum applicable hardness = 250 mg/L	-	2013	Approved	481	429
Non-Metals		Total Dissolved Solids	mg/L	1,000 to 3,000	-	1987	Working	-	1,000
Metals and Metalloids	Total	Antimony (III)	mg/L	0.009	-	2015	Working	-	-
Metals and Metalloids	Total	Arsenic	mg/L	-	0.005	2002	Approved	-	-
Metals and Metalloids	Total	Barium	mg/L	1	-	2015	Working	-	-
Metals and Metalloids	Total	Beryllium	mg/L	0.00013	-	2015	Working		0.0053
Metals and Metalloids	Total	Boron	mg/L	1.2	-	2003	Approved	-	-
Metals and Metalloids	Total	Chromium [f]	mg/L	0.001	-	1999	Working	-	0.005
Metals and Metalloids	Total	Cobalt	mg/L	0.004	0.11	2004	Approved	-	$\exp^{0.414[\ln(\text{hardness})]-0.99}$
Metals and Metalloids	Total	Iron	mg/L	-	1	2008	Approved		-
Metals and Metalloids	Total	Lead [e]	mg/L	For hardness ≤8 mg/L, none proposed For hardness 8 to 360 mg/L, WQG = 0.001×{3.31+ $\exp^{[1.273 \times \ln(\text{hardness}) - 4.704]}$} No more than 20% of samples in a 30-d period should be >1.5X the guideline. Maximum applicable hardness = 360 mg/L	For hardness ≤8 mg/L, WQG ≤0.003 For hardness 8 to 360 mg/L, WQG = 0.001×{$\exp^{[1.273 \times \ln(\text{hardness}) - 1.460]}$} Maximum applicable hardness = 360 mg/L	1987	Approved	-	-
Metals and Metalloids	Total	Manganese [e]	mg/L	For hardness 37 to 450 mg/L, WQG ≤0.004 × hardness + 0.605 Maximum applicable hardness = 450 mg/L	For hardness 25 to 259 mg/L, WQG ≤0.01102 × hardness + 0.54 Maximum applicable hardness = 259 mg/L	2001	Approved	-	-
Metals and Metalloids	Total	Mercury [g]	mg/L	MeHg ≤0.5% of THg, WQG = 0.00002 Else, WQG = [0.0001/(MeHg/THg)] OR When MeHg = 0.5% of THg, WQG= 0.00002 When MeHg = 1.0% of THg, WQG = 0.00001 When MeHg = 8.0% of THg, WQG= 0.00000125	-	2001	Approved	-	-
Metals and Metalloids	Total	Molybdenum	mg/L	7.6	46	2021	Approved	-	-
Metals and Metalloids	Total	Nickel [e,h]	mg/L	For hardness ≤60, WQG = 0.025 For hardness 60 to 180, WQG = $\exp^{0.76[\ln(\text{hardness})]+1.06}$×0.001 For hardness ≥180, WQG = 0.15	-	1987	Working	-	0.0053
Metals and Metalloids	Total	Selenium	mg/L	0.002	-	2014	Approved	0.070	-
Metals and Metalloids	Total	Silver [e]	mg/L	For hardness ≤100 mg/L, WQG = 0.00005 For hardness >100 mg/L, WQG = 0.0015	For hardness ≤100 mg/L, WQG = 0.0001 For hardness >100 mg/L, WQG = 0.003	1996	Approved	-	-
Metals and Metalloids	Total	Thallium	mg/L	0.0008	-	1997	Working	-	-
Metals and Metalloids	Total	Uranium	mg/L	0.0085	-	2011	Working	-	-
Metals and Metalloids	Total	Vanadium	mg/L	-	-	-	-	-	0.12
Metals and Metalloids	Total	Zinc [e]	mg/L	For hardness ≤90 mg/L, WQG = 0.0075 For hardness 90 to 330 mg/L, WQG = [7.5 + 0.75 (hardness - 90)]×0.001; Maximum applicable hardness = 330 mg/L	For hardness ≤90 mg/L, WQG = 0.033 For hardness 90 to 500 mg/L, WQG = [33 + 0.75 (hardness - 90)]×0.001; Maximum applicable hardness = 500 mg/L	1999	Approved	-	-
Metals and Metalloids	Dissolved	Aluminum	mg/L	When pH ≥6.5, WQG = 0.05 When pH <6.5, WQG = $\exp^{[1.6 - 3.327(\text{median pH})+ 0.402(\text{median pH})\text{^}2]}$	When pH ≥6.5, WQG = 0.1 When pH <6.5, WQG = $\exp^{[1.209 - 2.426(\text{pH})+ 0.286 (\text{pH})\text{^}2]}$	2001	Approved	-	-
Metals and Metalloids	Dissolved	Cadmium [e]	mg/L	For hardness = 3.4 to 285 mg/L, WQG = {$\exp^{[0.736 \times \ln(\text{hardness}) - 4.943]}$}×0.001 Maximum applicable hardness = 285 mg/L	For hardness = 7 to 455 mg/L, WQG = {$\exp^{[1.03 \times \ln(\text{hardness})-5.274]}$}×0.001 Maximum applicable hardness = 455 mg/L	2015	Approved	$0.001 \times 10^{0.83(\log(\text{hardness}))-2.53}$ Maximum applicable hardness = 285 mg/L	-
Metals and Metalloids	Dissolved	Copper	mg/L	Biotic Ligand Model	Biotic Ligand Model	2019	Approved	-	-
Metals and Metalloids	Dissolved	Iron	mg/L	-	0.35	2008	Approved	-	1.1

Notes: mg/L = milligrams per litre; < = less than; WQG = water quality guideline; > = greater than; - = no data/not applicable; ≤ = less than or equal to; ≥ = greater than or equal to; % = percent; 30-d = 30-day; MeHg = methylmercury; THg = total mercury; BC WQG = British Columbia Water Quality Guideline.

[a] British Columbia Working (BCMOECCS 2021a) or Accepted (BCMOECCS 2021b) Water Quality Guidelines for the Protection of Aquatic Life. For guidelines dependent on other analytes (e.g., hardness), guidelines are screened using concurrent values.

[b] Site-specific benchmarks or interim screening values are applied instead of BC WQG, as appropriate. The most conservative (i.e., lowest) relevant benchmark or screening value is listed in the table.

[c] Dependent on concurrent chloride concentration.

[d] Unrestricted change permitted within this pH range.

[e] Hardness-based guidelines are calculated using concurrent hardness values. If hardness values exceed the maximum applicable hardness, then guidelines are determined using the maximum applicable hardness. If hardness values are lower than the minimum hardness, then guidelines are determined using the minimum hardness.

[f] Chromium(VI) is the dominant and most toxic form of chromium in oxygenated environments; therefore, its guideline was applied.

[g] The most conservative guideline (0.00000125 mg/L) is applied.

[h] Interim screening value.

with the annual concentrations represented by the estimated marginal means from the ANOVA model. The significant difference between the current study year (*Year*$_i$) and all other years was assessed.

Question 3 was addressed by comparing differences in concentrations of mine-related constituents observed downstream of the antiscalant addition location relative to upstream both before and after the introduction of antiscalant treatment (i.e., using a Before-After-Control-Impact [BACI] design). A two-way ANOVA with factors *Area* and *Year* was used to evaluate the difference between monthly mean values at GH_GH2 and GH_GH1, which are downstream and upstream of the antiscalant addition facility on Lower Greenhills Creek, respectively (Figure 2.1). Water chemistry data collected prior to initiation of calcite management on October 23, 2017, represent the "before" period and data collected thereafter 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. Instead, the analyses only included May to September means for 2017 through 2021.[14]

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 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 analyte concentrations calculated for GH_GH2 post-treatment, and $GH\_GH2_{predicted\ post-treatment}$ is the predicted mean concentration for GH_GH2. This assumes that the ratio of concentration of GH_GH1 to GH_GH2 is the same as pre-treatment:

$$\begin{aligned} GH\_GH2_{predicted\ post-treatment} \\ &= 10\text{^}[log_{10}(GH\_GH2_{post-treatment}) + log_{10}(GH\_GH2_{pre-treatment}) \\ &- log_{10}(GH\_GH1_{pre-treatment})] \end{aligned}$$

The significant difference between 2017 and each of the post-treatment years (i.e., 2018 to 2021) was assessed.

[14] The antiscalant addition facility was not operating in September 2019; consequently, September 2019 data were excluded from the "after" data set, consistent with previous years of reporting (Minnow 2020a, 2021a). Additionally, based on a review of unpublished flow data and operational reports, it was determined that the antiscalant addition facility was not operating in May 2018 or May 2020 (Teck 2021c). Consequently, these data were also excluded from the "after" data set used for this report.

Data analyses were completed using R statistical software (R Core Team 2021). Water quality and aqueous selenium speciation data were used to interpret the results of substrate, benthic invertebrate community, benthic invertebrate tissue chemistry, and WCT data analyses, as appropriate (see Sections 3.2 to 3.5, below).

2.3 Substrate Quality

2.3.1 Calcite

2.3.1.1 Field Sampling

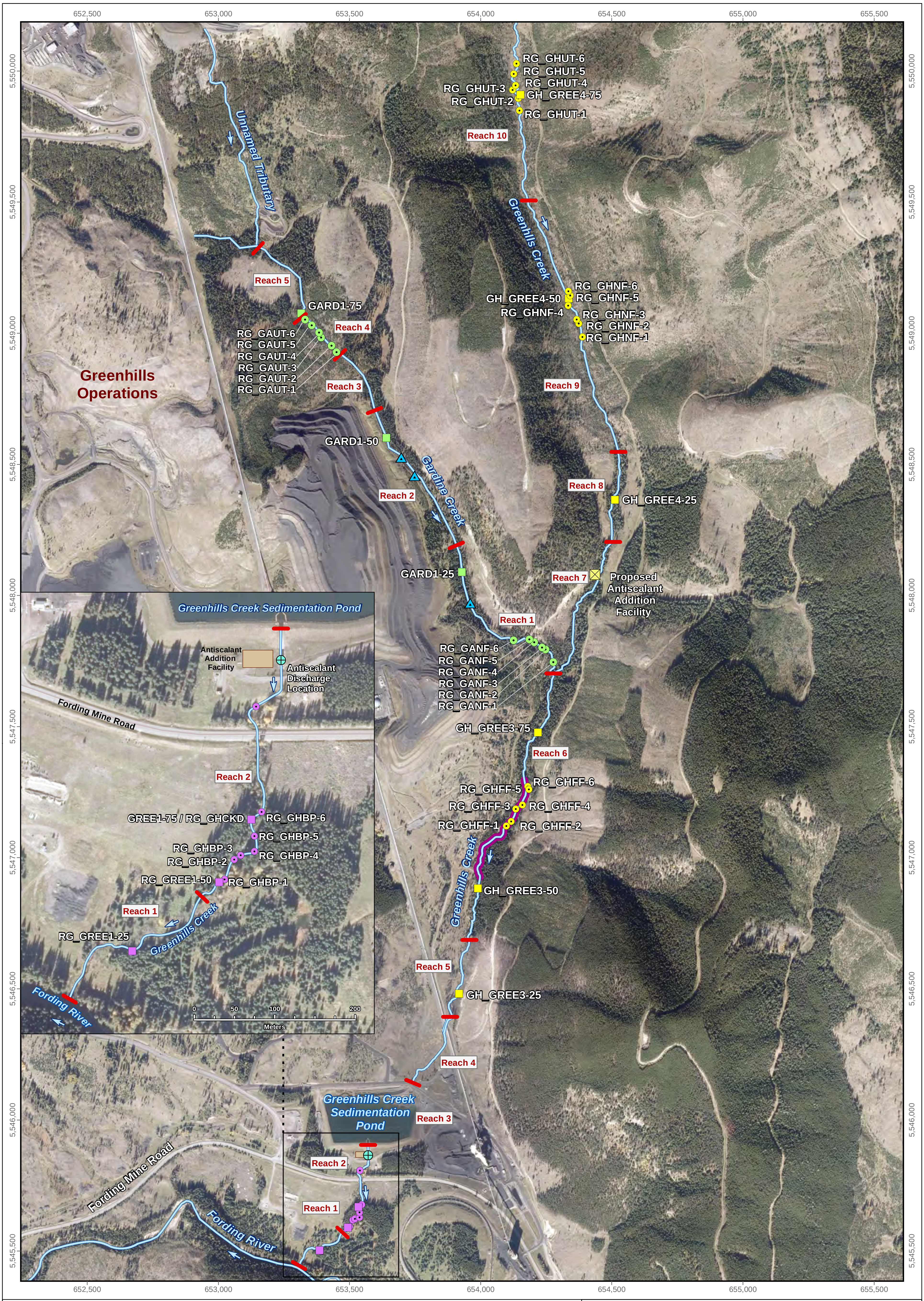
Calcite in Greenhills and Gardine creeks was monitored at the following locations in 2021 as part of the Regional Calcite Monitoring Program for Teck (Figure 2.2; Robinson et al. 2022):

- GREE3-25, GREE3-50, GREE3-75, GREE4-25, GREE4-50, and GREE4-75 on Upper Greenhills Creek;
- 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 2021 were consistent with those described by Lotic Environmental Ltd. (Lotic 2021; Robinson et al. 2022). Historically (i.e., from 2015 to 2020), data collected from Gardine Creek as part of the Regional Calcite Monitoring Program were reported as an average of three stations. In 2022, data were reported individually for each of the three stations on Gardine Creek (i.e., GARD1-25, GARD1-50, and GARD1-75) (Robinson et al. 2022); this change is reflected in the data tables presented in Section 3.2.1.

As part of the September 2021 GGCAMP sampling, Minnow collected calcite data from the immediate vicinity of each area-based benthic invertebrate creek sampling station (i.e., RG_GHUT, RG_GHNF, RG_GHFF, RG_GHBP, RG_GAUT, and RG_GANF [six stations per biological monitoring area]) to allow for direct correlation of benthic invertebrate community endpoints with CI and CI' values (Figure 2.2; Table 2.1). Calcite measurements were made on 50 randomly selected pebbles, rather than 100, 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 RAEMP areas).

Calcite index measurements at biological monitoring areas were made using updated methods that Teck is implementing on a trial basis; these methods are described in detail by Zathey et al. (2021). A summary of the methods used in 2021 are presented in Lotic (2021). First, the presence (C_p; score = 1) or absence (score = 0) of calcite was recorded to estimate CI, consistent with previous years (Minnow 2021a,b). Second, the proportional presence score



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)
- Proposed Antiscalant Addition Facility Location (2022)
- Antiscalant Discharge Location
- Seep
- Remediation Area Selected (2023)
- Reach Break
- Antiscalant Addition Facility

Calcite Monitoring Locations

0 0.25 0.5 1
Kilometers

Projection: North American Datum 1983 UTM Zone 11U
Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Date: June 2022
Project 227202.0016

minnow environmental inc.

Figure 2.2

Document Path: C:\Users\capol\Trinity Consultants, Inc\Teck - 227202.0016 - 2022 GGCAMP\D - GIS\2021 GGCAMP Report\22-16 Figure 2.2 Calcite Monitoring Locations.mxd (i.e., calcite presence prime [C_p']) was 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% 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 layer (greater than [>] 1 centimetre [cm]) of fines was encountered and calcite presence could not be visually confirmed, fines were pinched between the thumb and fingers and evaluated for calcite presence. If fines contained 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. Where moss was present on a particle, it was removed to determine if calcite was present. Where calcite was present, a value of 1 (for presence) and 0 (for concretion, when moss was easily removed) was recorded, and where the moss was removed with calcite-induced resistance a value of 1 (for concretion) was recorded. If the moss was fully encrusted and immovable, values of 1 (for presence) and 2 (for concretion) were recorded (Lotic 2021). If a rock was visible under fines, the rock was selected for calcite index measurements.

2.3.1.2 Data Analysis

Calcite indices for the 2021 GGCAMP were calculated in two ways, the first being consistent with methods used historically and in 2020 (Minnow 2021a; Teck 2016) and the second based on the trial methods and calculation steps described by Zathey et al. (2021) (see also Lotic 2021).

Calcite indices (CI and CI') calculated for each biological monitoring area 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?

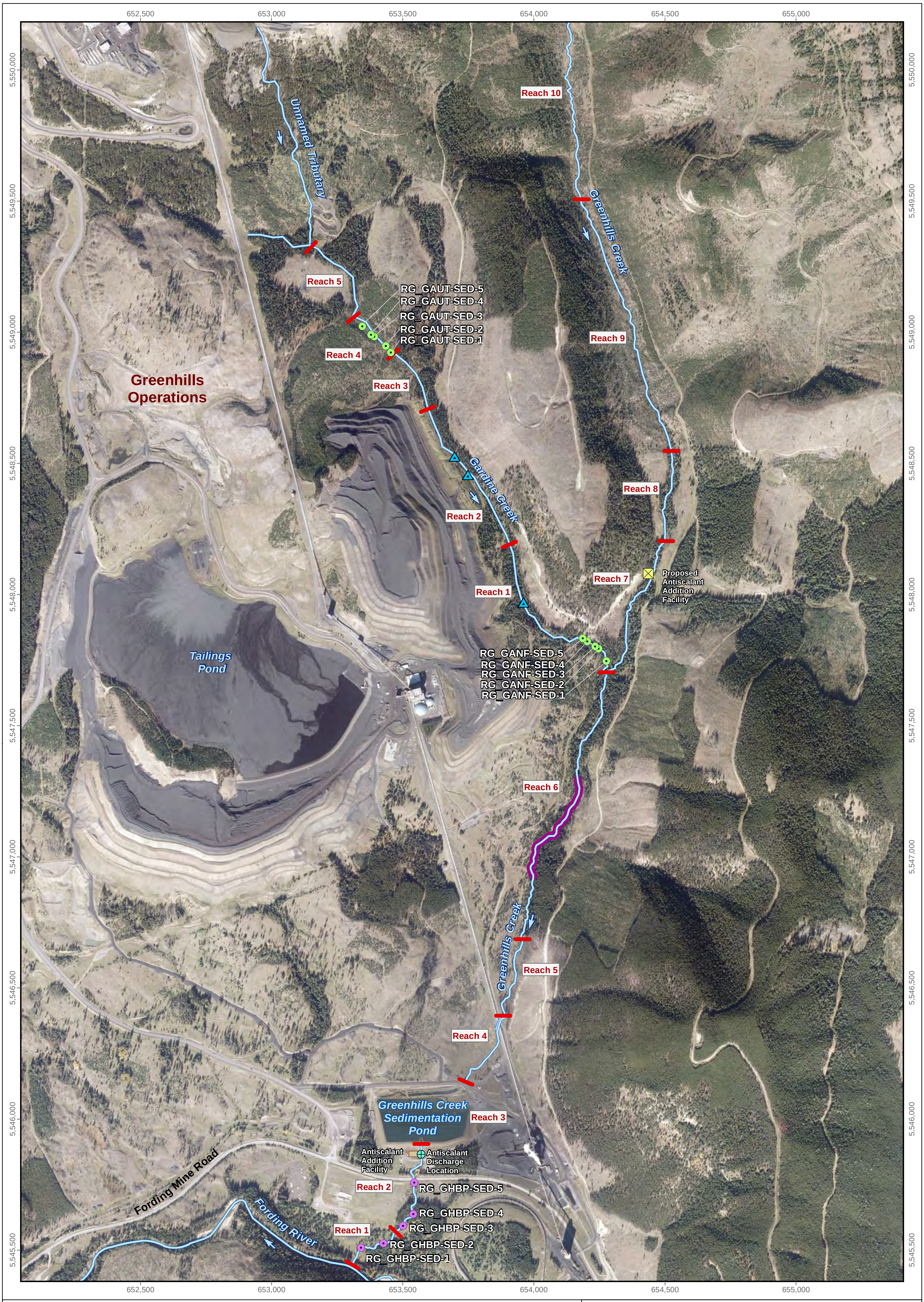
These questions were addressed using methods consistent with those employed for the 2020 GGCAMP report (Minnow 2021a) and those laid out in the 2021 GGCAMP study design (Minnow 2021b). Statistical analyses were completed in R (R Core Team 2021). Calcite presence (C_p and C_p') and concretion scores were 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; see Section 2.4). Results from the 2021 Regional Calcite Monitoring Program Report (Robinson et al. 2022) were used, as appropriate, to support interpretation of calcite data collected as part of the GGCAMP.

2.3.2 Sediment

2.3.2.1 Field Sampling

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 2021 (Figure 2.3; Table 2.1). Sediment chemistry sampling was also completed at deeper, depositional habitats within Greenhills Creek Sedimentation Pond in September 2021 (RG_GHP; Figure 2.4; Table 2.1). Consistent with previous years of sediment chemistry monitoring (e.g., Minnow 2020a, 2021a), no sediment chemistry sampling was completed in Upper Greenhills Creek. This is because during the September 2016 assessment of Greenhills Creek, only a few small (e.g., 1 to 2 square metres [m^2]) sediment deposits were noted in Upper Greenhills Creek, most of which were likely ephemeral (i.e., would be washed downstream during a storm event or freshet) (Minnow 2017). Similar observations were noted by the field crew in 2020 and 2021. This is consistent with the relatively high gradient (i.e., 4 to 8%) of the creek (Minnow 2017). Thus, Greenhills Creek Sedimentation Pond represents the main deposition area for fine sediments originating from Upper Greenhills Creek.

Sampling in Lower Greenhills and Gardine creeks was completed by individuals on foot and sampling locations were approached in such a way as to avoid sediment disturbance before sampling. To the extent possible, the same locations sampled for sediment in previous years (i.e., 2017 to 2020; Figure 2.3) were sampled in 2021. A handheld Global Positioning System (GPS) was used to mark the Universal Transverse Mercator (UTM) coordinates of each sediment sampling location. A stainless-steel spoon was used to collect sediment samples from deposits of fines amongst the cobbles. 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 Ziploc® 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) were recorded on field sheets. These included observations of calcite presence within the sediment samples (e.g., based on sample texture and colour). Field QA/QC



LEGEND

- Gardine Creek Sediment Sampling Location
- Lower Greenhills Creek Sediment Sampling Location
- Remediation Area Selected (2023)
- Proposed Antiscalant Addition Facility Location (2022)
- Antiscalant Discharge Location
- Seep
- Reach Break
- Antiscalant Addition Facility

Creek Sediment Sampling Locations, September 2021

0 0.25 0.5 1
Kilometers

N W E S

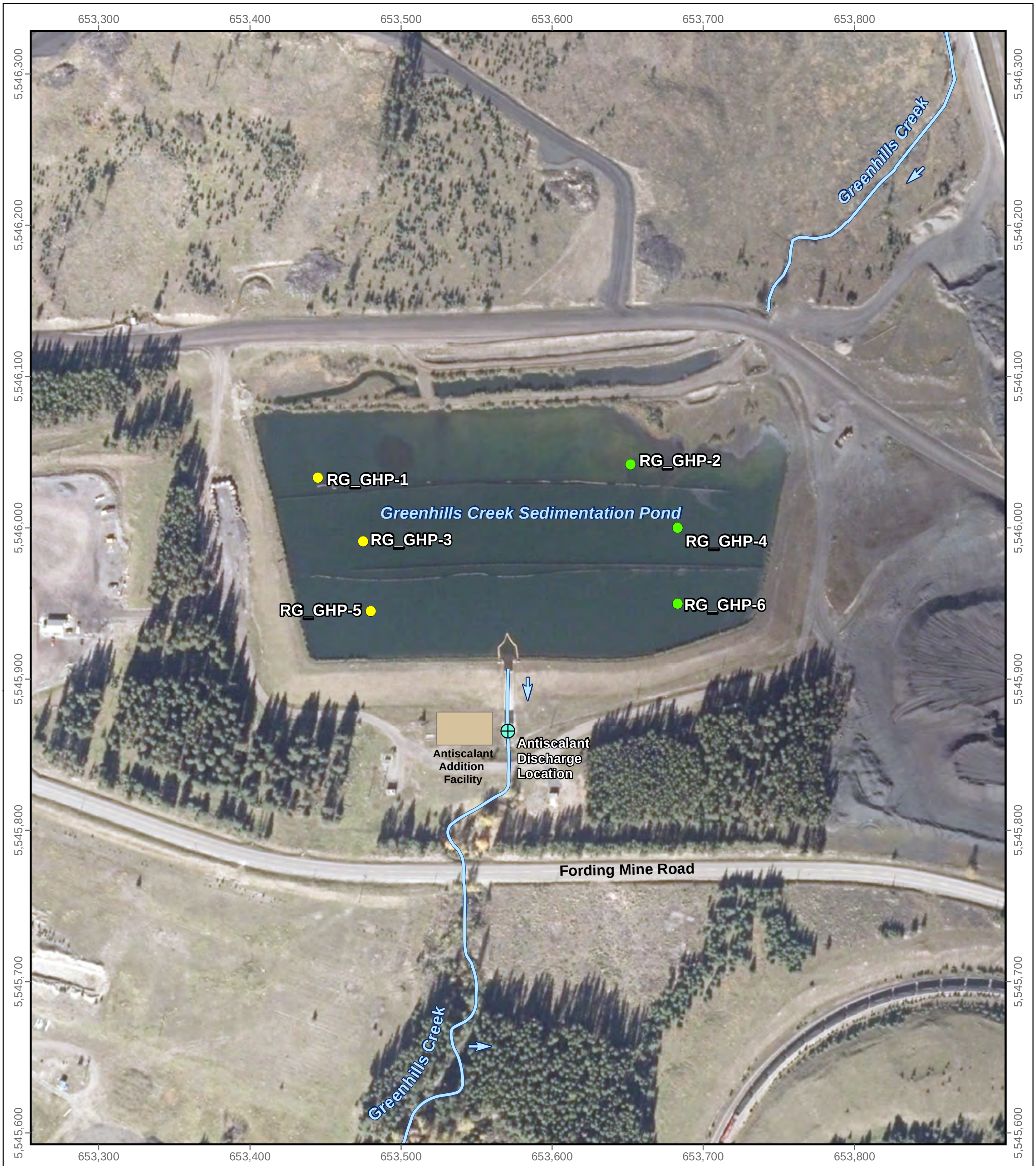
Projection: North American Datum 1983 UTM Zone 11U
Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Date: June 2022
Project 227202.0016

minnow environmental inc.

Figure 2.3

Document Path: C:\Users\capol\Trinity Consultants, Inc\Teck - 227202.0016 - 2022 GGCAMP\D - GIS\2021 GGCAMP Report\22-16 Figure 2.3 Sed Sampling Locations.mxd



LEGEND

- Sediment and Benthic Invertebrate Community Sampling Location
- Sediment, Benthic Invertebrate Community, and Tissue Sampling Location
- Antiscalant Discharge Location
- Antiscalant Addition Facility

Sediment and Benthic Invertebrate Sampling Locations in Greenhills Creek Sedimentation Pond, September 2021

0 62.5 125 250 Meters

N W E S

Projection: North American Datum 1983 UTM Zone 11U

Date June 2022
Project 227202.0016

minnow environmental inc.

Figure 2.4

Document Path: C:\Users\capol\Trinity Consultants, Inc\Teck - 227202.0016 - 2022 GGCAMP\D - GIS\2021 GGCAMP Report\22-16 Figure 2.4 Sediment and BI in Greenhills Sediment Pond.mxd measures included the collection of field duplicates at a minimum frequency of 10% of total samples collected during the sampling event (see Appendix A).

Sediment samples were collected from Greenhills Creek Sedimentation Pond 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[15], was collected at each of five of the six[16] sediment sampling stations (i.e., RG_GHP-1, RG_GHP-3, RG_GHP-4, RG_GHP-5 and RG_GHP-6). 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 Ziploc® 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 calcite particles) were recorded on field sheets. To the extent possible, the same locations sampled for sediment in previous years (2018 to 2020; Figure 2.4) were sampled in 2021. Field duplicates for QA/QC purposes were collected at a rate of at least 10% of total samples collected during the sampling event.

2.3.2.2 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 the samples submitted in Ziploc® bags for analysis of moisture content, particle size, total organic carbon (TOC), sequential extraction analysis (SEA), and metals. Samples submitted in glass jars were used for analysis of polycyclic aromatic hydrocarbons (PAHs).

Sediment chemistry samples were analyzed using the following methods:

- Metals by Collision Reaction Cell Inductively Coupled Plasma-Mass Spectrophotometry (CRC-ICPMS; United States Environmental Protection Agency [EPA] 200.2/6020A mod) and Collision Cell Mass Spectrophotometry (CCMS; Tessier Extraction 1979/EPA 6020A);

[15] The study design for 2021 (Minnow 2021b) indicated that each sample would consist of the top 2 cm of three grabs. However, a decision was made in the field to collect five grabs instead of three (or 10 grabs in the case of a field duplicate) to ensure that target sample volumes for laboratory analyses (Section 2.3.2.2) would be achieved.

[16] A total of n = 6 stations were targeted for sampling (Minnow 2021b). However, the field crew was unable to collect sediment from station RG_GHP-2, despite multiple attempts, due to the presence of dense aquatic vegetation at this location.

- Mercury by Cold Vapour Atomic Absorption Spectroscopy (CVAAS; EPA 200.2/1631E mod);
- TOC calculated from total and inorganic carbon (Canadian Society of Soil Science [CSSS] [2008] 21.2)[17];
- Inorganic Carbon as a calcium carbonate ($CaCO_3$) equivalent calculation;
- PAHs by tumbler extraction using hexane/acetone (EPA 3570/8270) 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 (CSSS Chapter 16); and
- Moisture content by gravimetry (i.e., weighing the sample before and after drying at 105 degrees Celsius [°C]).

The SEA was performed by the ALS laboratory in Vancouver, BC in accordance with Tessier et al. (1979). Reagents used to analyze the first four sediment fractions typically assessed in SEA are weaker than those used for the analysis of "total" or "bulk" metal concentrations in sediments. The method involves five sequential extraction steps; each extraction step represents a different fraction of 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).

[17] Total carbon and inorganic carbon content are determined by combustion methods (CSSS [2008] 21.2) and reaction with acetic acid (CSSS [2008] P216-217), respectively.

Laboratory QA/QC included an assessment of sensitivity (i.e., evaluation of LRLs and blank samples), accuracy (laboratory control samples, internal reference materials, and CRM), and precision (laboratory duplicates) (see Appendices A and B).

2.3.2.3 Data Analysis

Metal and PAH concentrations in sediment samples from Lower Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond were tabulated and plotted to support comparisons to applicable BC Working Sediment Quality Guidelines[18] (BC WSQG; BCMOECCS 2021a). Concentrations in "bulk" sediment and the sums of concentrations in sediment fractions 1 to 4 were included in the comparisons.[19] The upper and lower BC WSQG were included in the evaluation, recognizing that the BC WSQG are based on co-occurrence analysis, rather than cause-effect studies (BCMOECCS 2021a). The lower BC WSQG that were used to screen the "bulk" and SEA results represent concentrations below which adverse biological effects would not be expected to occur under most circumstances and are considered comparable to the Canadian Council of Ministers of the Environment (CCME) Threshold Effects Levels or Interim Sediment Quality Guidelines (ISQG; BCMOECCS 2021a). In contrast, the upper BC WSQG are considered equivalent to the CCME's Probable Effects Levels (CCME 2001) and represent a concentration above which effects to aquatic biota may be more frequently observed (BCMOECCS 2021a).

Regional reference area normal ranges, which represent the 2.5th and 97.5th percentiles of the reference area data for a particular constituent, were also included in the plots of metal and PAH concentrations in sediments (Minnow 2020d,e). For lotic areas (i.e., RG_GHBP, RG_GAUT, and RG_GANF), regional reference area normal ranges calculated based on sediment chemistry data collected from creek habitats as part of the RAEMP (Minnow 2020d) were used.[20] Reference area normal ranges derived as part of the Lentic Area Supporting Study (Minnow 2020e) were applied to the Greenhills Creek Sedimentation Pond (RG_GHP; Figure 2.1; Table 2.1). 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, 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

---

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

[19] The comparisons of sediment fractions 1 to 4 to the BC WSQG are 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 Greenhills and Gardine creeks.

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

lower BC WSQG (Minnow 2020d,e). 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 2020e; Minnow 2021d).

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

Q1: Does sediment chemistry differ among areas?

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?

Q3: Has sediment chemistry downstream of the antiscalant addition facility changed relative to upstream after the introduction of water treatment?

Question 1 was addressed by comparing sediment chemistry (“bulk” and SEA) among biological monitoring areas to evaluate potential mine-related influences on sediment. A censored regression two-way ANOVA with factors *Area*, *Year*, and *Area x Year* was used to compare sediment chemistry among areas on Lower Greenhills Creek (RG_GHBP), Gardine Creek (RG_GAUT and RG_GANF), and Greenhills Creek Sedimentation Pond (RG_GHP). The censored regression allowed and accounted for censored data (i.e., values less than [<] the LRL); however, analytes that had >75% censored data were excluded from the analyses. Appropriate *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.

To address Question 2, temporal differences in metal and calcium[21] concentrations in “bulk” sediments and SEA fractions 1 to 5 (individually and combined) were examined for RG_GHBP on Lower Greenhills Creek, RG_GAUT and RG_GANF on Gardine Creek, and Greenhills Creek Sedimentation Pond (RG_GHP). Again, a censored regression two-way ANOVA with factors

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

Area, *Year*, and *Area x Year* was used. 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 2021 to standardize the sizes of the "bulk" sediment chemistry and SEA data sets among areas and years. Within each two-way ANOVA, there is a test for interactions (i.e., between *Area* and *Year*). If interaction is not significant, then the temporal comparisons, as an example, would continue by combining data for all areas (RG_GHBP, RG_GAUT, RG_GANF, and RG_GHP) within a year to support the comparison among years (e.g., to compare 2021 to 2019). If a similar temporal comparison between the SEA results for 2021 and 2018 was completed, the results would not be very meaningful. This is because pooled data for RG_GHBP, RG_GAUT, RG_GANF, and RG_GHP (2021) would be compared to RG_GHBP only (i.e., no other areas were sampled for SEA that year).

Question 3 was addressed by comparing differences in concentrations of analytes in "bulk" sediment before (2017) and after (2018 to 2021) initiation of antiscalant addition. 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, consistent with the approach described in the 2021 GGCAMP study design (Minnow 2021b). 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 2021) to the "before" year (i.e., 2017). For significant differences, a MOD was calculated as:

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

where the *MCT* is the measure of central tendency or, more specifically, the estimated marginal mean 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 2021).

To support conclusions regarding overall sediment quality (i.e., all analytes 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. Calculations were completed in R (R Core Team 2021) following the approach of the CCME Sediment Quality Index 1.0 (CCME 2002, 2014; see also Minnow 2020e). The SQI integrate the following qualities of guideline exceedances:

- scope (i.e., percentage of analytes that did not meet their respective guidelines [number of analytes with failed samples/total number of analytes*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).[22] 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.

2.4 Benthic Invertebrate Community

2.4.1 Field Sampling

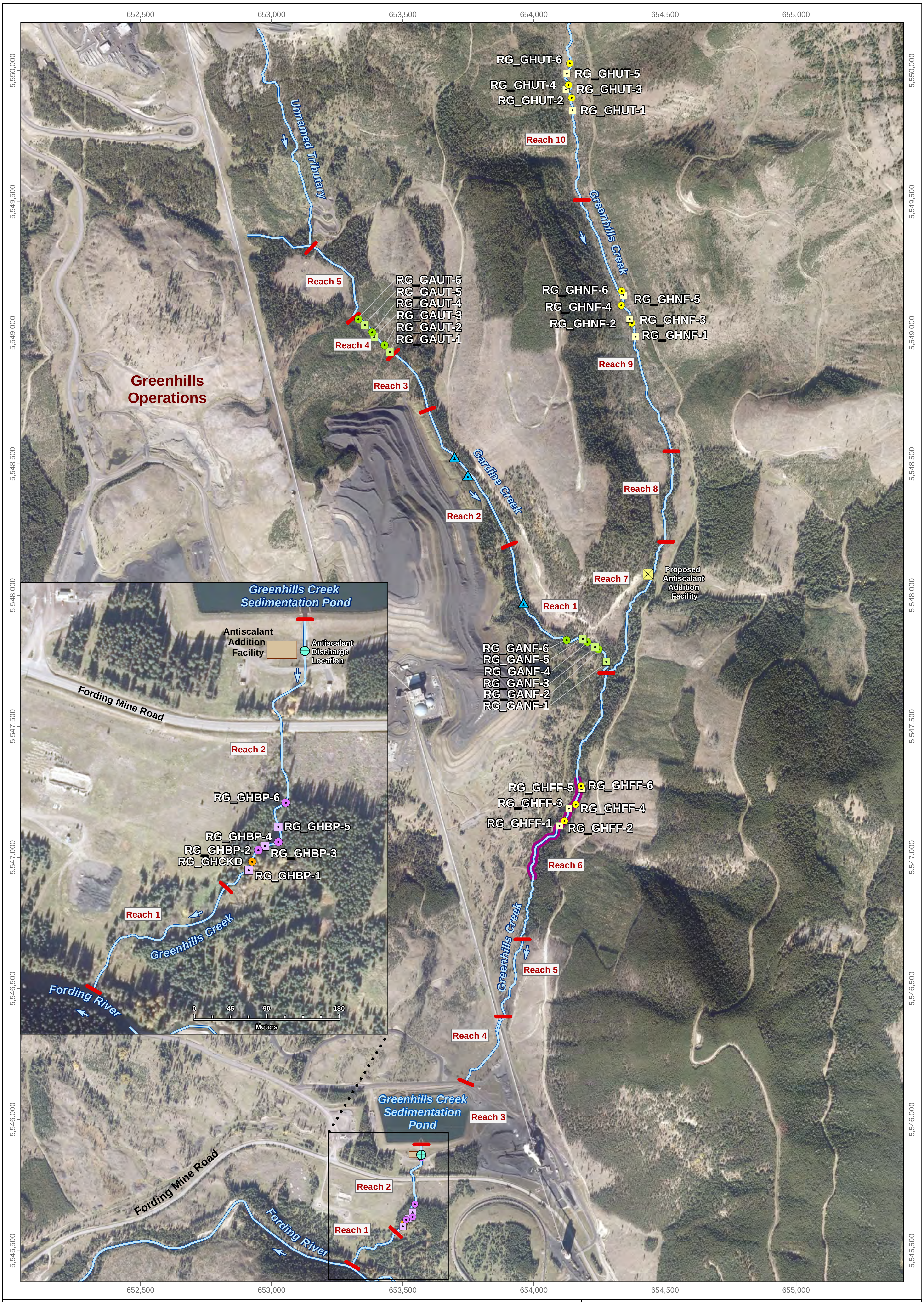
2.4.1.1 Greenhills and Gardine Creeks

Benthic invertebrate community samples representative of lotic habitats were collected from the following biological monitoring areas in September 2021 (Figure 2.5; Table 2.1):

- RG_GHUT, RG_GHNF, 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 was completed at six stations per biological monitoring area to support detection of a two standard deviation change in the relative differences among the three areas on Upper Greenhills Creek over two sampling periods (one before and one after) using $\alpha = \beta = 0.1$. This sample size was estimated by assuming that an ANOVA on the paired area differences (after-before) will be conducted for the three areas.

[22] The ISQG from the CCME (2002) and lower BC WSQG (BCMOECCS 2021a) are equivalent for most parameters, 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.



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
- Remediation Area Selected (2023)
- Proposed Antiscalant Addition Facility Location (2022)
- Seep
- Antiscalant Discharge Location
- Antiscalant Addition Facility
- Reach Break

Creek Benthic Invertebrate Sampling Locations, February and September 2021

0 0.25 0.5 1
Kilometers

N E S W

Projection: North American Datum 1983 UTM Zone 11U

Date: June 2022
Project 227202.0016

minnow environmental inc.

Figure 2.5

Document Path: C:\Users\capol\Trinity Consultants, Inc\Teck - 227202.0016 - 2022 GGCAMP\D - GIS\2021 GGCAMP Report\22-16 Figure 2.5 Creek BI Sampling Locations.mxd

Monitoring on Upper Greenhills Creek provided a sixth year of pre-treatment data and monitoring on Lower Greenhills Creek provided a fourth year of data following the activation of the antiscalant addition system. The year 2021 represented the third year of data collection on Gardine Creek.

Area-based benthic invertebrate samples were collected to support estimations of benthic invertebrate densities and productivity (biomass), which are considered general indicators of food availability for WCT. Each of the area-based benthic invertebrate community samples was collected by kick sampling an area of approximately 1/3 m^2 into a 400 micrometre (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 poured 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 (three stations) on Upper Greenhills Creek to support comparisons to reference area normal ranges and the assessment of biological triggers for %EPT (see Section 2.4.3).[23] 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 2021 sampling due to the presence of barrage tufa that blocked flow and formed cascades and calcite terraces. 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,

[23] 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 2021b,c). This is consistent with the approach for Lower Greenhills Creek in 2020 (Minnow 2021a).

and the contents poured 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 2.3.1, 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).

2.4.1.2 Greenhills Creek Sedimentation Pond

Benthic invertebrate community samples were collected from six locations in Greenhills Creek Sedimentation Pond in September 2021 (Figure 2.4; Table 2.1). The year 2021 represented the fourth year of benthic invertebrate community data collection in Greenhills Creek Sedimentation Pond.

Benthic invertebrate community samples were collected 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), was 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 field-sieved using a 500 µm mesh bag. The material retained in the bag 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]) was collected concurrent with, and at the same locations as, each benthic invertebrate community sample.

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. 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 was gently placed onto a fine cloth or paper towel to drain excess surface moisture (preservative) before being weighed to the nearest 0.1 milligram (mg). Total and family-level biomass and the density of each taxon was reported for each of the area-based samples. Laboratory QA/QC procedures included assessments of sub-sampling accuracy and precision and percent organism recovery (Appendices A and B).

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 (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; otherwise, the whole sample was sorted. 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).

2.4.3 Data Analysis

Data for area-based samples collected from Upper Greenhills Creek, Lower Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond were summarized by calculating endpoints that are considered to be indicators of changes in benthic invertebrate community production and structure. Endpoints included:

- 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 proportions of major taxa (i.e., EPT combined, as well as Ephemeroptera, Plecoptera, Trichoptera, and Diptera).

Endpoints typically reported for the RAEMP (e.g., Minnow 2020d) were also calculated for timed kick samples. For RG_GHCKD (Greenhills Creek downstream of the Greenhills Creek Sedimentation Pond), results for these endpoints will be reported in the next RAEMP report. However, results for RG_GHCKD were used in this report to support comparisons to reference area normal ranges and the biological trigger evaluation for %EPT (see below).

Biological monitoring areas on Upper Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond are upstream of the antiscalant dosing module, which is scheduled to be relocated to Upper Greenhills Creek in 2022 (Hillman 2021a, pers. comm.). Therefore, data collected from these areas in 2021 were included with pre-treatment data collected from 2016 to 2020. Data collected from RG_GHBP on Lower Greenhills Creek represents a fourth year of monitoring post-antiscalant addition.

Benthic invertebrate community endpoints were summarized and 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)?

Questions 1 and 2 were addressed together. Differences among areas and years for benthic community endpoints were compared using ANOVA with factors *Area* and *Year* and *Area x Year*. Methods were consistent with those outlined in the 2021 GGCAMP study design (Minnow 2021b). 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 measure of central tendency for a given year after 2016[24], MCT_{2016} is the MCT in 2016, and SD_{2016} is the standard deviation for 2016. Similarly, the MODs between areas with significant *post hoc* comparisons were calculated as:

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

Question 3 was addressed by comparing differences in benthic community endpoints in relation to the addition of antiscalant based on a BACI design (Green 1979), where an ANOVA model is used to fit the data for each area from pre- and post-application of antiscalant (see Minnow 2021b). Potential BACI effects were assessed by testing the significance of the interaction terms containing the BA (fixed factor with two levels: before [2016 and 2017] and after [2018 to 2021] use of antiscalant) and CI (fixed factor for area type with two levels: use of antiscalant and no antiscalant) terms. A p-value of 0.1 was used to test the significance of the interaction terms. Interpretation of the ANOVA table was carried out following the approach described in detail in the 2021 GGCAMP study design (Minnow 2021b).

[24] The first year of baseline for Greenhills Creek.

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.

Additionally, potential relationships between benthic invertebrate community endpoints and calcite measurements (CI, CI', and concretion scores) and water chemistry data were examined by correlation analysis.[25] Benthic invertebrate community endpoints for area-based samples were correlated with paired calcite indices and concretion scores collected concurrently with the benthic community samples in 2021, and from 2017 to 2020. Specific endpoints included of density, biomass, LPL richness, family richness, %EPT, %Ephemeroptera, %Plecoptera, %Trichoptera, and %Diptera. Significant correlations were assessed at $\alpha = 0.05$, with Bonferroni corrections for the number of independent comparisons. Water quality data for analytes with EWTs were also included in the correlation analyses; concentrations measured in samples collected concurrent with area-based benthic invertebrate community sampling in September 2021 were used. Again, significance was assessed at $\alpha = 0.05$, with Bonferroni corrections for the number of comparisons. Statistical analyses were completed in R (R Core Team 2021).

Comparisons to regional reference area normal ranges from the RAEMP (Minnow 2020d) were completed for the timed kick samples collected from RG_GHNF and RG_GHCKD (RAEMP area) on Upper and Lower Greenhills Creek, respectively. Data from area-based kicks completed in 2021 were not compared to regional reference area normal ranges. This change relative to previous years (e.g., Minnow 2020a, 2021a) is based on the acknowledgement that the methods underlying the reference area normal ranges (i.e., timed kicks) and the area-based

[25] 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.

(1/3 m^2) benthic invertebrate community kicks are not comparable or compatible.[26] For example, Minnow has found that, in general, LPL and family richness calculated for area-based kick samples tend to fall toward the lower end of or below regional reference area normal ranges calculated from timed kick samples. This is attributed to the greater likelihood that rarer taxa will be missed when sampling the smaller area (m^2) and lower overall diversity of habitats associated with the area-based versus timed kicks (Minnow 2018b).

Comparisons to the %EPT biological triggers (Teck 2018, 2021a) were made for 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). Data for RG_GHCKD was used for Lower Greenhills Creek because, as indicated above, the sampling method for RG_GHCKD (i.e., timed kicks) is consistent with the methods on which the %EPT biological triggers are based, whereas the sampling method used for RG_GHBP (i.e., area-based kicks) is not. Biological monitoring areas RG_GHBP and RG_GHCKD are on the same reach in Lower Greenhills Creek.

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 biological monitoring areas on Greenhills and Gardine creeks in February and September 2021. Target sample sizes were one sample from each of the three replicate stations at biological monitoring areas on Upper Greenhills Creek (RG_GHUT, RG_GHNF, and RG_GHFF), Lower Greenhills Creek (RG_GHBP), and Gardine Creek (RG_GANF and RG_GAUT; Figure 2.5; Table 2.1).

Benthic invertebrate tissue chemistry samples were collected using the kick sampling method described in Section 2.4.1.1, 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 introduce variability in selenium chemistry results if included in the composite-taxa samples for tissue chemistry analyses (Golder 2021b; 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

[26] A comparison of benthic invertebrate community endpoints between co-located area-based and timed kick samples is provided in Appendix F and supports the shift away from comparing area-based kick data to regional reference area normal ranges based on timed kicks.

invertebrate biomass represented by annelids (Golder 2021b). 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, the protocol was to include them 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 2021b). Additionally, separate "annelid-only" tissue chemistry samples were collected and labelled appropriately from any tissue chemistry kicks identified as containing annelids. For all samples, tweezers were used to carefully remove organisms until a target sample mass of 1 to 2 grams (g) was obtained. Each sample for tissue chemistry analysis was photographed. 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.

2.5.1.2 Greenhills Creek Sedimentation Pond

Three composite-taxa benthic invertebrate tissue chemistry samples were collected from deeper, depositional areas within Greenhills Creek Sedimentation Pond (RG_GHP) in September 2021 (Figure 2.4; Table 2.1). Each of the three samples corresponded with one of the six benthic invertebrate community sampling locations (i.e., RG_GHBP-1, RG_GHP-3, and RG_GHBP-5) and were collected using the same methods described in Section 2.4.1.2. 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 2.5.1.1 (Golder 2021b). Each sample for tissue chemistry analysis was photographed, placed into a labelled scintillation vial, and stored in a cooler with ice until it could be transferred to a freezer later in the day.

Benthic invertebrate tissue chemistry sampling completed in September 2021 focused on the deeper, depositional areas of Greenhills Creek Sedimentation Pond. This is because selenium concentrations in the samples collected along the shoreline (RG_GHPS) and from deeper, depositional habitats (RG_GHP) in previous years (2018, 2019, and 2020) were identified as being statistically comparable (Minnow 2021b). Therefore the samples from RG_GHP are considered sufficiently representative of selenium concentrations in benthic invertebrate tissues from within Greenhills Creek Sedimentation Pond.

2.5.2 Laboratory Analysis

Benthic invertebrate tissue samples were stored frozen until they could be shipped on ice to TrichAnalytics Inc. (Trich), which is a CALA-accredited laboratory, in Saanichton, BC. Following receipt of the samples by the analytical laboratory, the laboratory staff noted that bivalves comprised part (RG_GHP_INV-3 and RG_GHP-5) or all (RG_GHP_INV-1) of the biomass in the samples from Greenhills Creek Sedimentation Pond. Because the high calcium content of the bivalves' shells could significantly impact the analytical results for multiple analytes (e.g., strontium, barium, lead, and possibly selenium), replicates RG_GHP_INV-3 and RG_GHP-5 were split into "bivalve-only" and "all other taxa" sub-samples prior to analysis (Christensen 2021, pers. comm.). Individual samples were desiccated and then analyzed for metal concentrations using laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS). Results were reported on a dry weight basis. Laboratory QA/QC procedures employed by Trich included assessments of sensitivity (i.e., evaluation of LRLs), accuracy (i.e., CRM), and precision (laboratory duplicates) (see Appendices A and B).

2.5.3 Data Analysis

Benthic invertebrate tissue selenium concentrations were summarized for 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 from Upper and Lower Greenhills Creek and Gardine Creek 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 ANOVA with factors *Area* and *Year* and *Area x Year* as described in Minnow (2021b). The MODs for comparisons over time and among areas were calculated as:

$$MOD = (MCT_{examined\ year} - MCT_{base\ year}) / MCT_{base\ year} \times 100\%$$

or

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

respectively, where the MCT is the measure of central tendency (i.e., the back-transformed estimated marginal means).

A separate comparison of tissue selenium concentrations measured in composite-taxa samples from February and September was completed within each year (i.e., 2019 to 2021; no winter sampling was completed in 2018) to determine if tissue concentrations differed 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 estimated marginal means).

To address Question 3, concentrations of selenium in composite-taxa benthic invertebrate tissue chemistry samples from lotic habitats were compared to prediction intervals generated from the regional lotic bioaccumulation model (Golder 2020), consistent with the RAEMP (Minnow 2020d). If observed concentrations were higher than the upper prediction limit, tissue concentrations were be 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). 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 Greenhills Creek Sedimentation Pond to warrant comparisons to model predictions at this time.

Biological triggers developed for selenium concentrations in benthic invertebrate tissues as part of Teck's AMP (Teck 2018, 2021a) were applied to RG_GHNF on Upper Greenhills Creek and RG_GHBP on Lower Greenhills Creek as an additional means of addressing Question 3. 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 and GH_GH1, respectively; Figure 2.1). Biological monitoring area RG_GHBP was also included in the assessment of biological triggers for 2020 (Minnow 2021a). Interpretation of biological triggers for RG_GHBP was completed in consideration of the fact that GH_GH1 is upstream of the antiscalant addition facility and RG_GHBP is downstream from the facility.

Selenium concentrations in benthic invertebrate tissue samples collected in February and September 2021 were also interpreted in consideration of site-specific selenium speciation information (see Section 2.2) and compared to regional reference area normal ranges and EVWQP Benchmarks. Selenium concentrations in benthic invertebrate tissues collected from lotic habitats and the Greenhills Creek Sedimentation Pond were compared to predictions generated using the selenium speciation bioaccumulation tool (B-tool; de Bruyn and Luoma 2021). 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 (Table 2.4; Golder 2014).[27] Concentrations were also compared to the preliminary dietary benchmark (i.e., 45 milligrams per kilogram dry weight [µg/g dw]) for maternal amphibian diet (Massé et al. 2015). Comparisons to the BCMOECCS interim guideline (i.e., 4 µg/g dw) were not made because the EVWQP Benchmarks are considered more site-specific and therefore more relevant (BCMOE 2014; Golder 2014).

2.6 Westslope Cutthroat Trout

2.6.1 Field Sampling

Fishing for WCT was completed at three biological monitoring areas on Upper Greenhills Creek and two areas on Gardine Creek in September 2021 (Ministry of Forests, Lands, Natural Resource Operations, and Rural Development [MFLNRORD] permit CB21-631191). In Upper Greenhills Creek, fishing was completed at RG_GHFF (Reach 6), RG_GHNF (Reach 9), and RG_GHUT (Reach 10; Figure 2.6; Table 2.1). In Gardine Creek, fishing was completed near RG_GANF (Reach 1) and RG_GAUT (Reach 3). Monitoring in Upper Greenhills Creek in 2021 represented a fourth year of pre-treatment data collection and monitoring in Gardine Creek provided a second year of WCT data collection.

The 2021 GGCAMP did not include fishing in Lower Greenhills Creek. Instead, data interpretation for Lower Greenhills Creek (see Section 3.5) relied on the results of Teck's 2021 Upper Fording River Population Monitoring Program (Thorley et al. 2022). This approach was taken primarily to minimize fish handling, and therefore potential risks to fish, in Lower Greenhills Creek. It is also recognized that the range of the WCT population in the mainstem of the Upper Fording River extends into Lower Greenhills Creek whereas the WCT in Upper Greenhills and Gardine creeks represent an isolated population. Detailed field sampling methods for WCT in Lower Greenhills Creek are provided in the 2021 Upper Fording River WCT Population Monitoring report (Thorley et al. 2022).

Methods for monitoring WCT in Upper Greenhills and Gardine creeks in September 2021 were consistent with those used from 2017 to 2019 (Minnow 2018b, 2019a,b, 2020a) and similar to the closed station electrofishing completed as part of the Upper Fording River Population Monitoring Program in 2021 (Thorley et al. 2022). Three closed stations (approximately 100 m^2 each)

[27] However, the site-specific EVWQP Level 1 Benchmark for dietary effects to growth of juvenile fish (i.e., 11 µg/g dw) is not applicable to juvenile WCT and WCT are the only fish species known to occur in Greenhills and Gardine Creeks (Table 2.4; Teck 2014).

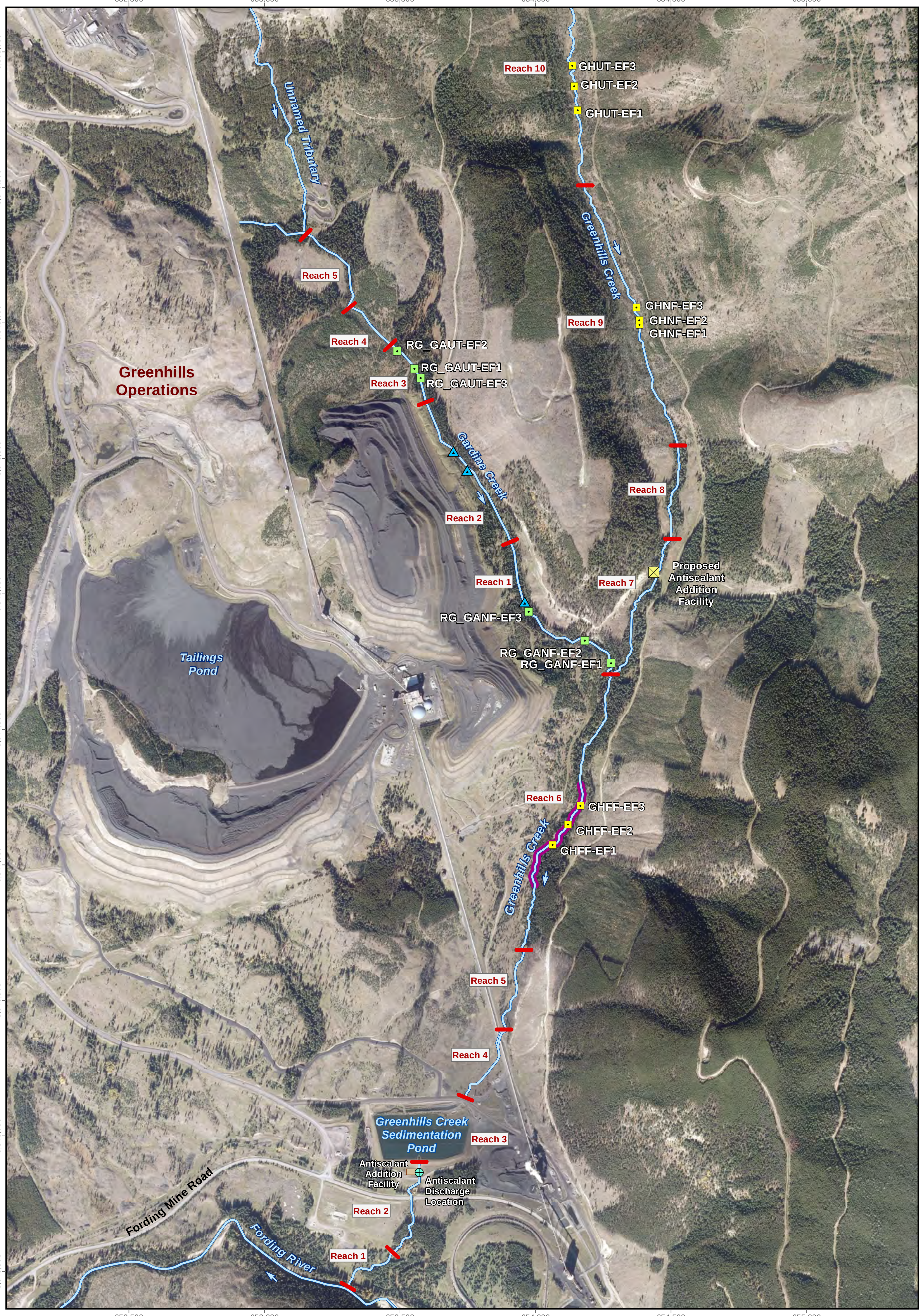
Table 2.4: Selenium Benchmarks for Benthic Invertebrate Tissues, Elk River Watershed [a]

Endpoint	Tissue Type	Benchmark		Source
		Value (µg/g dw)	Description	
Benthic Invertebrates	Whole body	13	Level 1 (~10% effect) benchmark for growth, reproduction, and survival of invertebrates	Teck 2014
	Whole body	20	Level 2 (~20% effect) benchmark for growth, reproduction, and survival of invertebrates	Teck 2014
	Whole body	27	Level 3 (~50% effect) benchmark for growth, reproduction, and survival of invertebrates	Golder 2014
	Whole body	11 [b]	Level 1 (~10% effect) benchmark for dietary effects to juvenile fish (growth)	Teck 2014
	Whole body	18	Level 2 (~20% effect) benchmark for dietary effects to juvenile fish (growth)	Teck 2014
	Whole body	26	Level 3 (~50% effect) benchmark for dietary effects to juvenile fish (growth)	Golder 2014
	Whole body	15	Level 1 (~10% effect) benchmark for dietary effects to juvenile birds	Teck 2014
	Whole body	22	Level 2 (~20% effect) benchmark for dietary effects to juvenile birds	Teck 2014
	Whole body	41	Level 3 (~50% effect) benchmark for dietary effects to juvenile birds	Golder 2014
	Whole body	45	Level 1 (~10% effect) benchmark for maternal amphibian diet	Massé et al. 2015

Notes: µg/g dw = micrograms per gram dry weight; ~ = approximate; % = percent.

[a] The 4 µg/g dw British Columbia guideline (BCMOE 2014) was not used in the assessment of benthic invertebrate tissue selenium concentrations. The assessment was completed relative to site-specific benchmarks only.

[b] Site-specific benchmark is not applicable to effects to juvenile westslope cutthroat trout because studies with Yellowstone cutthroat trout have reported no effects at the Level 1 Benchmark (see Teck [2014], Annex E, Appendix D [Elk Valley Water Quality Plan - Selenium Toxicity Literature Review]).



LEGEND

- Gardine Creek Electrofishing Location
- Upper Greenhills Creek Electrofishing Location
- Proposed Antiscalant Addition Facility Location (2022)
- Remediation Area Selected (2023)
- Seep
- Antiscalant Discharge Location
- Reach Break
- Antiscalant Addition Facility

Closed-station Electrofishing Locations on Greenhills and Gardine Creeks, September 2021

0 0.25 0.5 1
Kilometers

Projection: North American Datum 1983 UTM Zone 11U
Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Date: June 2022
Project 227202.0016

minnow environmental inc.

Figure 2.6

Document Path: C:\Users\capol\Trinity Consultants, Inc\Teck - 227202.0016 - 2022 GGCAMP\D - GIS\2021 GGCAMP Report\22-16 Figure 2.6 Greenhills Creek and Gardine Creek Closed Electrofishing Locations.mxd were backpack electrofished at four of the five biological monitoring areas targeted for fishing (i.e., at RG_GHUT, RG_GHNF, RG_GHFF, and RG_GANF). Stop nets were used to enclose each of the electrofishing stations. Care was taken to confirm that stream morphology and total sampling areas (m^2) of each station were as similar as possible and stations were spaced at least 10 m apart. Efforts were made to include representative stream habitat types (e.g., riffle, run, and pool) within each of the approximately 100 m^2 closed stations. The length of each closed station was recorded. Wetted and bankfull widths were measured along five equally-spaced transects within each station and water depths were also measured at three points along each of these transects.

Due to low water levels, the presence of dry channel sections, and poor access at RG_GAUT in September 2021, three 100 m^2 closed stations could not be established, consistent with monitoring completed in 2019 (Minnow 2020a). Instead, electrofishing was completed in pools that were isolated by existing barriers (e.g., culverts, low water levels) and/or with stop nets. The two pools that were electrofished at RG_GAUT in 2019 (RG_GAUT-EF1 and RG_GAUT-EF2; Minnow 2020a) were fished again in 2021, along with a smaller, third pool that was identified by the field crew in September 2021 (RG_GAUT-EF3; Figure 2.6). The size (m^2) and depth of each pool was recorded.

Supporting habitat data, including *in situ* water quality measurements (i.e., temperature, dissolved oxygen, pH, and specific conductance) were collected from each closed station or pool, concurrent with fishing activities in Upper Greenhills and Gardine creeks. The GPS coordinates of the upstream and downstream station boundaries (closed stations) or pools were recorded. Each station or pool was photographed and data pertaining to substrate characteristics, riparian vegetation types, and canopy cover were recorded.

To support density estimates for fry and juvenile WCT (i.e., fish with fork lengths <20 cm), each closed station on Upper Greenhills or Gardine creek was fished by a two-person crew using three-pass removal depletion methods (adapted from Ptolemy et al. 2006). A pulsed direct current (DC) backpack electrofishing unit (Smith Root LR24) was used to make three successive passes of declining catch. The anode operator worked closely with the netter to turn over rocks or move away overhanging vegetation to help recover stunned fish. Fishing was completed by certified and experienced crews. At each sampling area, electrofishing was initiated at the downstream net, and consisted of a thorough surprise/ambush search in an upstream direction, followed by a systematic sweep back towards the downstream net. Electrofishing seconds were monitored and recorded so that each successive depletion used similar effort.

Fish captured during electrofishing were processed according to the following methods to support assessments of fish condition (i.e., weight-at-length) and external health (i.e., anomalies[28], such as parasites, deformities, erosions [fin and gill], lesions, or tumors), in addition to estimates of fish density and biomass. Care was taken to minimize fish handling, to the extent reasonably possible. Fork lengths for WCT captured from Upper Greenhills and Gardine creeks were measured to the nearest millimetre (mm) using a measuring board. Fresh body weight of fish less than approximately 30 g was measured using a Scout Pro balance (to the nearest 0.001 g with plus or minus [±] 1% precision) and fresh body weight of fish >30 g was measured using Pesola™ spring scales (precision to the nearest 1% to 5% of total weight). External anomalies observed during processing were evaluated and recorded, consistent with the approach identified in the 2021 to 2023 RAEMP study design (Table 2.5; Minnow 2021c). Caudal fin length was measured to the nearest hundredth of a millimetre using digital calipers following the methods of Bosakowski and Wagner (1994) to assess fin erosion.[29] Fish larger than the minimum fork length for insertion of Passive Integrated Transponder (PIT) tags (i.e., 6.5 cm; Teck 2017) were scanned with a Biomark handheld PIT tag reader to support calculation of growth rates for recaptured fish. This approach was taken by the field crew to minimize handling and potential stress to smaller WCT, and because any previously-tagged WCT (i.e., fish that were tagged in 2019 or earlier) would logically have fork lengths greater than 6.5 cm in 2021. No PIT tagging (regardless of fish body size) or tissue chemistry sampling was completed in 2021 to minimize fish handling. Upon completion of external data collection, fish were released back to their capture areas. Capture, effort (area and electrofishing time for each pass), WCT body size (length and weight), and external health data were submitted to MFLNRORD within 90 days of permit expiration (as per the requirements of permit CB21-631191).[30]

In addition to the late summer/fall monitoring described above, redd surveys, environmental DNA (eDNA) sampling, and opportunistic sampling of WCT tissues for chemistry analyses were completed within the Greenhills Creek watershed in 2021. Redd surveys were completed in Lower Greenhills Creek in 2021 as part of Teck's Upper Fording River Population Monitoring Program. Details for the survey methods used in 2021 are provided in the Upper Fording River WCT Population Monitoring 2021 report (Thorley et al. 2022). From June to August

[28] These external assessments were formerly referred to as "DELT" (deformities, erosion, lesion, and tumor) surveys, based on classifications by Sanders et al. (1999). The approach used for the 2021 GGCAMP is consistent with the revised approach used for the RAEMP (Minnow 2021b,c).

[29] Due to an equipment malfunction, the field crew was required to read the calipers manually (rather than relying on the digital read-out) for a sub-set of the WCT captured in 2021. Manual readings were completed to the nearest 1 mm.

[30] Typically, individual PIT tag identification data would also be submitted to MFLNRORD as part of the permit response package; however, as indicated in Section 3.5, no tagged fish were captured from Upper Greenhills or Gardine creeks in 2021.

Table 2.5: Severity Assessment for External Anomalies in Fish[a]

Scale	Body Surface	Body Form	Lesions	Tumours	Fins	Lips/Jaws/ Snout	Eyes	Gills	Opercula	Infection (fungus, bacteria, virus)	Parasites
0	Normal; no aberrations	Normal	None	None	No active erosion	Normal, no lesions, swelling, tears etc.	No aberrations; good "clear" eye	Normal; No apparent aberrations	Normal; both opercula intact and complete	No observed infections	No observed parasites
1	Slight inflammation or reddening	Slight spinal curvature	Tears or wounds on caudal fins, pectoral or dorsal fins	Tumour present, but localized and with no signs of sloughing/ ulceration	Light active erosion	Swelling on or around lips, mouth or snout	Swollen or protruding eyes	Gills with light, discolored margin along tips of the lamellae	Slight shortening of one or both opercula, gills covered	Minor, spatially isolated infection	Few observed parasites
2	Moderate inflammation or reddening	One of lordosis, kyphosis or scoliosis	Lesions or wounds on side of body	More than one tumour or one large tumour with no/minor sloughing/ ulceration	Moderate active erosion with some hemorrhaging	Small punctures or lesions	Hemorrhaging eye(s) or blind in one or both eyes	Frayed; erosion of tips of gill lamellae resulting in "ragged" gills	Moderate shortening of one or both opercula, gills exposed	Moderate infection or more than one body surface affected	Moderate parasite infestation
3	Severe inflammation or reddening	Signs of lordosis and kyphosis and scoliosis	Many lesions, rips or tears on body and on fins, possibly on face as well	One or more large tumour that may impair breathing/ feeding/ swimming performance; signs of ulceration and/ or sloughing	Severe active erosion with hemorrhaging	Tears, hanging maxilla, missing lips	Missing eye(s)	Clubbed; swelling of the tips of the gill lamellae	One or both opercula substantially shortened or missing, gills completely exposed	Infection covering large spatial area (>25% of surface)	Numerous parasites

Notes: > = greater than; % = percent.
a This severity assessment replaces “DELT” (deformities, erosion, lesion, and tumor) surveys (Sanders et al. 1999) completed in previous years.

2021, eDNA samples were collected from five locations on Upper Greenhills Creek, as well as a negative control site on Rush Creek, which is to the west of GHO (Ecofish 2022). Tissue samples collected opportunistically by Teck and/or Teck's consultants from incidental WCT mortalities identified within the Greenhills Creek watershed in 2021 were analyzed by Trich for the same suite of parameters as the benthic invertebrate tissue samples described in Section 2.5.

2.6.2 Data Analysis

Estimates of fish abundance, densities, and biomass and health endpoint measurements were summarized for the sampling areas in Upper Greenhills and Gardine creeks and were used to address the following general questions:

- Q1: Do estimates of WCT abundance, densities, biomass, and health endpoints differ among areas?
- Q2: 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?

Estimates of WCT densities, abundance, and biomass at the closed electrofishing stations on Greenhills (RG_GHUT, RG_GHNF, RG_GHFF, and Reach 1) and lower Gardine (RG_GANF) creeks were calculated as described in the 2021 GGCAMP study design (Minnow 2021b).[31] Densities, abundance, and biomass were not estimated for the isolated pools on upper Gardine Creek (RG_GAUT; Figure 2.6).

Estimates of abundance, densities, biomass, and fish meristics (lengths, weights, and condition [weight-at-length]) in 2021 were qualitatively compared among areas sampled in Upper Greenhills and Gardine creeks in 2021 and previous years. Results for the isolated population of WCT in Upper Greenhills and Gardine creeks were also qualitatively compared with fish captured from Lower Greenhills Creek as part of the Upper Fording River WCT Population Monitoring Program (Thorley et al. 2022). To support comparisons to Lower Greenhills Creek, a visual examination of length-frequency plots was completed to identify age-1 and age-2+ fish. Because no previously-tagged fish were captured from Greenhills or Gardine creeks in 2021 (see Section 3.5), no estimates of growth rates were completed as part of this report (see Minnow 2021b).

Statistical comparisons of fish health endpoints among years were completed in accordance with the study design (Minnow 2021b). Fish with fork lengths <6.5 cm were excluded from statistical analyses to minimize the influence of factors such as low capture efficiency and

[31] Abundances were also estimated differently, using new methods, as part of the Upper Fording River WCT Population Monitoring Program; these new methods will be applied in the 2022 GGCAMP report.

density-dependence, consistent with the cut-off used in the analyses for Lower Greenhills Creek (Thorley et al. 2022). All statistical analyses were completed in R (R Core Team 2021).

Fish tissue sampling was not completed as part of the GGCAMP in 2021. However, biological triggers developed for selenium concentrations in WCT muscle as part of Teck's AMP (Teck 2018, 2021a) were applied to tissue samples that were collected opportunistically from incidental mortalities. Additionally, all tissue selenium data collected opportunistically from WCT in 2021 were compared to estimated effects thresholds and site-specific benchmarks (Nautilus Environmental and Interior Reforestation 2011; Teck 2014).

3 RESULTS

3.1 Water Quality

Water quality sampling at Teck's routine monitoring stations and at biological monitoring areas on Greenhills and Gardine creeks was completed as described in Section 2.2.1. However, due to unsafe access or the absence of flow, *in situ* measurements of water quality and water chemistry samples were not collected from RG_GHNF and RG_GHFF on Upper Greenhills Creek or RG_GAUT and RG_GANF on Gardine Creek in February 2021. Target sample/data types and numbers were achieved for RG_GHUT (Upper Greenhills Creek) and RG_GHBP (Lower Greenhills Creek) in February 2021 and at all biological monitoring areas targeted for sampling in September 2021 (see Table 2.1).

In Upper Greenhills Creek, concentrations of mine-related constituents with EWTs were below BC WQG, EVWQP Level 1 Benchmarks, and/or interim screening values in 2021, except for TDS, nitrate, sulphate, total nickel, total selenium, total uranium, and dissolved cadmium[32] (Appendix Figures C.1 to C.16; Appendix Tables C.1 and C.2). Comparison of mine-related constituents measured at the routine monitoring station on Upper Greenhills Creek above the confluence with Gardine Creek (GH_CTF and GH_HWGH_BRB) and the routine monitoring station above Greenhills Creek Sedimentation Pond (GH_GH1B) generally showed similar seasonal patterns between 2017 and 2021 (i.e., lower concentrations in spring versus summer and fall). Additionally, concentrations of most constituents with EWTs were statistically similar among GH_CTF, GH_HWGH_BRB, and GH_GH1B in 2021 (Appendix Figure C.17). Exceptions included total antimony, nickel, and selenium, which had lower concentrations at GH_GH1B, downstream from the Gardine Creek mouth, relative to upstream, and total manganese and uranium concentrations, which were the highest at GH_CTF and lowest at GH_GH1B (Figure 2.1; Appendix Figures C.1 to C.17). Concentrations of total barium decreased with increasing distance downstream on Upper Greenhills Creek (Appendix Figure C.17). The higher concentrations at GH_CTF and GH_HWGH_BRB relative to further downstream at GH_GH1B indicate that Gardine Creek acts as a source of dilution for some constituents with EWTs, with the exception of total barium. Station GH_GC1 on Gardine Creek had the highest annual mean total barium concentration in 2021 and higher concentrations in Gardine Creek appear to have influenced concentrations at GH_GH1B (Appendix Figure C.17; Appendix Table C.1).

[32] The water chemistry samples collected from the furthest upstream biological monitoring area on Upper Greenhills Creek (i.e., RG_GHUT) in February and September were the only samples with dissolved cadmium concentrations in excess of the long-term average BC WQG in 2021 (Appendix Figure C.15; Appendix Tables C.1 and C.2).

In Lower Greenhills Creek, most mine-related constituents with EWTs were below BC WQG, EVWQP Level 1 Benchmarks, and/or interim screening values in 2021, except for TDS, nitrate, sulphate, and total nickel, selenium, and uranium (Appendix Figures C.1 to C.16; Appendix Tables C.1 and C.2). Mine-related constituents with EWTs that were measured at routine monitoring stations upstream (GH_GH1) and downstream (GH_GH2) of the antiscalant addition facility generally showed similar seasonal patterns (i.e., dips in concentrations during freshet; Figure 2.1; Appendix Figures C.1 to C.16). Concentrations of most mine-related constituents at GH_GH1 and GH_GH2 did not differ significantly from concentrations at GH_GH1B upstream from the Greenhills Creek Sedimentation Pond (Figure 2.1; Appendix Figure C.17). Specific exceptions include total manganese and molybdenum at GH_GH1B versus GH_GH2 (with the differences for total molybdenum being attributed to antiscalant addition; see below) (Appendix Figures C.1 to C.17; Appendix Table C.1).

Water quality in Gardine Creek in 2021 was generally of better quality than Greenhills Creek (despite the results noted for total barium, above); sulphate and selenium were the only constituents with EWTs that had concentrations greater than the long-term BC WQG (Appendix Figures C.1 to C.17; Appendix Tables C.1 and C.2). However, selenium concentrations were consistently below the Level 1 EVWQP Benchmark (Appendix Tables C.1 and C.2). Again, Gardine Creek appears to act as a source of dilution for some mine-related constituents in Greenhills Creek.

Water quality monitoring was also completed at Greenhills Creek Sedimentation Pond (RG_GHP) in September 2021 (Appendix Figures C.1 to C.16; Appendix Tables C.2 and C.3). Concentrations of most mine-related constituents with EWTs were below BC WQG, EVWQP Level 1 Benchmarks, and/or interim screening values in September 2021, except for TDS, nitrate, sulphate, and total nickel, selenium, and uranium. These results are similar to those for Lower Greenhills Creek, downstream from the pond.

Selenium speciation samples were collected from two biological monitoring areas in February 2021 (i.e., RG_GHUT and RG_GHBP) and from seven biological monitoring areas in September 2021 (i.e., RG_GHUT, RG_GHNF, RG_GHFF, RG_GHBP, RG_GAUT, RG_GANF, and RG_GHP; Figure 2.1; Appendix Table C.4). Samples were not collected from RG_GHNF and RG_GHFF on Upper Greenhills Creek or RG_GAUT and RG_GANF on Gardine Creek in February 2021 due to unsafe access or the absence of flow. Water sampling for selenium speciation was also completed upstream and downstream from the Greenhills Creek Sedimentation Pond in 2021 to support the Elk Valley Selenium Speciation Monitoring Program (Appendix Table C.4; ADEPT 2022). Aqueous selenium species were dominated by selenate for all areas and sampling events. However, concentrations of dimethylselenoxide and methylseleninic acid in water samples collected from Upper Greenhills Creek (RG_GHNF, RG_GHFF, and GH_GH1A), Lower Greenhills Creek (GH_GH1SP_DS1 and RG_GHBP), and Greenhills Creek Sedimentation Pond (RG_GHP) in 2021 were above the draft screening value (0.025 micrograms per litre [µg/L]) for enhanced bioaccumulation (ADEPT 2022). The highest combined concentrations of dimethylselenoxide and methylseleninic acid were observed in the Greenhills Creek Sedimentation Pond and downstream at RG_GHBP. These results are attributed to enhanced formation of organoselenium species resulting from processes within the pond environment and carry-over effects to lotic habitats immediately downstream (i.e., RG_GHBP) (Golder 2021a).

Overall, concentrations of mine-related constituents and organoselenium species tended to differ among areas, depending on whether they were upstream or downstream from Gardine Creek and/or the Greenhills Creek Sedimentation Pond. This was largely attributed to the comparatively good water quality in Gardine Creek having a dilution effect on constituent concentrations in Greenhills Creek downstream from the Gardine Creek mouth. Concentrations of organoselenium species tended to increase with increasing distance downstream in Greenhills Creek; the highest concentrations were observed within the Greenhills Creek Sedimentation Pond and Lower Greenhills Creek in September 2021.

Concentrations of most mine-related constituents with EWTs have remained relatively stable or have decreased over time at Teck's routine water quality monitoring stations on Greenhills and Gardine creeks (Appendix Table C.5). Concentrations of total nickel were significantly and substantially lower (i.e., 57 to 66%) at all stations in 2021 relative to the base year of sampling (i.e., 2016 or 2017) and 2018 (Appendix Figure C.11; Appendix Table C.5). Decreases in nickel concentrations may be associated with inter-annual variations in flow volumes (e.g., 2016 being a low flow year) and the declining influences of a 2014 spoil failure and Teck's pumping of water with elevated nickel concentrations from the Cougar Phase 3 Pit to Greenhills Creek for a short period in 2018 (Minnow 2021a). A spoil failure occurred in December 2014 and increased aqueous concentrations of nickel were identified downstream following the failure. It is considered likely that stabilization of the spoil and weathering of the exposed material since 2014 has contributed to the reduction in nickel concentrations over time (Jaeger 2020, pers. comm.). Additionally, the temporal decreases in nickel concentrations to current levels also appear to coincide with the period following cessation of pumping from the Cougar Phase 3 Pit in 2018, after which no additional pumping was completed. Total antimony concentrations at GH_CTF on Upper Greenhills Creek significantly decreased year-over-year from 2017 to 2021 and concentrations at all stations were substantially lower (i.e., 41 to 52%) in 2021 relative to the base year of sampling (i.e., either 2016 or 2017; Appendix Figure C.5; Appendix Table C.5). It is uncertain whether these results for total antimony are attributed to stabilization of the spoil, as indicated above for nickel, or some other factor(s).

Aqueous concentrations of total selenium were higher at GH_GH1, between the Greenhills Creek Sedimentation Pond outlet and the antiscalant addition facility, throughout 2017 to 2021, relative to 2016 (Appendix Figure C.12; Appendix Table C.5). These results could be attributed to 2016 being a low flow year. The timing of the shift in concentrations (i.e., in 2017) and the fact that GH_GH1 is upstream of the antiscalant addition facility suggest that the increasing concentrations are not related to initiation of treatment with antiscalant. No other significant changes in selenium concentrations over time were identified for Teck's routine monitoring stations on Greenhills or Gardine Creeks.

Preventative treatment for calcite in Lower Greenhills Creek commenced October 23rd, 2017. Thus, water quality samples collected after that date (including all samples collected in 2021) are considered representative of conditions associated with calcite management. In 2021, the ratios between upstream (GH_GH1) and downstream (GH_GH2) concentrations of mine-related constituents were not significantly different when compared to before treatment in 2017 (Appendix Table C.6). Total and dissolved molybdenum were the only exceptions; concentrations were 87% (p-value = 0.005) and 88% (p-value = 0.002) higher, respectively, downstream relative to upstream in 2021 versus 2017 (Appendix Table C.6). Similar results for molybdenum were also observed in 2019 (Figure 3.1). The higher concentrations of molybdenum associated with calcite treatment in 2019 and 2021 were still well below the BC WQG (Appendix Figure C.10) and were as expected, due to molybdenum being a component of the antiscalant compound (Teck 2019b). The lack of a difference in the ratio of concentrations between GH_GH1 and GH_GH2 in 2020 is likely attributed to a dip in molybdenum concentrations at GH_GH2 in June of that year (Figure 3.1). This dip likely reflects reduced dosing at the start of June 2020, when flows in Lower Greenhills Creek were outside the allowable window that is used to maintain the correct dose of antiscalant within the creek (Teck 2021c). Regardless, it can be concluded that, overall, concentrations of mine-related constituents in Lower Greenhills Creek have not undergone unexpected changes relative to upstream following the application of antiscalant.

3.2 Substrate Quality

3.2.1 Calcite

In 2021, calcite measurements completed as part of the Regional Calcite Monitoring Program (Robinson et al. 2022) and the GGCAMP indicated that calcified substrates were present throughout Greenhills Creek (Table 3.1; Appendix Tables D.1 to D.4). No statistically significant differences in C_p were identified among areas on Upper and Lower Greenhills Creek in 2021,

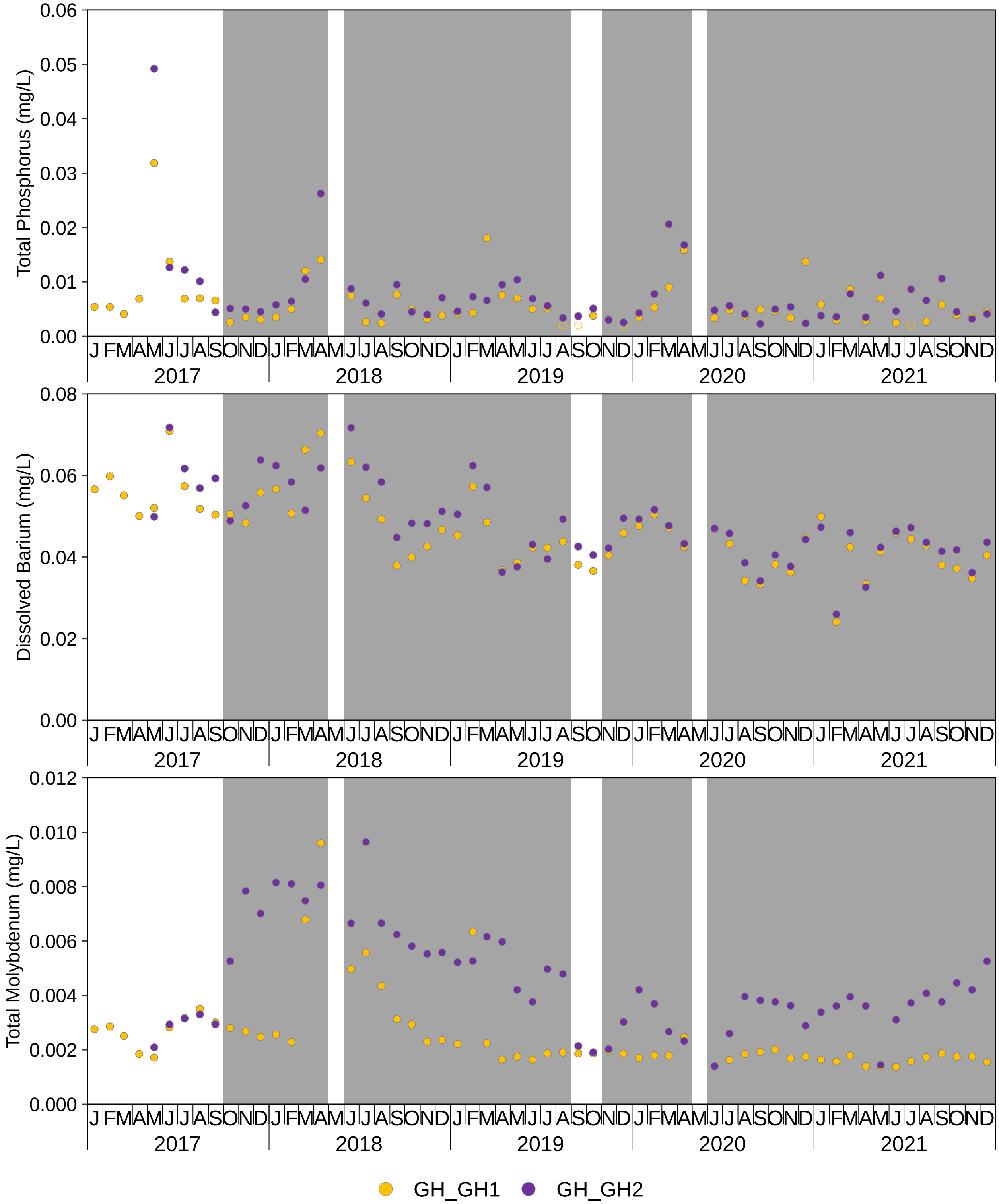


Figure 3.1: Monthly Mean Concentrations of Analytes Showing Significant Differences Before and After Calcite Treatment for Stations Upstream (GH_GH1) and Downstream (GH_GH2) from the Water Treatment Facility, 2017 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Grey shading represents prevention−mode calcite treatment. Only analytes with significant overall p-values in the ANOVA table were included in the plots.

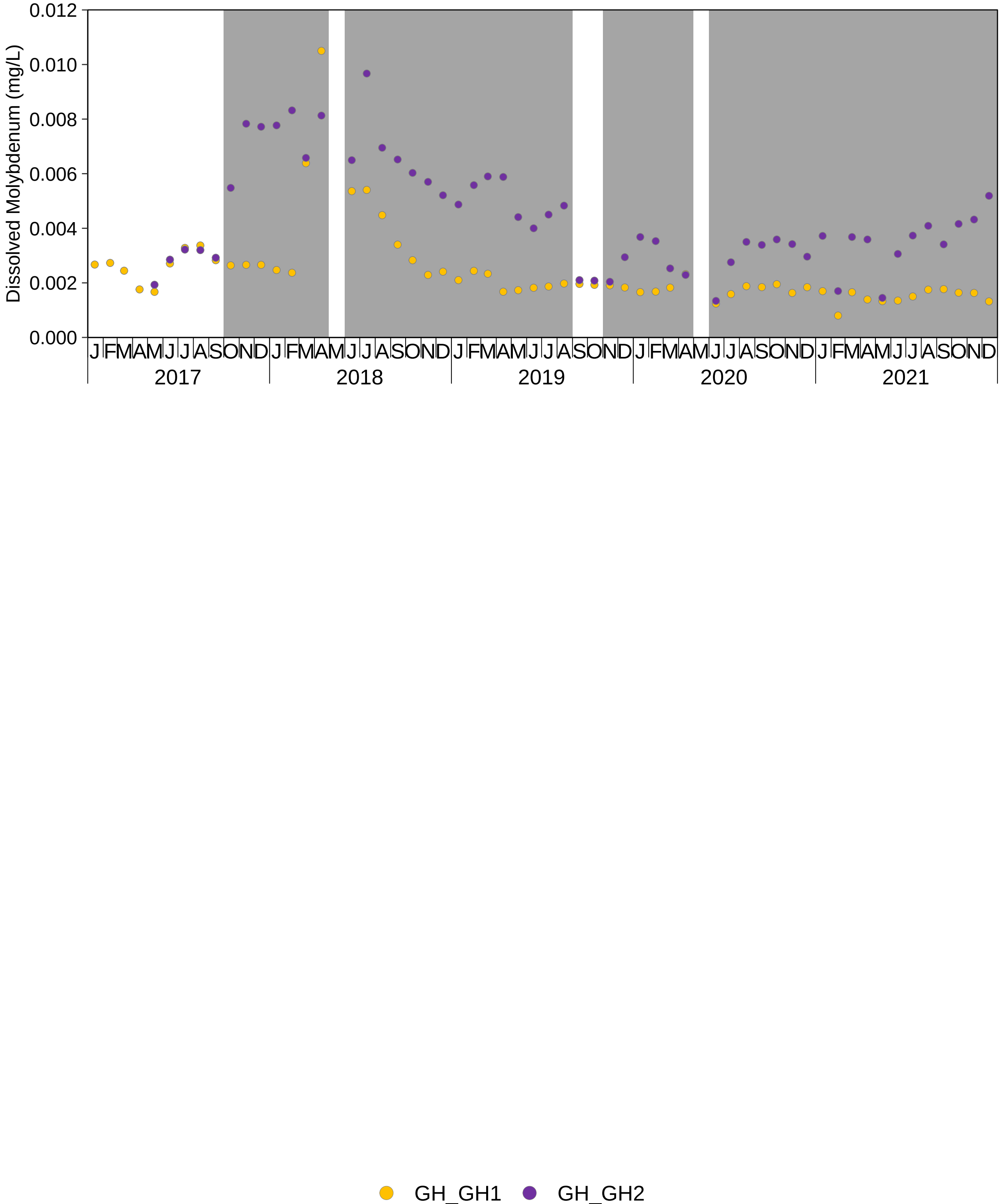


Figure 3.1: Monthly Mean Concentrations of Analytes Showing Significant Differences Before and After Calcite Treatment for Stations Upstream (GH_GH1) and Downstream (GH_GH2) from the Water Treatment Facility, 2017 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Grey shading represents prevention−mode calcite treatment. Only analytes with significant overall p-values in the ANOVA table were included in the plots.

Table 3.1: Calcite Indices (CI and CI') for Monitoring Locations on Greenhills and Gardine Creeks, 2015 to 2021

Watercourse	Station ID	UTM Coordinates (NAD83, 11U)		Calcite Index (CI)							Calcite Index Prime (CI')
		Easting	Northing	2015	2016	2017	2018	2019	2020	2021	2021
Upper Greenhills Creek	RG_GHUT-6	654138	5550027	-	-	2.2	2.8	2.9	2.2	1.9	1.8
	RG_GHUT-5	654127	5549988	-	-	1.7	2.5	2.6	2.5	1.7	1.7
	RG_GHUT-4	654134	5549945	-	-	1.1	2.3	2.9	2.6	2.3	2.2
	RG_GHUT-3	654123	5549927	-	-	2.7	2.8	3.0	2.5	1.6	1.5
	GREE4-75	654152	5549910	2.8	2.5	2.3	2.6	2.3	2.7	2.7	2.7
	RG_GHUT-2	654145	5549895	-	-	2.8	2.5	2.9	2.6	1.6	1.6
	RG_GHUT-1	654149	5549848	-	-	2.3	2.8	2.5	2.4	2.7	2.7
	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	2.2
	GREE4-50	654336	5549133	2.9	2.6	2.9	2.9	2.9	2.9	2.8	2.8
	RG_GHNF-5	654342	5549130	-	-	3.0	2.5	3.0	2.6	1.9	1.9
	RG_GHNF-4	654335	5549104	-	-	2.3	2.4	2.9	2.9	2.5	2.5
	RG_GHNF-3	654367	5549052	-	-	3.0	2.7	2.9	2.7	2.2	2.2
	RG_GHNF-2	654375	5549036	-	-	2.9	2.7	3.0	2.5	1.9	1.9
	RG_GHNF-1	654384	5549004	-	-	3.0	2.8	3.0	2.8	2.4	2.4
	GREE4-37.5	654447	5548758	2.8	-	-	-	-	-	-	-
	GREE4-25	654512	5548365	2.8	2.7	2.8	2.8	1.8	2.9	2.6	2.6
	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	2.4
	RG_GHFF-5	654187	5547244	-	-	2.4	2.7	2.6	2.5	2.7	2.5
	GREE3-75	654172	5547243	2.5	2.4	2.7	2.5	1.6	2.6	2.7	2.7
	RG_GHFF-4	654161	5547200	-	-	2.2	2.5	2.8	2.5	2.6	2.6
	RG_GHFF-3	654135	5547185	-	-	1.8	2.6	2.8	2.5	2.3	2.2
	RG_GHFF-2	654118	5547137	-	-	2.0	2.5	2.2	2.2	2.7	2.6
	RG_GHFF-1	654099	5547120	-	-	2.6	2.6	2.2	2.3	2.2	2.0
	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	2.9
	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	2.4

Calcite Index 0 to 0.50.
Calcite Index 0.51 to 1.00.
Calcite Index 1.00 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, 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 2021

Watercourse	Station ID	UTM Coordinates (NAD83, 11U)		Calcite Index (CI)							Calcite Index Prime (CI')
		Easting	Northing	2015	2016	2017	2018	2019	2020	2021	2021
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	1.0
	GH_GREE1-75	653534	5545668	1.4	2.1	2.1	1.4	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	0.44
	RG_GHBP-4	653538	5545628	-	0.72	0.72	1.6	0.76	0.50	0.90	0.42
	RG_GHBP-3	653521	5545623	-	0.68	0.68	0.24	0.62	0.42	0.90	0.45
	RG_GHBP-2	653513	5545618	-	0.52	0.52	0.40	0.54	0.64	0.90	0.47
	RG_GHBP-1	653501	5545593	-	0.30	0.30	0.32	0.72	0.30	0.86	0.36
	GH_GREE1-50	653494	5545590	0.88	0.90	0.90	0.26	0.54	0.11	1.0	0.26
	GH_GREE1-25	653386	5545504	0.30	0.23	0.23	0.23	0.21	0.47	1.1	0.86
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	-	-	-	-	0.08	0	0	0
	RG_GAUT-1	653451	5548928	-	-	-	-	0	0	0.14	0.04
	GARD1[a] GARD1-75	653316	5549076							0	0
	GARD1[a] GARD1-50	653641	5548601	0.32	0.14	0.60	0.64	0.50	0.60	0	0
	GARD1[a] GARD1-25	653316	5549076							2.2	2.1
	RG_GANF-6	654125	5547829	-	-	-	-	1.8	1.9	2.0	1.9
	RG_GANF-5	654186	5547833	-	-	-	-	1.5	2.4	2.1	2.0
	RG_GANF-4	654204	5547822	-	-	-	-	2.2	2.3	1.3	1.1
	RG_GANF-3	654234	5547802	-	-	-	-	1.9	1.9	1.0	0.55
	RG_GANF-2	654247	5547794	-	-	-	-	2.2	2.6	1.0	0.50
	RG_GANF-1	654277	5547746	-	-	-	-	1.6	1.2	1.1	0.67

Calcite Index 0 to 0.50.
Calcite Index 0.51 to 1.00.
Calcite Index 1.00 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, the data were reported for individual stations.

whereas C_p was significantly lower for Lower Greenhills Creek relative to Upper Greenhills Creek during previous years of monitoring (i.e., 2017 to 2020; Appendix Table D.5). However, C_p' values for the areas on Upper Greenhills Creek were approximately double the values for Lower Greenhills Creek in 2021 (Figure 3.2; Appendix Tables D.1 to D.4). This suggests that although calcite was frequently encountered on Lower Greenhills Creek, the assessed particles were not fully covered in calcite, whereas particles from Upper Greenhills Creek were more often fully covered in calcite (hence higher C_p' values for Upper Greenhills Creek). Concretion scores (C_c) were also significantly higher in Upper Greenhills Creek relative to Lower Greenhills Creek throughout 2017 to 2021 (Figure 3.2; Appendix Table D.5). The greater incidence of full calcite coverage and concretion (Table 3.2) in Upper versus Lower Greenhills Creek is evident in the CI and CI' values (Table 3.1). Within Lower Greenhills Creek specifically, CI showed little variability within increasing distance downstream (Table 3.1), but CI' and C_c decreased with increasing distance downstream until GH_GREE1-25, which is 0.12 km from the Greenhills Creek mouth (Tables 3.1 and 3.2).

Calcite presence and concretion were low in Gardine Creek upstream from the seeps (RG_GAUT; Figures 2.2 and 3.3; Tables 3.1 and 3.2; Appendix Table D.6). An increase in C_p, C_p', C_c, and overall CI and CI' values was observed downstream of where the seeps first enter Gardine Creek (i.e., at and downstream from regional monitoring location GARD1-25, which is 0.64 km from the Gardine Creek mouth; Figure 2.2; Tables 3.1 and 3.2; Appendix Table D.7), including at RG_GANF. Although there was some variability among individual sampling stations, C_c, and overall CI and CI' tended to decrease within increasing distance downstream from GARD1-25 (Tables 3.1 and 3.2).

Overall, calcified substrates were found throughout Greenhills Creek and in Gardine Creek within and downstream from the seeps from the GHO east spoil; calcified substrates were encountered infrequently upstream from the seeps on Gardine Creek. Concretion was highest in Upper Greenhills Creek and lowest in Lower Greenhills Creek and then Gardine Creek upstream from the seeps. The high level of calcite presence (C_p and C_p') and concretion at areas on Upper Greenhills Creek was reflected in the higher CI and CI' scores relative to other areas on Lower Greenhills and Gardine Creeks.

No changes in C_p over time from 2017 to 2020 were identified for the biological monitoring areas on Upper Greenhills Creek, but changes to C_p, in addition to high-magnitude changes in C_c, were identified for Lower Greenhills Creek over the same period (Table 3.2; Appendix Table D.5). In 2021, C_p for Lower Greenhills Creek was 32% higher than in 2017 and was also higher than C_p values for 2018 to 2020 (i.e., the first three years of antiscalant addition). The field crew noted that, in September 2021, there were more particles with calcite present relative to previous years,

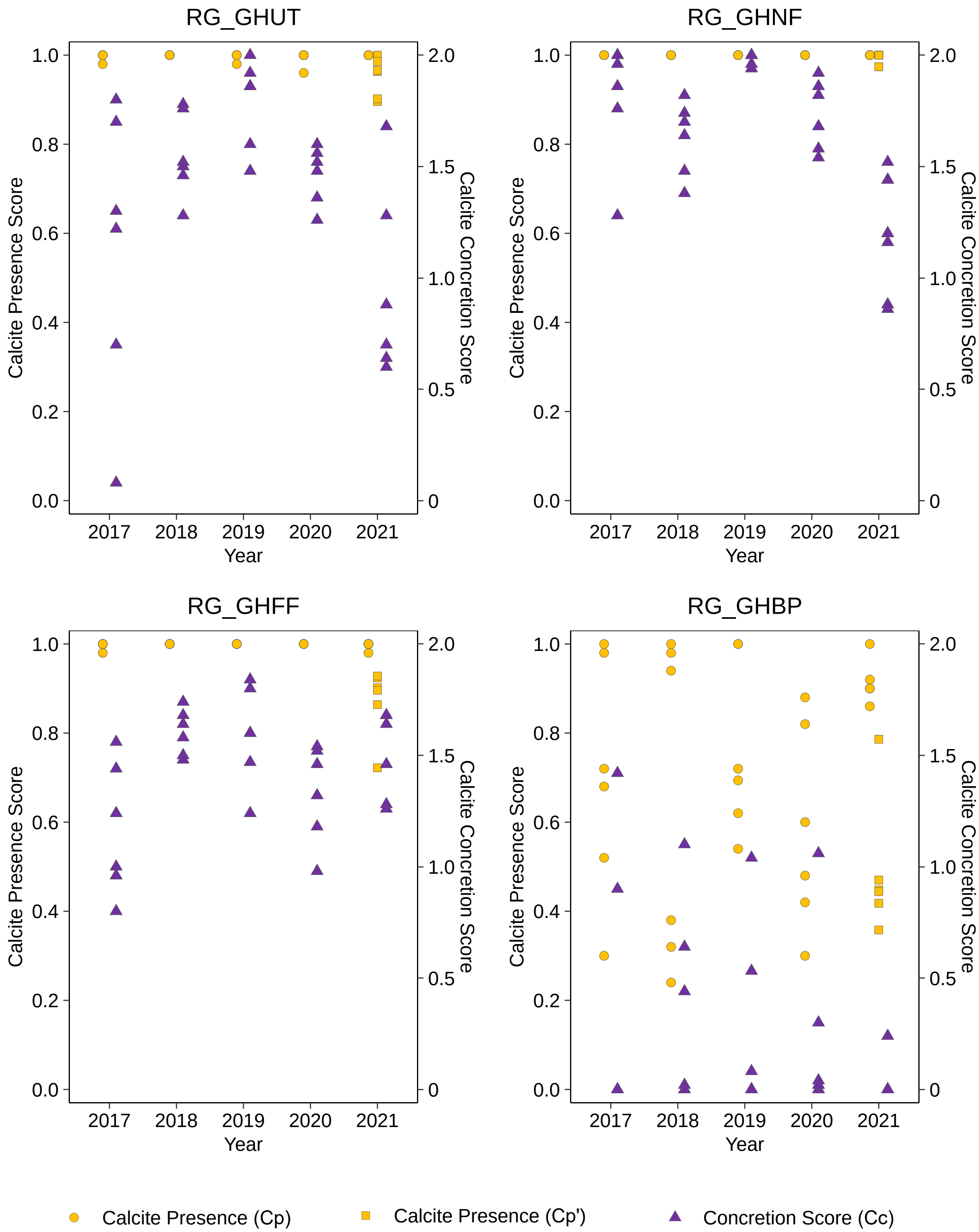


Figure 3.2: Calcite Presence and Concretion Scores for Monitoring Areas on Greenhills Creek, 2017 to 2021

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

Table 3.2: Calcite Concretion Scores for Stations on Greenhills and Gardine Creeks, 2015 to 2021

Watercourse	Station ID	UTM Coordinates (NAD83, 11U)		2015	2016	2017	2018	2019	2020	2021
		Easting	Northing							
Upper Greenhills Creek	RG_GHUT-6	654138	5550027	-	-	1.2	1.5	1.9	1.3	0.88
	RG_GHUT-5	654127	5549988	-	-	0.70	1.5	1.6	1.5	0.70
	RG_GHUT-4	654134	5549945	-	-	0.08	1.3	1.9	1.6	1.3
	RG_GHUT-3	654123	5549927	-	-	1.7	1.8	2.0	1.5	0.60
	GREE4-75	654152	5549910	1.8	1.5	1.4	1.6	1.3	1.8	1.7
	RG_GHUT-2	654145	5549895	-	-	1.8	1.5	1.9	1.6	0.64
	RG_GHUT-1	654149	5549848	-	-	1.3	1.8	1.5	1.4	1.7
	GREE4-62.5	654195	5549512	1.8	-	-	-	-	-	-
	RG_GHNF-6	654336	5549159	-	-	1.8	1.6	2.0	1.9	1.2
	GREE4-50	654336	5549133	1.9	1.7	1.9	1.9	1.9	1.9	1.8
	RG_GHNF-5	654342	5549130	-	-	2.0	1.5	2.0	1.6	0.88
	RG_GHNF-4	654335	5549104	-	-	1.3	1.4	1.9	1.9	1.5
	RG_GHNF-3	654367	5549052	-	-	2.0	1.7	1.9	1.7	1.2
	RG_GHNF-2	654375	5549036	-	-	1.9	1.7	2.0	1.5	0.86
	RG_GHNF-1	654384	5549004	-	-	2.0	1.8	2.0	1.8	1.4
	GREE4-37.5	654447	5548758	1.8	-	-	-	-	-	-
	GREE4-25	654512	5548365	1.8	1.7	1.8	1.8	0.81	1.9	1.6
	GREE4-12.5	654393	5547996	1.9	-	-	-	-	-	-
	RG_GHFF-6	654181	5547271	-	-	0.96	1.7	1.6	0.98	1.5
	RG_GHFF-5	654187	5547244	-	-	1.4	1.7	1.6	1.5	1.7
	GREE3-75	654172	5547243	1.6	1.5	1.7	1.6	0.64	1.6	1.7
	RG_GHFF-4	654161	5547200	-	-	1.2	1.5	1.8	1.5	1.6
	RG_GHFF-3	654135	5547185	-	-	0.80	1.6	1.8	1.5	1.3
	RG_GHFF-2	654118	5547137	-	-	1.0	1.5	1.2	1.2	1.7
	RG_GHFF-1	654099	5547120	-	-	1.6	1.6	1.4	1.3	1.3
	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
	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

Concretion Score 0 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, the data were reported for individual stations.

Table 3.2: Calcite Concretion Scores for Stations on Greenhills and Gardine Creeks, 2015 to 2021

Watercourse	Station ID		UTM Coordinates (NAD83, 11U)		2015	2016	2017	2018	2019	2020	2021
			Easting	Northing							
Lower Greenhills Creek	GH_DSAF		653543	5545805	-	-	-	0.70	-	-	-
	RG_GHBP-6		653547	5545677	-	-	1.4	1.1	1.0	1.1	0.24
	GH_GREE1-75		653534	5545668	0.10	0.61	1.1	0.57	0.28	0.39	0.18
	RG_GHBP-5		653538	5545647	-	-	0.90	0.44	0.50	0.30	0
	RG_GHBP-4		653538	5545628	-	-	0	0.64	0.08	0.02	0
	RG_GHBP-3		653521	5545623	-	-	0	0	0	0	0
	RG_GHBP-2		653513	5545618	-	-	0	0.02	0	0.04	0
	RG_GHBP-1		653501	5545593	-	-	0	0	0	0	0
	GH_GREE1-50		653494	5545590	0.02	0.20	0.14	0.03	0	0	0
	GH_GREE1-25		653386	5545504	0	0	0.02	0	0	0	0.05
Gardine Creek	RG_GAUT-6		653321	5549045	-	-	-	-	0	0	0
	RG_GAUT-5		653346	5549023	-	-	-	-	0	0	0
	RG_GAUT-4		653379	5548991	-	-	-	-	0	0	0
	RG_GAUT-3		653392	5548984	-	-	-	-	0	0	0
	RG_GAUT-2		653431	5548953	-	-	-	-	0	0	0
	RG_GAUT-1		653451	5548928	-	-	-	-	0	0	0
	GARD1 [a]	GARD1-75	653316	5549076							0
		GARD1-50	653641	5548601	0.06	0.02	0.28	0.29	0.01	0.22	0
		GARD1-25	653316	5549076							1.2
	RG_GANF-6		654125	5547829	-	-	-	-	0.78	0.90	0.98
	RG_GANF-5		654186	5547833	-	-	-	-	0.54	1.4	1.1
	RG_GANF-4		654204	5547822	-	-	-	-	1.2	1.3	0.42
	RG_GANF-3		654234	5547802	-	-	-	-	0.86	0.98	0.04
	RG_GANF-2		654247	5547794	-	-	-	-	1.2	1.6	0
	RG_GANF-1		654277	5547746	-	-	-	-	0.70	0.38	0.12

Concretion Score 0 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, the data were reported for individual stations.

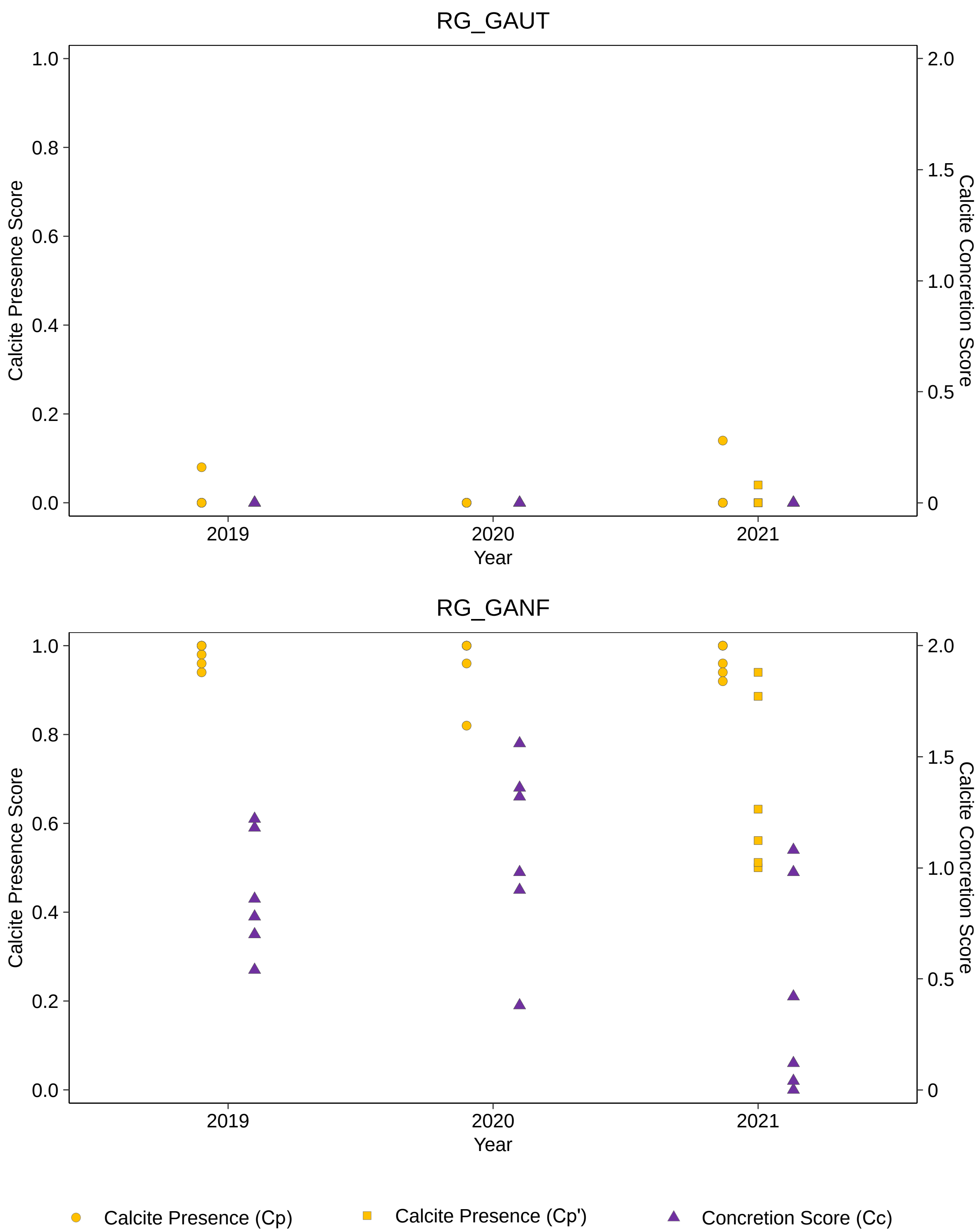


Figure 3.3: Calcite Proportion and Concretion Scores for Monitoring Areas on Gardine Creek, 2017 to 2021

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

but that calcite coverage was not complete and there was visibly less concretion. The latter observation aligns with the temporal contrasts for C_c, which indicate that concretion was 29%, 39%, and then 89% lower in Lower Greenhills Creek in 2019, 2020, and 2021, respectively, relative to the pre-treatment year (2017; Table 3.2; Appendix Table D.5). The observed decreases in concretion year-over-year in Lower Greenhills Creek are largely attributed to successful treatment with antiscalant. Also, the prevention of additional calcite precipitation following antiscalant addition may allow natural processes (e.g., high flows and forces on substrates during freshet) to support recovery of the natural substrates. It is uncertain whether the increase in C_p in 2021 is also attributed to antiscalant addition (on its own or in combination with natural factors) or other potential influences on Lower Greenhills Creek. Regardless, the lack of increase in calcite concretion in Lower Greenhills Creek in 2018 to 2021 (relative to 2017) provides support that, overall, the calcite management facility has been operating effectively to prevent further calcification of the stream bed.

3.2.2 Sediment in Creeks

Particle sizes and TOC content differed among biological monitoring areas on Lower Greenhills and Gardine creeks in 2021 but were consistent over time within each area. Sediment samples collected from RG_GHBP on Lower Greenhills Creek were primarily composed of silt with smaller proportions of clay (RG_GHBP-1, RG_GHBP-4, and RG_GHBP-5) or a mix of sand and silt with smaller proportions of clay (Appendix Table D.8). Samples from the furthest upstream biological monitoring area on Gardine Creek (RG_GAUT) were predominantly sand. However, the sample from RG_GAUT-4 had higher proportions of silt and gravel relative to the other four samples collected from RG_GAUT in 2021. Each of the five sediment chemistry samples collected from RG_GANF on Gardine Creek downstream from the seeps were a mix of sand and silt (Appendix Table D.8). In addition to generally having more clay and less sand/gravel, the samples from RG_GHBP had higher TOC content (i.e., mean = 15%) relative to RG_GAUT (mean = 7.7%) and RG_GANF (mean = 9.3%; n = 5 for each area; Appendix Tables D.8 and D.9). Overall, the sediment particle size and TOC data for each biological monitoring area in 2021 were consistent with findings from 2018 to 2020 (Minnow 2019b, 2020a), indicating little to no annual change in substrate texture at RG_GHBP, RG_GAUT, or RG_GANF. This conclusion was also largely supported by the results of the statistical tests for differences among years (Appendix Table D.10).

Concentrations of nickel, fluorene, 2-methylnaphthalene, naphthalene, and phenanthrene in at least four of the five "bulk" sediment samples collected from RG_GHBP on Lower Greenhills Creek in 2021 exceeded the upper BC WSQG; similarly, selenium concentrations were above the alert concentration (Figure 3.4; Appendix Table D.8).[33] Concentrations of these constituents were also consistently elevated relative to their respective reference area normal ranges (Figure 3.4). In 2021, concentrations of cadmium, manganese, zinc, acenaphthylene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, fluoranthene, and pyrene exceeded the lower, but not upper, BC WSQG in at least one sample from RG_GHBP (Figure 3.4; Appendix Table D.8). Concentrations of cadmium and zinc were within reference area normal ranges in 2021 (Figure 3.4).

Concentrations of selenium, acenaphthene, chrysene, fluorene, 2-methylnaphthalene, naphthalene, and phenanthrene in at least one "bulk" sediment sample collected from RG_GAUT on upper Gardine Creek in 2021 exceeded the upper BC WSQG or alert concentration (Figure 3.4; Appendix Table D.8). However, selenium concentrations in sediments were consistently within the reference area normal range in 2021 (Figure 3.4). Concentrations of arsenic, cadmium, iron, manganese, nickel, silver, acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, fluoranthene, and pyrene exceeded the lower, but not upper, BC WSQG in at least one sample (Figure 3.4; Appendix Table D.8). However, concentrations of arsenic, cadmium, and iron were within reference area normal ranges (Figure 3.4).

Concentrations of selenium, acenaphthene, chrysene, fluorene, 2-methylnaphthalene, naphthalene, and phenanthrene in at least one "bulk" sediment sample collected from RG_GANF on lower Gardine Creek in 2021 exceeded the upper BC WSQG or alert concentration (Figure 3.4; Appendix Table D.8). Concentrations of each of these constituents were also consistently above the reference area normal ranges, except for selenium (within the reference area normal range) and acenaphthene (no applicable reference area normal range; Figure 3.4). Concentrations of cadmium, nickel, acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, dibenz(a,h)anthracene, fluoranthene, and pyrene exceeded the lower, but not upper, BC WSQG in at least three out of five samples (Figure 3.4; Appendix Table D.8). Concentrations of cadmium and nickel were within the reference area normal ranges in 2021 (Figure 3.4).

Of the metals and PAHs with "bulk" concentrations above the lower or upper BC WSQG or the alert concentration for selenium, most had concentrations that were dissimilar among areas. Silver was the only exception, given that concentrations were similar among areas in 2021 (Appendix Table D.9). Throughout 2019 to 2021, concentrations of arsenic and manganese were

[33] The LRLs for acenaphthene (five of five samples), benz(a)anthracene (two of five samples), and chrysene (two of five samples) were also elevated relative to the upper BC WSQG (Appendix Table D.8).

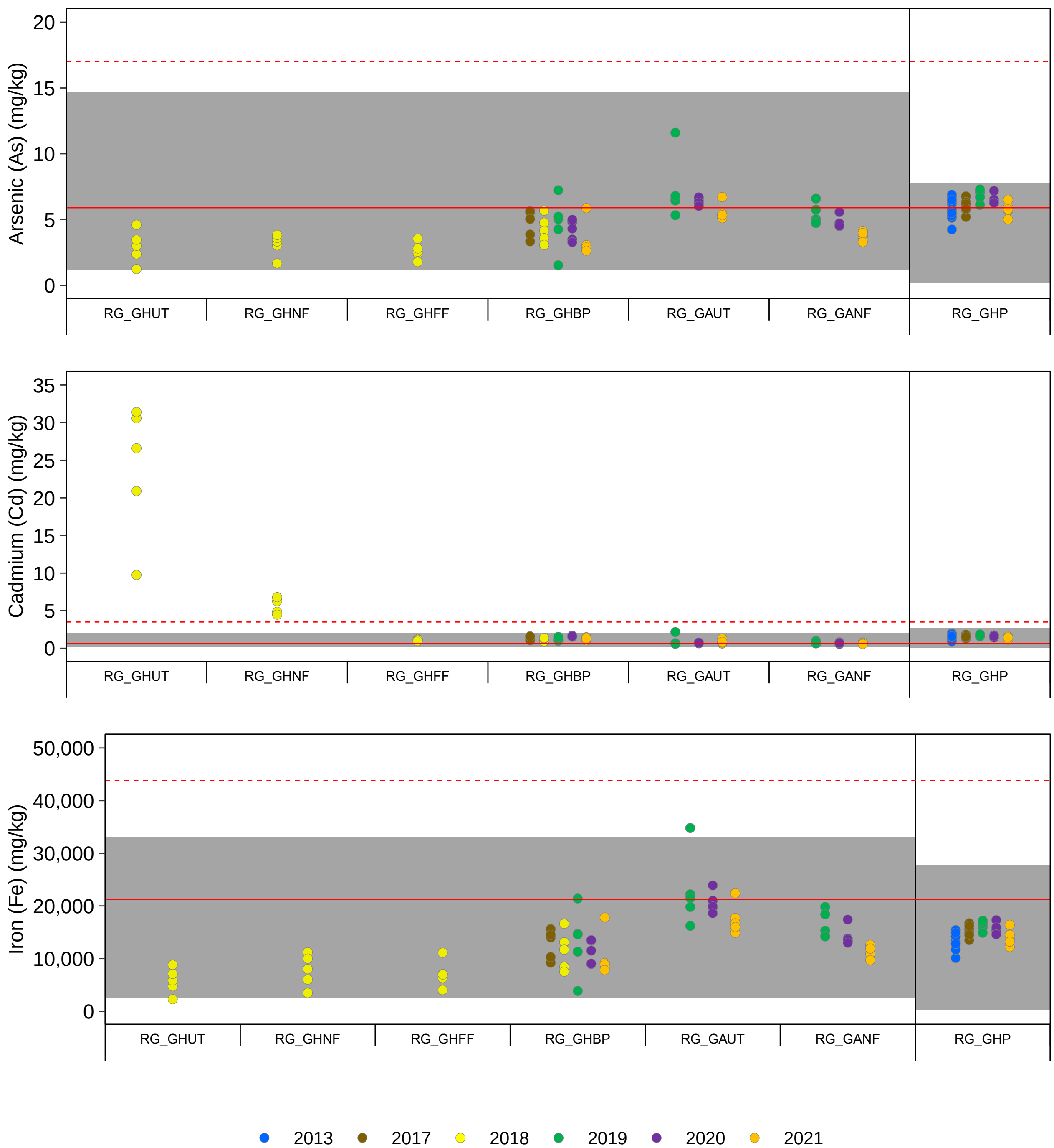


Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2021

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Solid red line = lower BC WSQG; hashed red line = upper BC WSQG (or alert concentration in the case of selenium). Grey shading = the reference area normal range (2.5th and 97.5th percentiles of pooled reference area distribution after removal of outliers). The lotic normal ranges were applied to the creek sites and the reference area normal ranges for lentic areas were applied to Greenhills Creek Sedimentation Pond. Normal ranges were excluded when 75% of the data values were censored (i.e., <LRL).

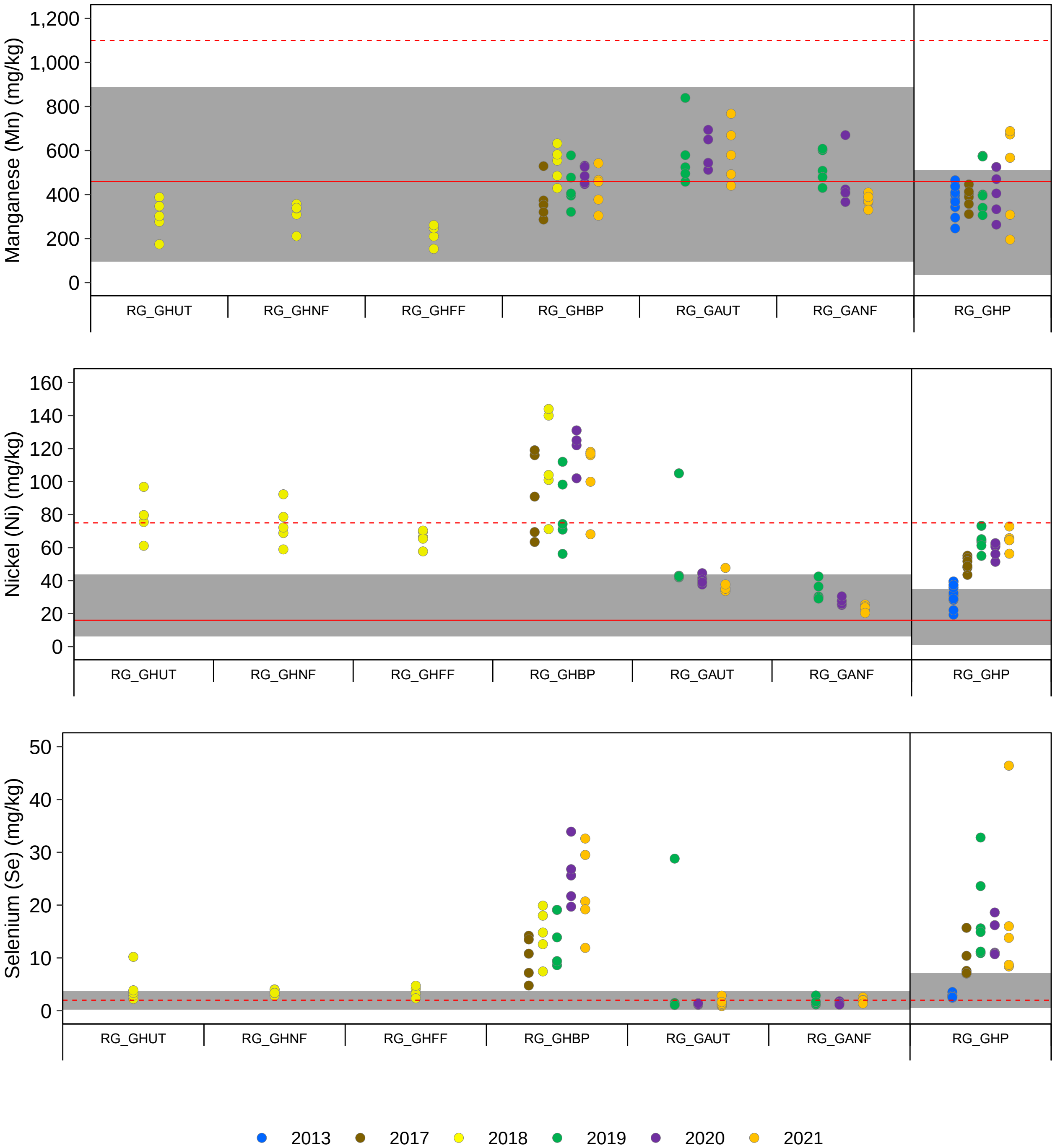


Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2021

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Solid red line = lower BC WSQG; hashed red line = upper BC WSQG (or alert concentration in the case of selenium). Grey shading = the reference area normal range (2.5th and 97.5th percentiles of pooled reference area distribution after removal of outliers). The lotic normal ranges were applied to the creek sites and the reference area normal ranges for lentic areas were applied to Greenhills Creek Sedimentation Pond. Normal ranges were excluded when 75% of the data values were censored (i.e., <LRL).

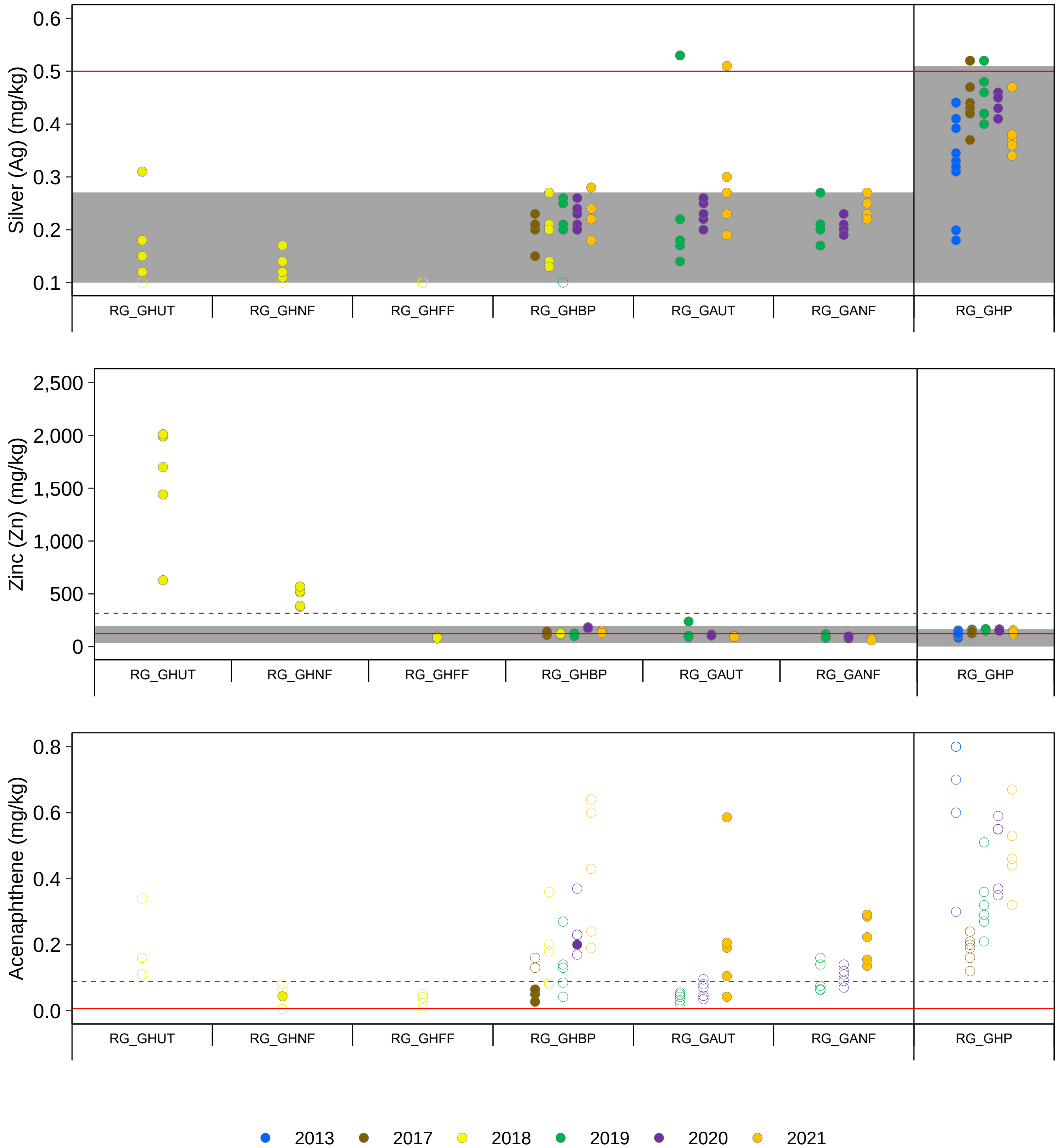


Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2021

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Solid red line = lower BC WSQG; hashed red line = upper BC WSQG (or alert concentration in the case of selenium). Grey shading = the reference area normal range (2.5th and 97.5th percentiles of pooled reference area distribution after removal of outliers). The lotic normal ranges were applied to the creek sites and the reference area normal ranges for lentic areas were applied to Greenhills Creek Sedimentation Pond. Normal ranges were excluded when 75% of the data values were censored (i.e., <LRL).

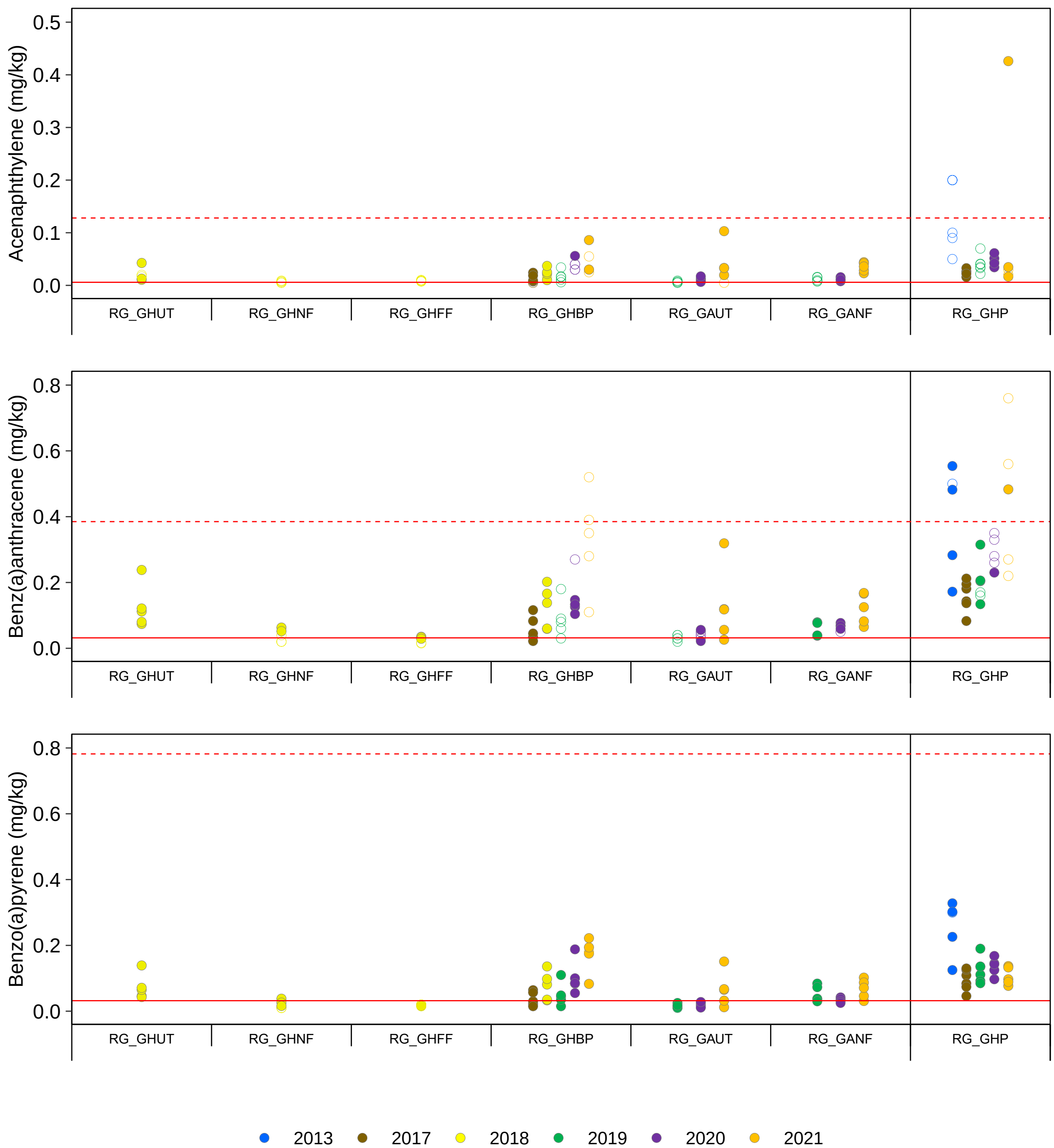


Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2021

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Solid red line = lower BC WSQG; hashed red line = upper BC WSQG (or alert concentration in the case of selenium). Grey shading = the reference area normal range (2.5th and 97.5th percentiles of pooled reference area distribution after removal of outliers). The lotic normal ranges were applied to the creek sites and the reference area normal ranges for lentic areas were applied to Greenhills Creek Sedimentation Pond. Normal ranges were excluded when 75% of the data values were censored (i.e., <LRL).

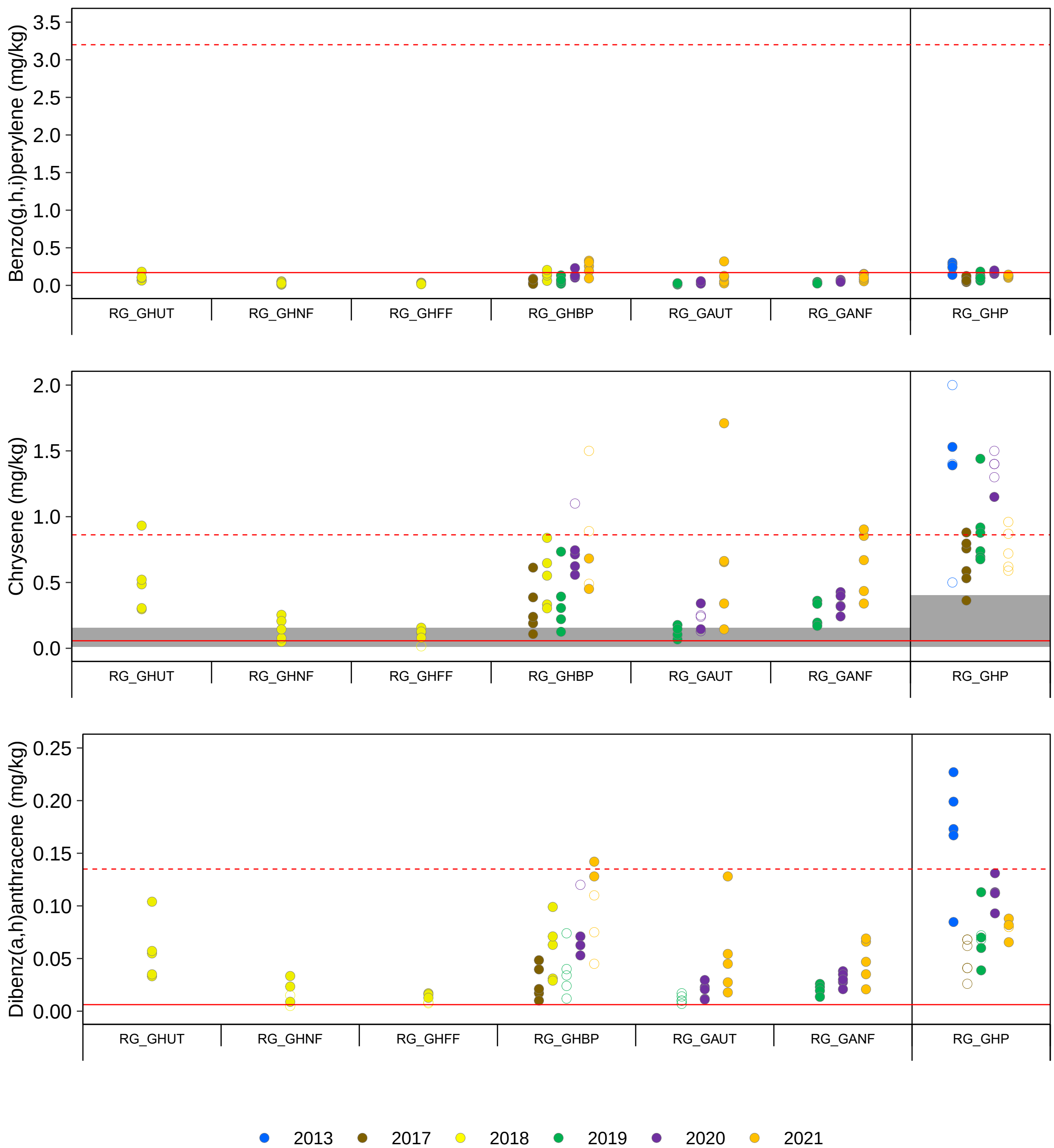


Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2021

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Solid red line = lower BC WSQG; hashed red line = upper BC WSQG (or alert concentration in the case of selenium). Grey shading = the reference area normal range (2.5th and 97.5th percentiles of pooled reference area distribution after removal of outliers). The lotic normal ranges were applied to the creek sites and the reference area normal ranges for lentic areas were applied to Greenhills Creek Sedimentation Pond. Normal ranges were excluded when 75% of the data values were censored (i.e., <LRL).

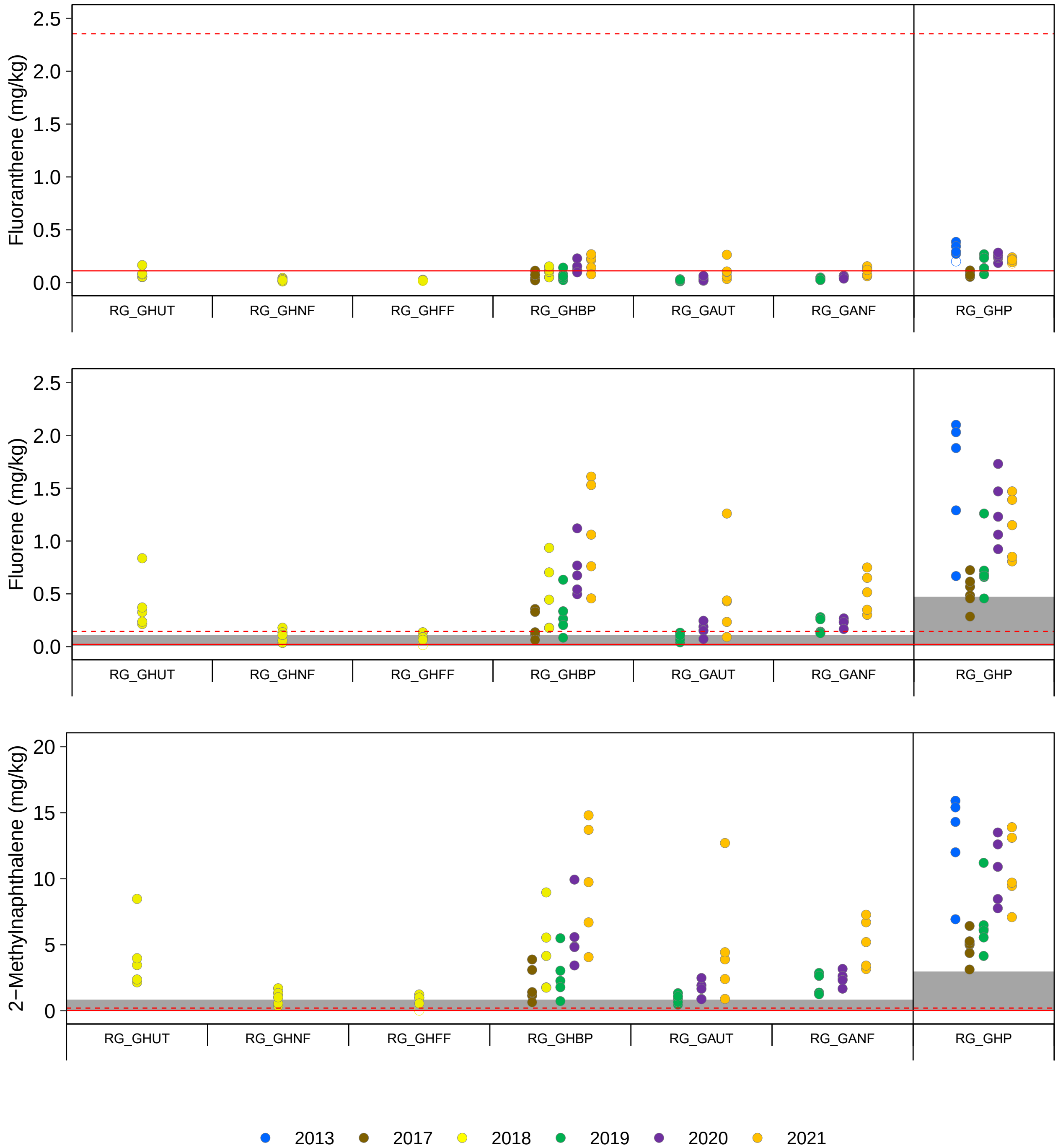


Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2021

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Solid red line = lower BC WSQG; hashed red line = upper BC WSQG (or alert concentration in the case of selenium). Grey shading = the reference area normal range (2.5th and 97.5th percentiles of pooled reference area distribution after removal of outliers). The lotic normal ranges were applied to the creek sites and the reference area normal ranges for lentic areas were applied to Greenhills Creek Sedimentation Pond. Normal ranges were excluded when 75% of the data values were censored (i.e., <LRL).

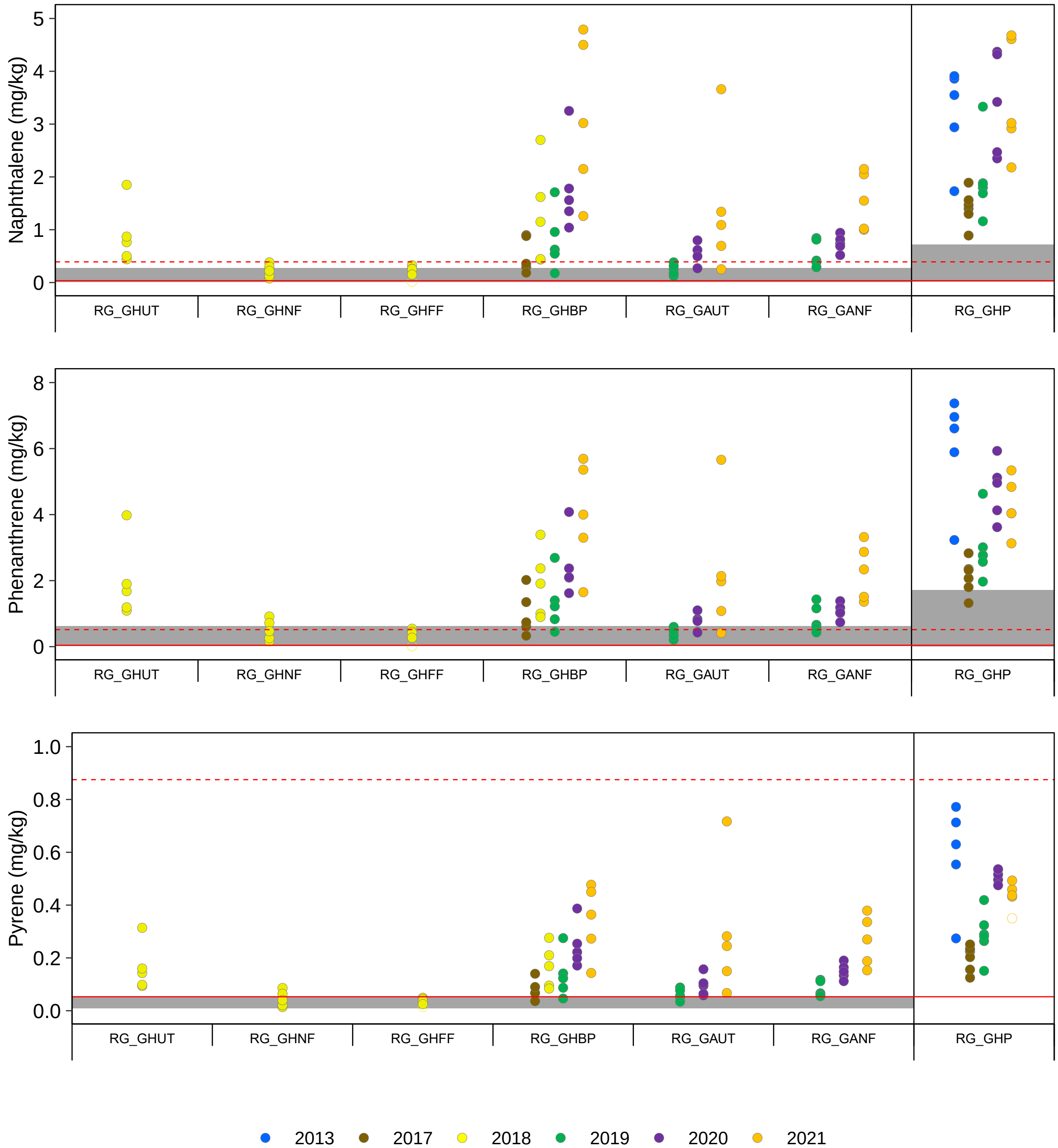


Figure 3.4: Concentrations of Analytes that Exceeded Sediment Quality Guidelines or the Alert Concentration for Selenium, Greenhills Creek, Gardine Creek, and Greenhills Creek Sedimentation Pond, September 2013 to 2021

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Solid red line = lower BC WSQG; hashed red line = upper BC WSQG (or alert concentration in the case of selenium). Grey shading = the reference area normal range (2.5th and 97.5th percentiles of pooled reference area distribution after removal of outliers). The lotic normal ranges were applied to the creek sites and the reference area normal ranges for lentic areas were applied to Greenhills Creek Sedimentation Pond. Normal ranges were excluded when 75% of the data values were censored (i.e., <LRL).

significantly higher at RG_GAUT (upper Gardine Creek) relative to RG_GHBP (Lower Greenhills Creek) or RG_GANF (lower Gardine Creek). Cadmium, nickel, and selenium concentrations were consistently and significantly lower on Gardine Creek versus Lower Greenhills Creek during the same time period; the opposite was true for iron concentrations (Appendix Table D.9). Zinc concentrations were highest in the samples from upper Gardine and Lower Greenhills creeks. Despite some year-to-year variability, concentrations of most PAHs (e.g., 2-methylnaphthalene, naphthalene) were highest at RG_GHBP on Lower Greenhills Creek and lowest at RG_GAUT on upper Gardine Creek (Appendix Table D.9). Calcium concentrations, which are a correlate for calcite, were consistently highest at RG_GHBP and RG_GANF from 2019 to 2021, which is unsurprising given the greater calcification of the substrates at these locations relative to RG_GAUT (see Section 3.2.1).

As suggested within the comparisons among areas, above, concentrations of most sediment metals that exceeded guidelines, as well as concentrations of calcium, at creek sampling areas remained relatively constant over time. Exceptions include concentrations of arsenic, which were generally lower at all creek monitoring areas in 2021 relative to 2019 and 2020, and iron, which had lower concentrations overall in 2021 relative to 2019 (Appendix Table D.10). Additionally, "bulk" concentrations of nickel (all creek areas) and zinc (Gardine Creek) in sediments generally increased over time. For most PAHs that had "bulk" sediment concentrations greater than BC WSQG, concentrations were generally higher in 2021 relative to 2019 and, depending on area, 2020 (e.g., chrysene at RG_GAUT versus RG_GANF; Appendix Table D.10).

Sediment sampling for SEA has been completed annually on Lower Greenhills and Gardine creeks since 2018 and 2019, respectively (Minnow 2019c, 2020a, 2021a). According to Tessier et al. (1979), metals associated with sediment fractions 1 to 4 (i.e., exchangeable and adsorbed metals, metals bound to carbonates, reducible metals and iron oxides, and metals bound to organic material, respectively) are considered potentially mobile, depending on environmental conditions. As indicated in Section 2.3.2.3, 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. Therefore, constituent concentrations in sediment fractions 1 to 4 are considered to be a highly conservative screening of the potentially bioavailable sediment constituents. Metals associated with fraction 5 (residual metals) are considered immobile and not bioavailable.

On Lower Greenhills Creek, concentrations of cadmium (two of five samples) and selenium (all five samples) in sediment fractions 1 to 4 exceeded the upper BC WSQG or alert concentration, respectively, in 2021 (Figure 3.5[34]; Appendix Tables D.11 to D.15). Exceedance of the BC WSQG for cadmium was consistently based on concentrations in sediment fractions 2 (bound to carbonates) and 3 (reducible and iron oxide associated). Concentrations of manganese and nickel in sediment fractions 1 to 4 exceeded the lower, but not upper, BC WSQG in two and five SEA samples, respectively (Figure 3.5; Appendix Tables D.11 to D.15).

Two SEA samples collected from upper Gardine Creek in 2021 had selenium concentrations in fractions 1 to 4 that exceeded the alert concentration (Figure 3.6; Appendix Tables D.16 to D.20). Concentrations of cadmium, manganese, and nickel in sediment fractions 1 to 4 exceeded the lower, but not upper, BC WSQG in at least two of the five SEA samples from 2021 (Figure 3.6; Appendix Tables D.16 to D.20).

Concentrations of selenium in four of the five SEA samples collected from lower Gardine Creek in 2021 exceeded the alert concentration and the majority of the selenium was associated with sediment fraction 4 (metals bound to organic matter; Figure 3.7; Appendix Tables D.21 to D.25). Concentrations of cadmium and nickel in at least four out of five SEA samples exceeded the lower, but not upper, BC WSQG in 2021 (Figure 3.7; Appendix Tables D.21 to D.25).

The spatial and temporal comparisons of the SEA data speak to the complexity of the sediment chemistry data set for the GGCAMP (Appendix Tables D.26 and D.27). Regardless, the distribution of constituent concentrations among sediment fractions 1 to 5 was generally consistent among areas and years (Figures 3.5 to 3.7; Minnow 2020a, 2021a). The largest proportions of recovered cadmium were consistently within sediment fractions 2 (carbonate) and 3 (easily reducible and iron and manganese oxides) (Figures 3.5 to 3.7). This consistent pattern was evident despite differences in "bulk" sediment constituent concentrations among areas and changes over time (e.g., increasing concentrations at RG_GHBP; Appendix Tables D.26 and D.27). Calcium was also predominantly within fractions 2 and 3 for areas with calcified substrates (Figures 3.5 to 3.7; Appendix Table D.26). This is somewhat unexpected, given that calcium in the sediments tested by Tessier et al. (1979) was predominantly in fraction 5 (residual metals), followed by fraction 2 (carbonate). At RG_GAUT, where calcite is nearly absent (see Section 3.2.1), higher proportions of calcium were consistently reported in fraction 1

[34] In 2021, concentrations of cadmium, calcium, cobalt, nickel, and selenium in "bulk" sediments and the sums of sediment fractions 1 to 5 were in generally poorer agreement (Figure 3.5) relative to results for upper and lower Gardine Creek and the Greenhills Creek Sedimentation Pond (Figures 3.6 to 3.8). To date, a root cause for the differences in the laboratory results for RG_GHBP on Lower Greenhills Creek has not been identified. However, similar discrepancies were occasionally observed for particular parameters and areas/stations in previous years of monitoring (e.g., most parameters in RG_GAUT-1 in 2019 and selenium in each of the five samples collected from RG_GAUT on upper Gardine Creek in 2020) (Minnow 2020a,2021a).

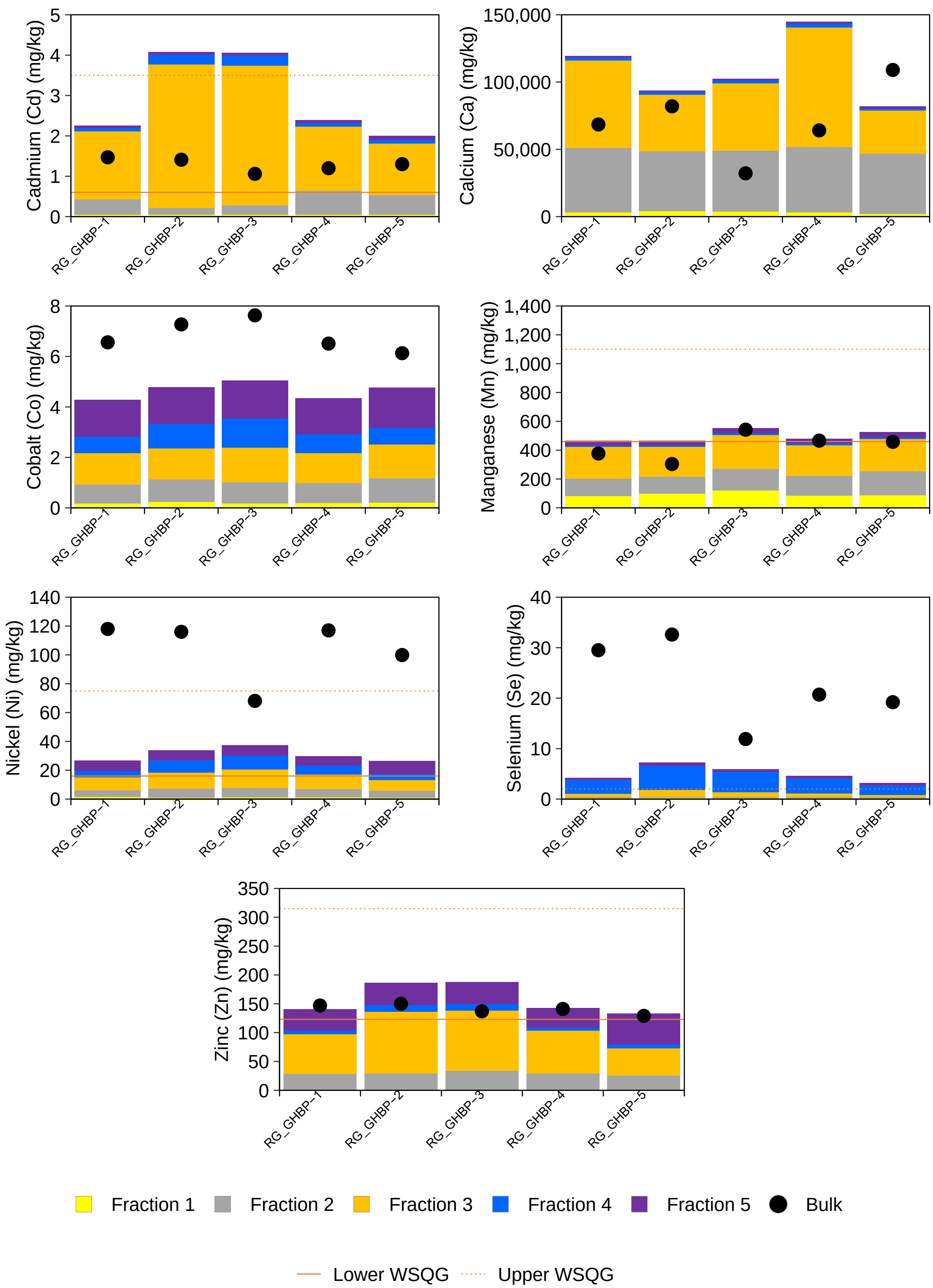


Figure 3.5: Comparisons of Metal Concentrations (Dry Weight Basis) in Sequentially Extracted Sediment Fractions to British Columbia Working Sediment Quality Guidelines, Lower Greenhills Creek (RG_GHBP), 2021

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

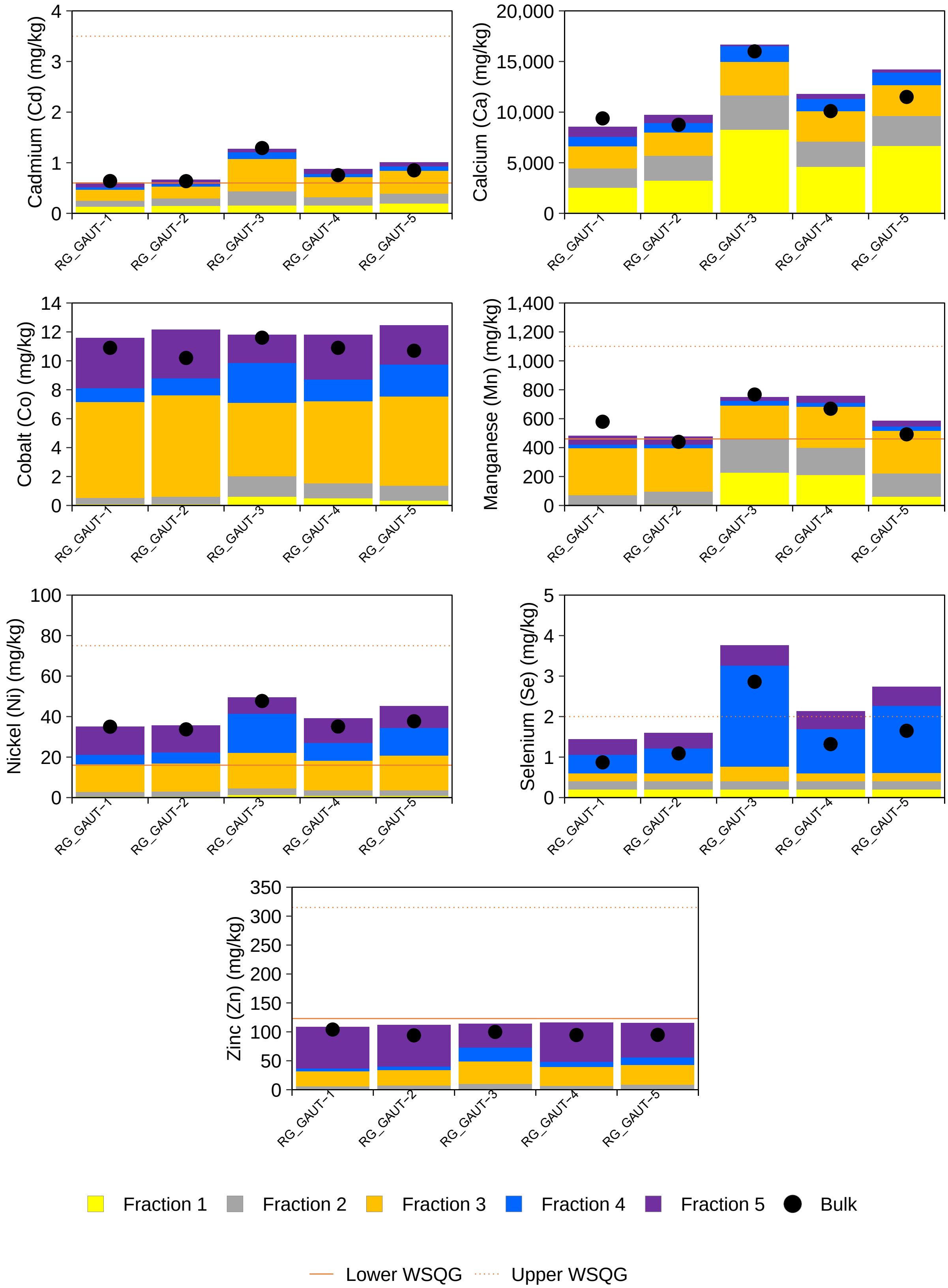


Figure 3.6: Comparisons of Metal Concentrations (Dry Weight Basis) in Sequentially Extracted Sediment Fractions to British Columbia Working Sediment Quality Guidelines, Upper Gardine Creek (RG_GAUT), 2021

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

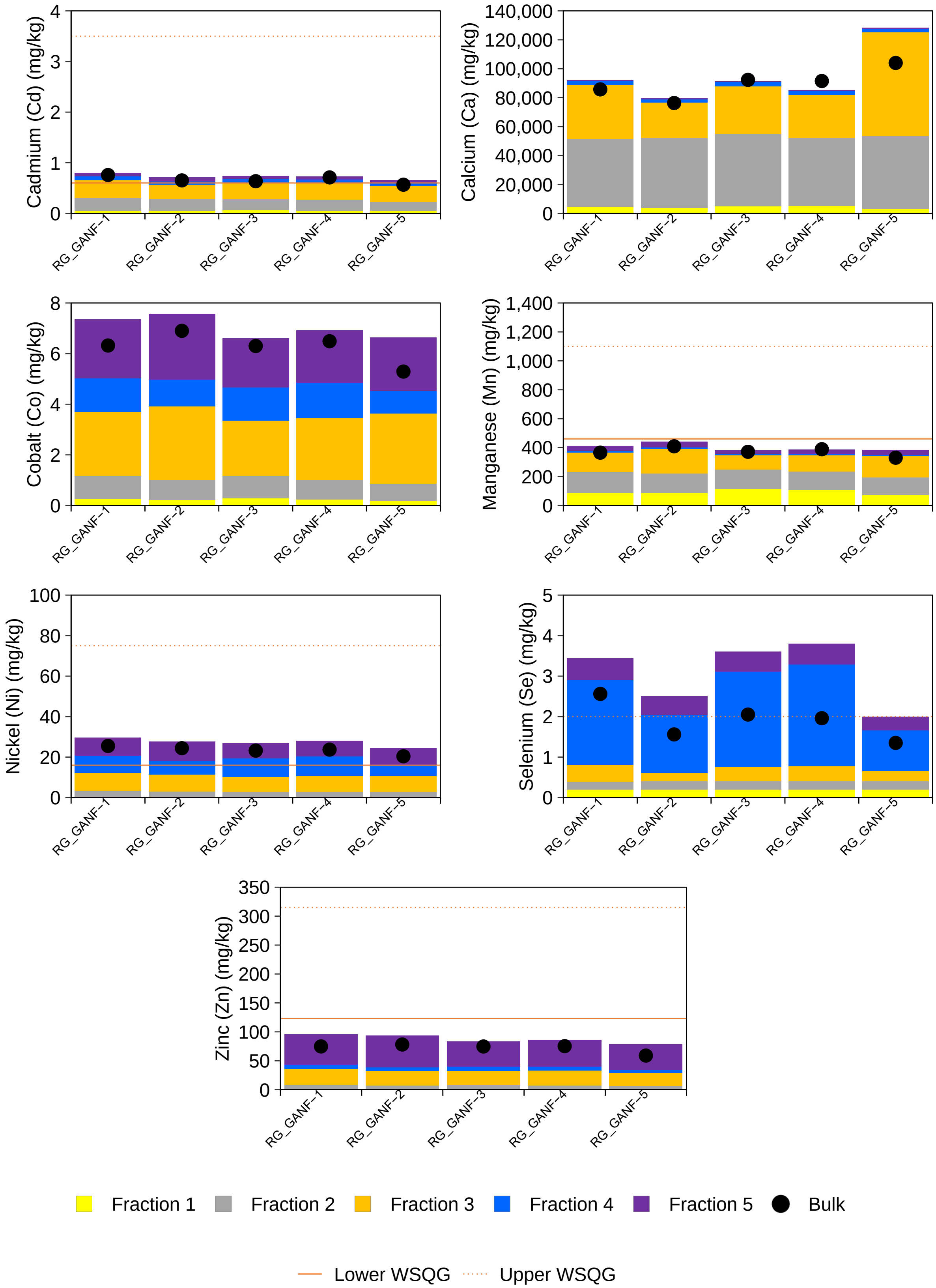


Figure 3.7: Comparisons of Metal Concentrations (Dry Weight Basis) in Sequentially Extracted Sediment Fractions to British Columbia Working Sediment Quality Guidelines, Lower Gardine Creek (RG_GANF), 2021

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

(exchangeable and adsorbed). These results are in good agreement with a more recent study of lake sediments completed using a modified version of the Tessier et al. (1979) extraction process (He et al. 2015). The results of the study indicated that calcium was primarily found in fraction 1 (exchangeable and adsorbed), followed by fractions 2 (carbonate) and 3 (easily reducible and iron and manganese oxides) (He et al. 2015; see also Figure 3.6). Cobalt and manganese were typically more evenly distributed among the sediment fractions, except manganese was more often found in oxide form, rather than in the organic-bound fraction (Figures 3.5 to 3.7). Nickel was consistently predominantly associated with sediment fractions 3 to 5 (residual metals fraction), with lesser amounts in fraction 2. Overall, nickel concentrations in fractions 1 to 4 were typically highest at RG_GHBP, followed by RG_GAUT, then RG_GANF (Appendix Table D.26). Most sequentially-extracted selenium was in fraction 4 (organic bound), regardless of when or where sediments were sampled (Appendix Tables D.26 and D.27). Finally, zinc was primarily associated with fractions 3 (easily reducible and bound to iron and manganese oxides) and 5 (residual).

As described in Section 2.3.2.3, statistical tests were completed to answer the question of whether sediment chemistry downstream of the antiscalant addition facility has changed relative to upstream after the introduction of water treatment (see Appendix Table D.28). Overall, concentrations of manganese, selenium, and a variety of PAHs, including 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, phenanthrene, and pyrene, in “bulk” sediments collected from RG_GHBP were higher during the treatment period (2018 to 2021) relative to before (2017; Appendix Table D.28). Concentrations of boron, sodium, titanium, zinc, benz(a)anthracene, 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% for individual PAHs), 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 D.28). 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 (Crane et al. 2010).

The SQI calculated for RG_GHBP on Lower Greenhills Creek and RG_GAUT and RG_GANF on Gardine Creek in 2021, as well as years prior, were indicative of poor sediment quality and were lower than SQI for most lotic sampling areas included in the 2017 to 2019 RAEMP report (Appendix Table D.29; Minnow 2020d). Within the Greenhills Creek watershed, SQI scores were, on average, lower on Lower Greenhills Creek relative to Gardine Creek. In 2021, the scope and frequency of BC WSQG exceedances were higher for RG_GAUT (upper Gardine Creek) than RG_GANF (lower Gardine Creek), but the amplitude of exceedances was similar between the two areas.

The SQI also indicate that overall sediment quality was lower at RG_GHBP in 2020 and 2021 relative to previous years, and at RG_GAUT and RG_GANF in 2021 relative to previous years (Appendix Table D.29). In 2021, the frequency and amplitude of BC WSQG exceedances were greater than any other year at RG_GHBP on Lower Greenhills Creek. Similarly, 2021 represented the year with the greatest scope, frequency, and amplitude of BC WSQG exceedances at RG_GAUT and the greatest amplitude of exceedances at RG_GANF (Appendix Table D.29).

It is noteworthy that although elevated concentrations of sediment constituents were identified in Lower Greenhills and Gardine creeks, 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.

3.2.3 Sediment in Greenhills Creek Sedimentation Pond

As indicated in Section 2.3.2.1, sediment samples were collected from five of the six targeted sampling sites in Greenhills Creek Sedimentation Pond (RG_GHP) in 2021. Consistent with sampling in 2020 (Minnow 2021a), dense vegetation at RG_GHP-2 prevented successful collection of acceptable surface sediments, despite multiple sampling attempts. Sediment samples collected from the remaining stations in the pond were predominantly silt and clay and had TOC contents that ranged from 17% to 22% which is significantly higher relative to the creek sampling areas (Appendix Tables D.8 and D.9; Section 3.2.2).

Concentrations of selenium and some PAHs (i.e., fluorene, 2-methylnaphthalene, naphthalene, and phenanthrene) in sediments from Greenhills Creek Sedimentation Pond were consistently greater than the alert concentration and the upper BC WSQG, respectively, as well as applicable reference area normal ranges (Figure 3.4). Additionally, “bulk” concentrations of acenaphthylene and benz(a)anthracene in one sample were greater than the upper BC WSQG (Appendix Table D.8).[35] Concentrations of arsenic, cadmium, manganese, nickel, zinc, acenaphthylene, benzo(a)pyrene, dibenz(a,h)anthracene, fluoranthene, and pyrene exceeded

[35] The LRLs for acenaphthene, benz(a)anthracene, and chrysene were greater than the upper BC WSQG for at least two samples each (Appendix Table D.8). Additionally, the LRLs for acenaphthylene, dibenz(a)anthracene, fluoranthene, and pyrene were greater than the lower BC WSQG for at least one sample each.

the lower, but not upper, BC WSQG in at least two out of five samples (Figure 3.4; Appendix Table D.8). Concentrations of arsenic and cadmium were within reference area normal ranges in 2021, but two of the five samples had manganese concentrations above the reference area normal range (Figure 3.4). Nickel concentrations in sediments were consistently above the reference area normal range in 2021.

Constituents associated with exceedances of the BC WSQG or alert concentration for selenium in 2021 (Figure 3.4) were often found at higher concentrations in the pond relative to creek sampling areas on Gardine Creek, but not Lower Greenhills Creek (Appendix Table D.9). Iron, manganese, acenaphthylene, benzo(a)anthracene, benzo(g,h,i)perylene (2021 only), chrysene (2021 only), and dibenz(a,h)anthracene were the exceptions in that concentrations were typically higher, or at least comparable, in samples from Gardine Creek, relative to the pond (Appendix Table D.9).

Similar to the creek sampling areas (Section 3.2.2), concentrations of most sediment metals that exceeded guidelines, calcium, and most PAHs remained relatively constant over time in “bulk” sediments from Greenhills Creek Sedimentation Pond (Appendix Table D.10). Dibenz(a,h)anthracene, which had higher concentrations in the samples collected in 2020 relative to 2019, was the exception (Appendix Table D.10).

Sediment sampling for SEA has been completed annually at RG_GHP since 2019 (Minnow 2020a, 2021a). In 2021, concentrations of cadmium and nickel in sediment fractions 1 to 4 consistently exceeded the lower BC WSQG (Figure 3.8; Appendix Tables D.30 to D.34). Exceedance of the lower BC WSQG for cadmium was based on concentrations in sediment fractions 2 (carbonate-bound) and 3 (easily reducible and iron and manganese oxides; Appendix Tables D.30 to D.34). Concentrations of selenium in sediment fractions 1 to 4 consistently exceeded the alert concentration, whereas concentrations of arsenic, silver, and zinc in fractions 1 to 4 did not exceed any BC WSQG (Figure 3.8; Appendix Tables D.30 to D.34).

Overall, the distribution of constituent concentrations among sediment fractions 1 to 5 was generally consistent with the creek sampling areas and over time in the Greenhills Creek Sedimentation Pond (Figures 3.5 to 3.8; Minnow 2020a, 2021a). Cadmium was primarily within sediment fractions 2 (carbonate) and 3 (easily reducible and iron and manganese oxides) and concentrations in these fractions were stable over time (Figures 3.5 to 3.8; Appendix Table D.27). Calcium was predominantly in fractions 1 (exchangeable and adsorbed), 2, and/or 3, consistent with the findings of He et al. (2015). Cobalt and manganese were more evenly distributed among the sediment fractions, except for relatively low concentrations in fractions 1 and 4, respectively (Figures 3.5 to 3.8). From 2018 to 2021, nickel was predominantly associated with fractions 3 to 5 and concentrations in the potentially mobile fractions were stable and typically lower in the pond

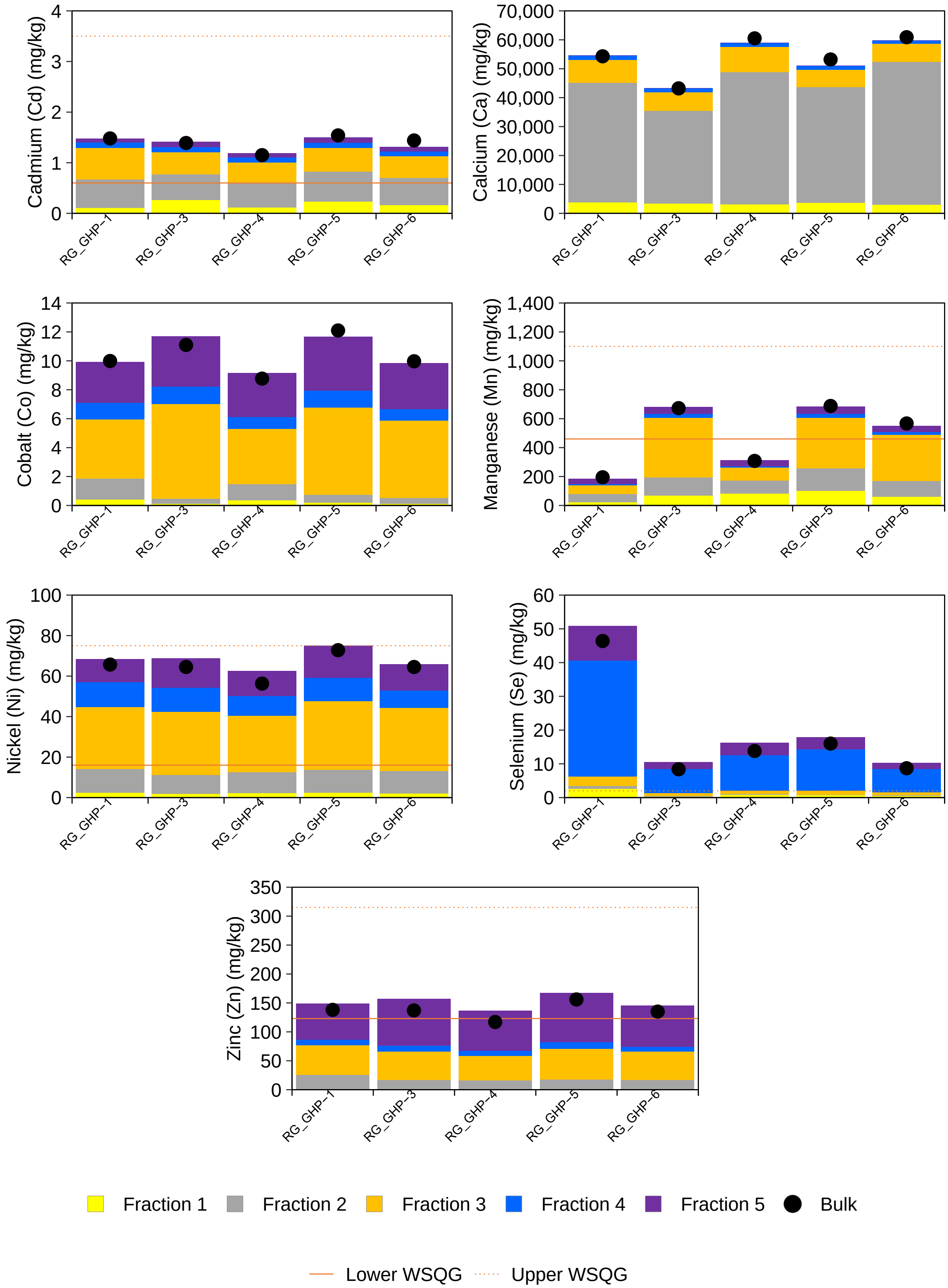


Figure 3.8: Comparisons of Metal Concentrations (Dry Weight Basis) in Sequentially Extracted Sediment Fractions to British Columbia Working Sediment Quality Guidelines, Greenhills Creek Sedimentation Pond (RG_GHP), 2021

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

relative to Lower Greenhills Creek (except in 2021), but higher in the pond relative to Gardine Creek (Appendix Tables D.26 and D.27). Similar to the creek samples, most sequentially-extracted selenium was in fraction 4 (organic bound) from 2019 to 2021. Finally, zinc was primarily associated with fractions 3 (easily reducible and iron and manganese oxides) and 5 (residual metals), regardless of year. Again, the consistency among areas and years in terms of the distributions of concentrations among the sediment fractions emphasizes the need for the study team to re-evaluate the need for annual SEA.

The SQI calculated for the Greenhills Creek Sedimentation Pond in 2021, as well as years prior, were indicative of poor overall sediment quality and were lower than SQI derived for creeks (Section 3.2.2) and natural or naturalized lentic areas in the Elk River watershed (Appendix Table D.29; Minnow 2020e). Despite some year-to-year variability in scope, frequency, and amplitude of BC WSQG exceedances, the overall SQI for Greenhills Creek Sedimentation Pond have not showed a consistent increase or decrease over time (Appendix Table D.29).

3.3 Benthic Invertebrate Community

3.3.1 Greenhills and Gardine Creeks

Results for the area-based kicks indicate that benthic invertebrate densities in 2021 were similar among RG_GHUT, RG_GHNF, and RG_GHBP, much like in 2020; however, unlike 2020, densities were lower at RG_GHFF relative to the other biological monitoring areas in 2021 (Figure 3.9 and 3.10; Appendix Table E.20; Minnow 2021a). Benthic invertebrate biomass was significantly lower throughout Upper Greenhills Creek, relative to Lower Greenhills Creek, in 2021. Together, the benthic invertebrate density and biomass results for Greenhills Creek indicate that the availability of food for fish was better in Lower Greenhills Creek, relative to Upper Greenhills Creek, in 2021.

Comparisons among areas for the remaining area-based community endpoints indicated that %Diptera was significantly lower at Lower Greenhills Creek versus all untreated sampling areas on Upper Greenhills Creek (Appendix Table E.20). These results are consistent with those for 2016 and 2018 through 2020 (Figures 3.9 and 3.10; Minnow 2021a) and indicate that organisms that are more tolerant of degraded conditions are more predominant in the community of Upper Greenhills versus Lower Greenhills Creek (Barbour et al. 1999; Minnow 2018c). There were no differences in LPL richness, %Ephemeroptera, or %Plecoptera among areas in 2021, but family richness and %Trichoptera were lowest at RG_GHNF and RG_GHFF on Upper Greenhills Creek (Appendix Table E.20). Overall, the comparisons of benthic invertebrate community endpoints appear to indicate that the Upper Greenhills Creek benthic invertebrate community is more impacted relative to Lower Greenhills Creek.

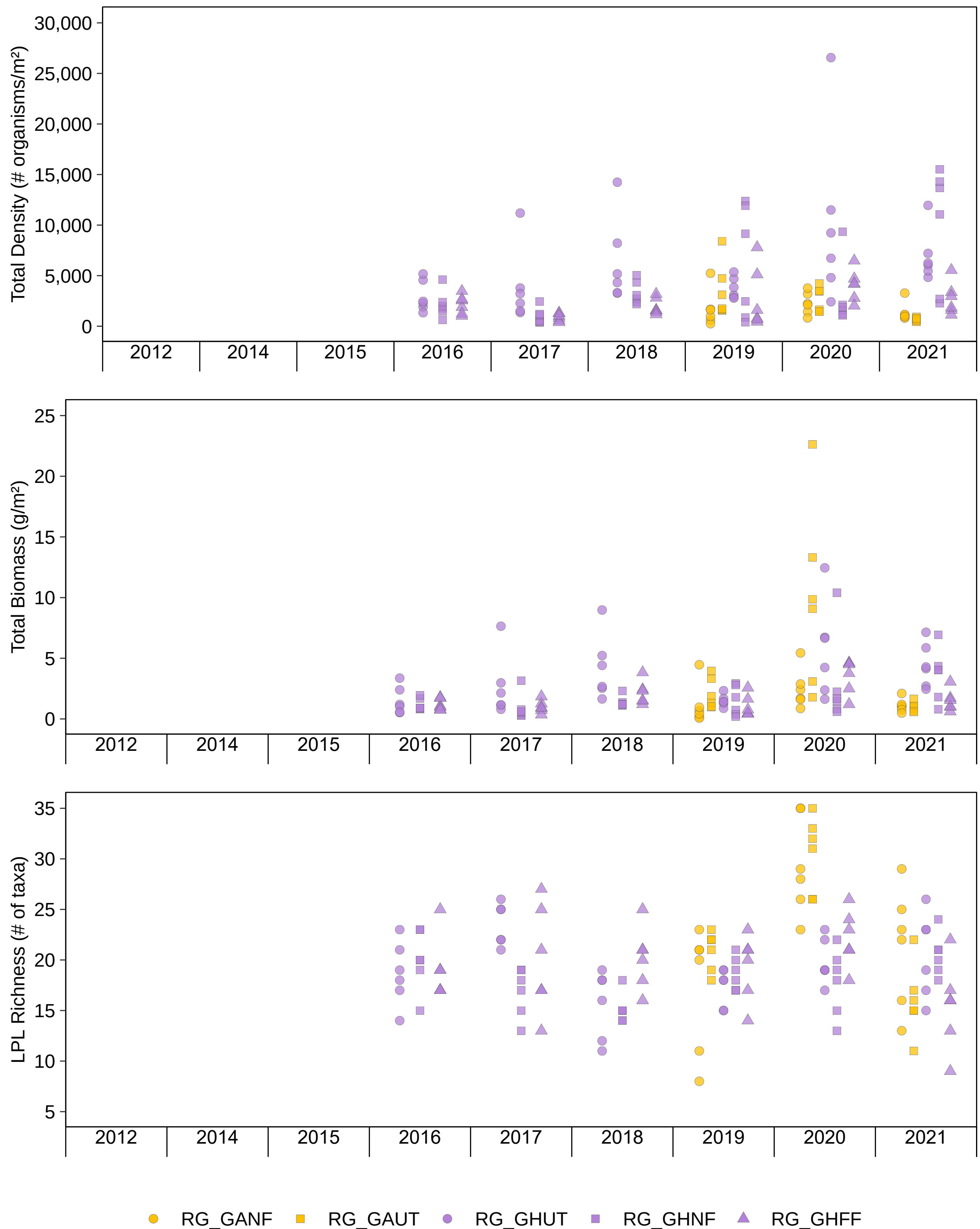


Figure 3.9: Benthic Invertebrate Community Endpoints for Area-based Kick Samples, Upper Greenhills and Gardine Creeks, September 2016 to 2021

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

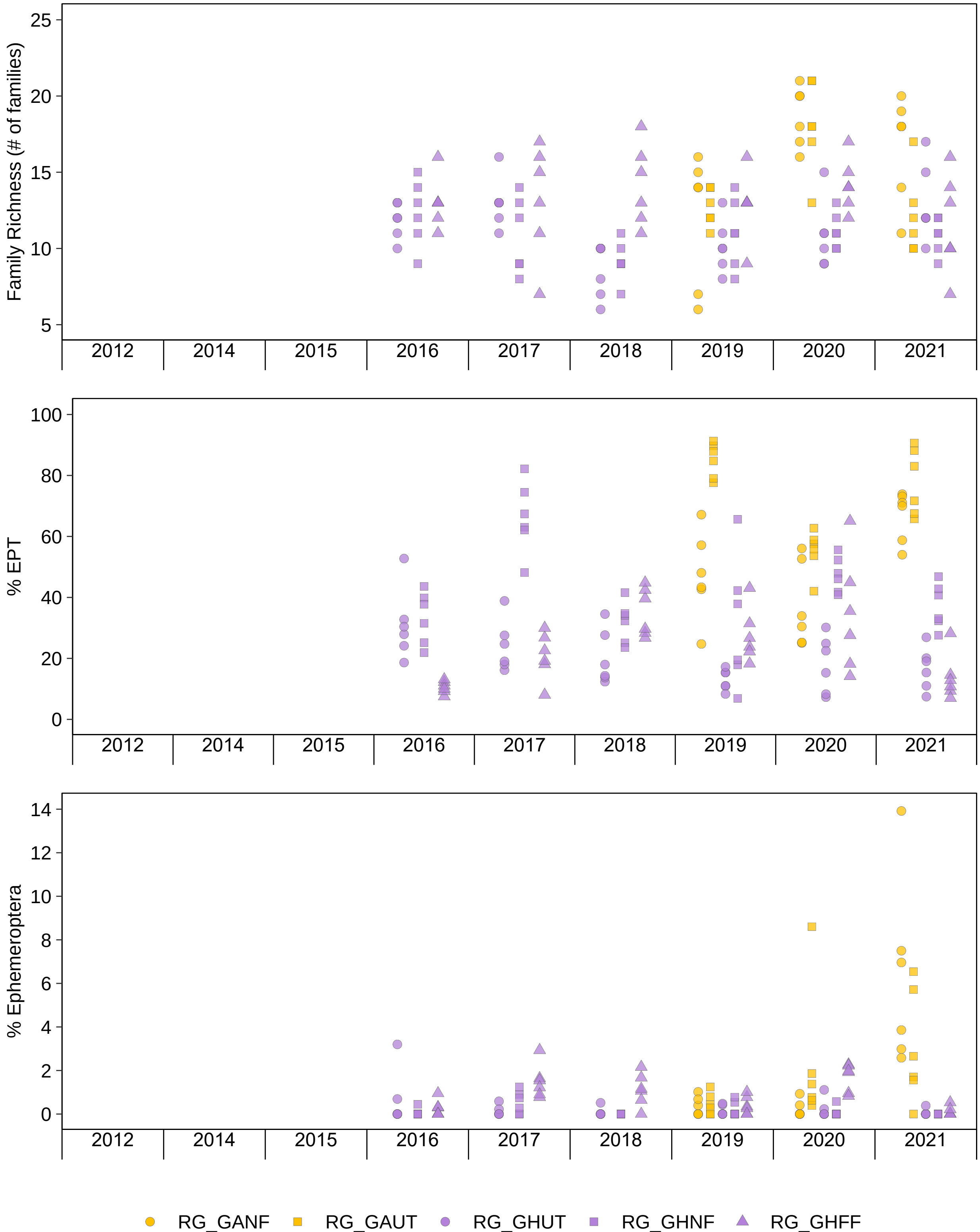


Figure 3.9: Benthic Invertebrate Community Endpoints for Area-based Kick Samples, Upper Greenhills and Gardine Creeks, September 2016 to 2021

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

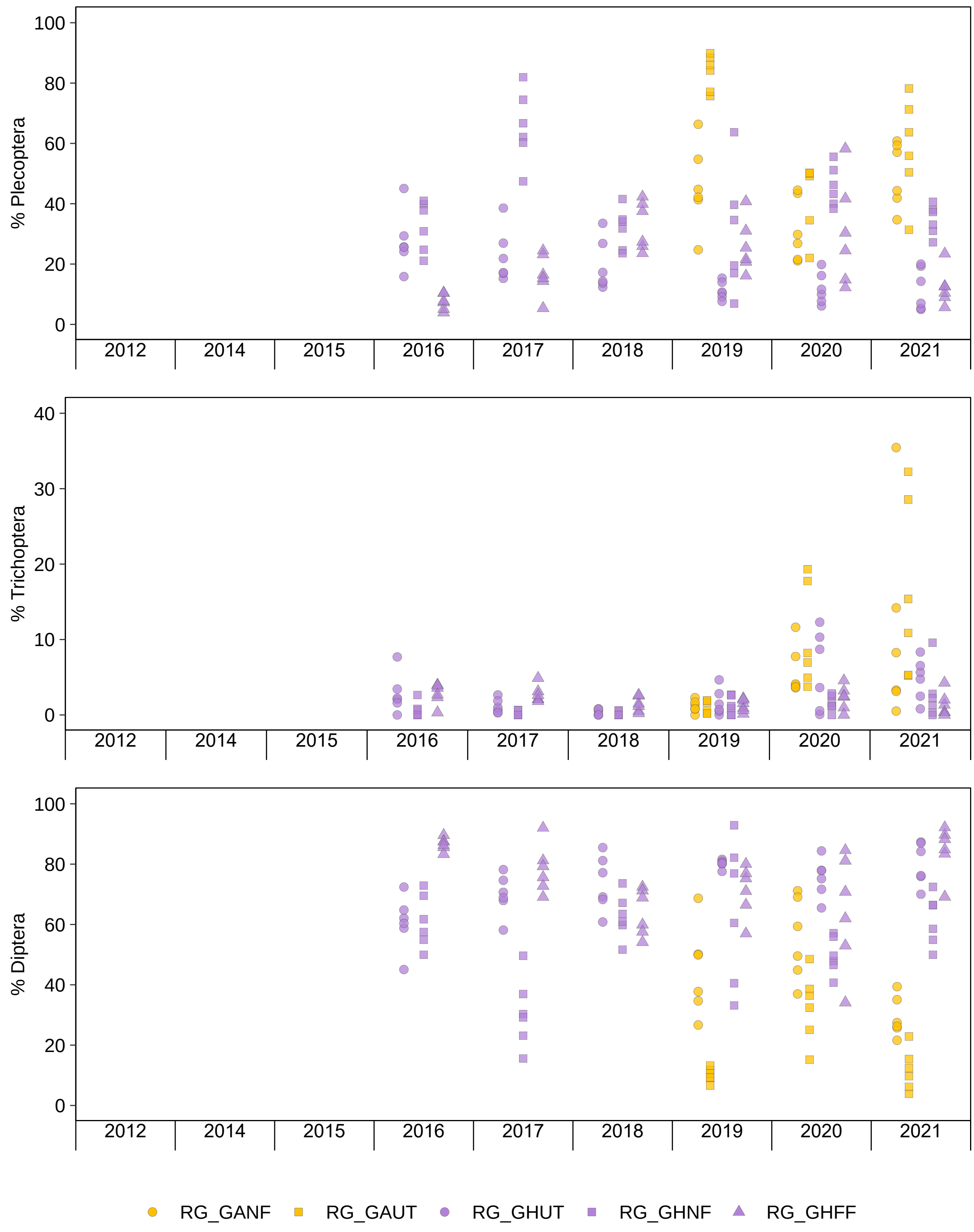


Figure 3.9: Benthic Invertebrate Community Endpoints for Area-based Kick Samples, Upper Greenhills and Gardine Creeks, September 2016 to 2021

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

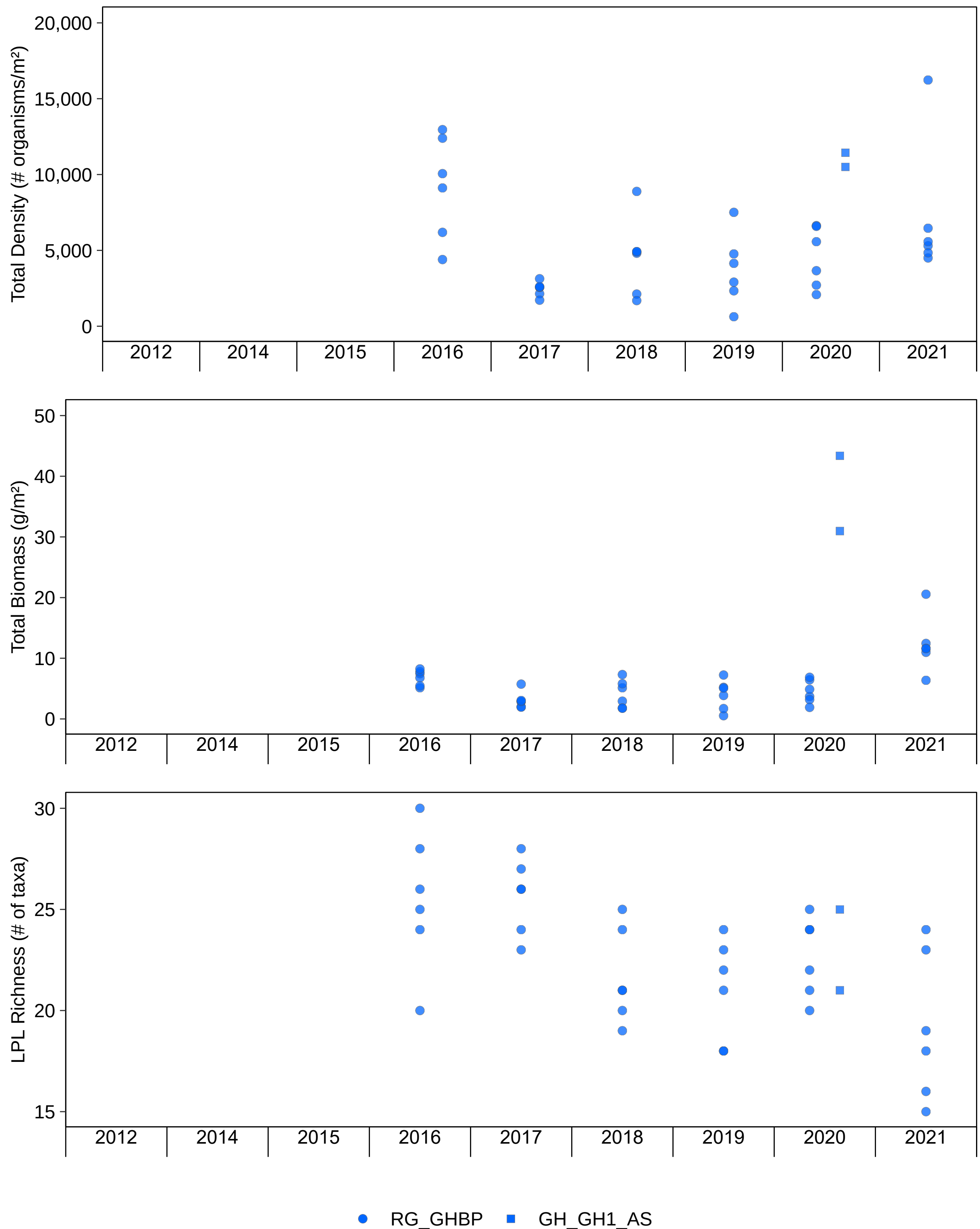


Figure 3.10: Benthic Invertebrate Community Endpoints for Area-based Kick Samples, Lower Greenhills Creek, September 2016 to 2021

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

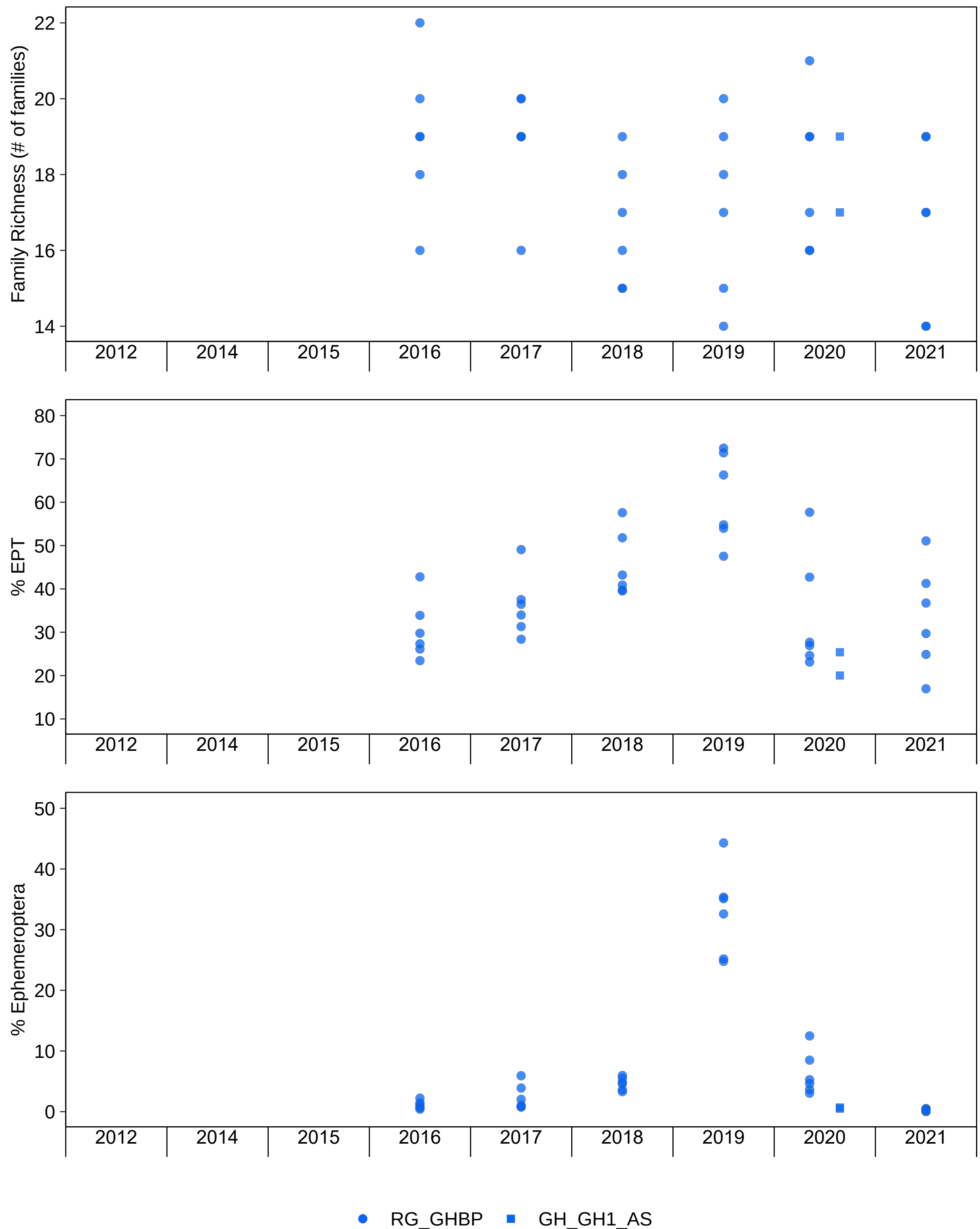


Figure 3.10: Benthic Invertebrate Community Endpoints for Area-based Kick Samples, Lower Greenhills Creek, September 2016 to 2021

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

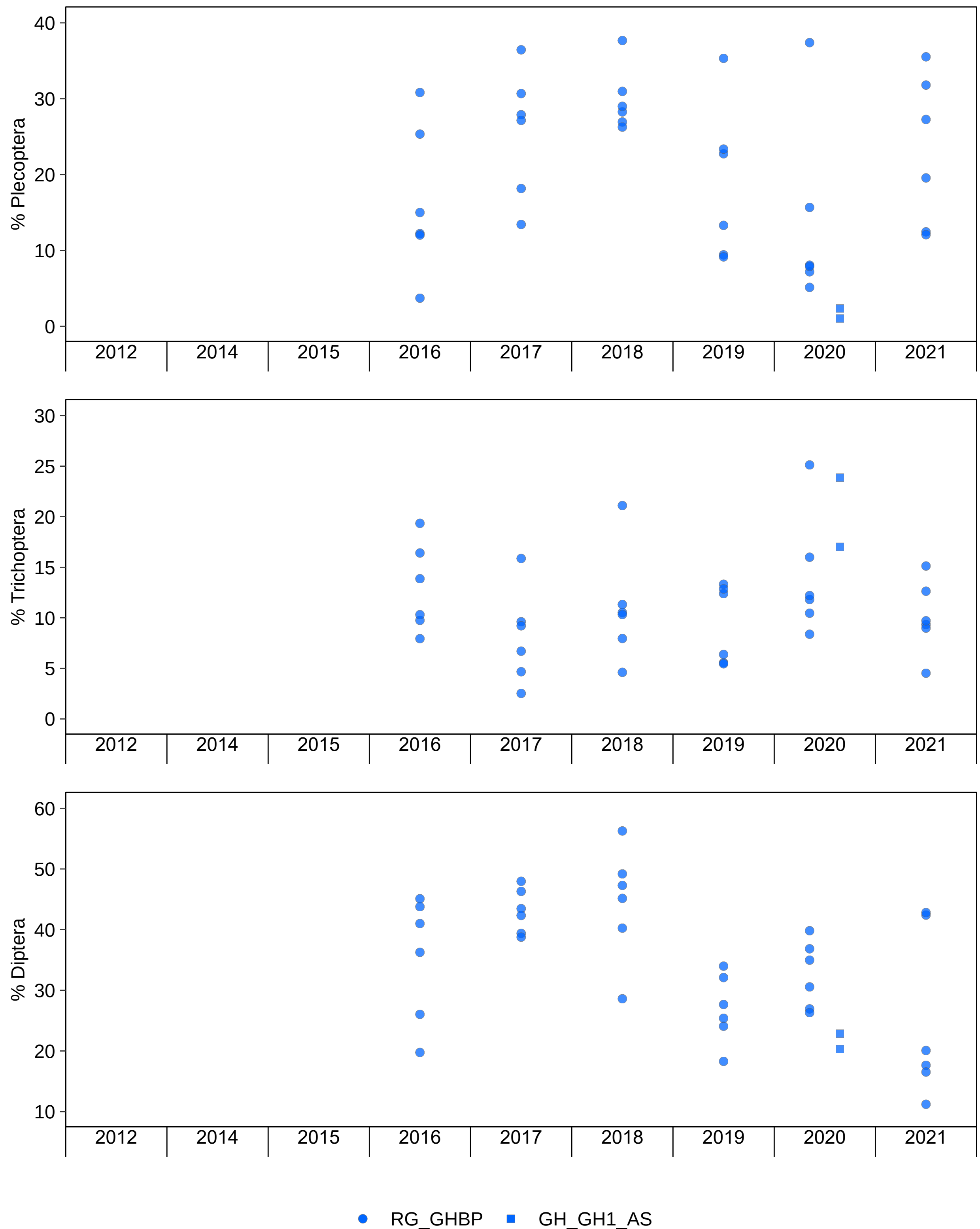


Figure 3.10: Benthic Invertebrate Community Endpoints for Area-based Kick Samples, Lower Greenhills Creek, September 2016 to 2021

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

For the timed kick samples, qualitative comparisons among areas and to reference area normal ranges indicated that, despite some similarities among samples collected from RG_GHNF (Upper Greenhills Creek) and RG_GHCKD (Lower Greenhills Creek), there were some subtle differences between the two areas in 2021. Total benthic invertebrate abundances at both biological monitoring areas were within the reference area normal range (Figures 3.11 and 3.12). Plecopteran and dipteran abundances were above their respective reference area normal ranges and these taxa represented a large proportion of the organisms identified in the timed kick samples. However, similar to the area-based samples (above), Diptera were more dominant in the samples from RG_GHNF on Upper Greenhills Creek relative to Lower Greenhills Creek (Appendix Table E.19). Proportions of Ephemeroptera and Trichoptera (i.e., two groups of EPT taxa) in the samples were higher at RG_GHCKD than RG_GHNF (Figures 3.11 and 3.12; Appendix Table E.19), consistent with the results for the area-based samples (Appendix Table E.18). In 2021, LPL and family richness were both below their respective reference area normal ranges at RG_GHNF; however, family richness at RG_GHCKD on Lower Greenhills Creek was higher, and within the regional reference area normal range (Figures 3.11 and 3.12). Overall, it appears that benthic invertebrate community endpoints for RG_GHCKD on Lower Greenhills Creek may have reflected slightly better aquatic environmental conditions and a healthier benthic invertebrate community, relative to RG_GHNF on Upper Greenhills Creek, in 2021.

On average, benthic invertebrate densities were higher at RG_GANF, the furthest downstream biological monitoring area on Gardine Creek, relative to upstream at RG_GAUT; however, biomass was comparable between the two areas (Figure 3.9; Appendix Table E.18). These results are likely attributed to chironomid (a dipteran family of organisms) larvae, which tend to have smaller body sizes relative to EPT taxa, being more abundant relative to Plecoptera and Trichoptera in the RG_GANF versus RG_GAUT samples. Again, RG_GAUT and RG_GANF are upstream and downstream, respectively, from the seeps from the GHO east spoil; therefore, the higher %Diptera in the samples from RG_GANF likely reflect this taxonomic group's ability to tolerate a wider range of environmental conditions.

Changes in benthic invertebrate community endpoints over time were evaluated for the area-based samples collected from Upper Greenhills Creek (RG_GHUT, RG_GHNF, and RG_GHFF), Lower Greenhills Creek (RG_GHBP), and Gardine Creek (RG_GAUT and RG_GANF). Few consistent increasing or decreasing trends over time were identified for the biological monitoring areas on Greenhills Creek (Figures 3.9 and 3.10; Appendix Table E.20). At RG_GHFF on Upper Greenhills Creek, %EPT was higher in 2017 to 2020 relative to 2016, but in 2021, %EPT was lower and more comparable to 2016 than 2017 to 2020. It appears this pattern was likely driven by opposing shifts in %Ephemeroptera and %Plecoptera

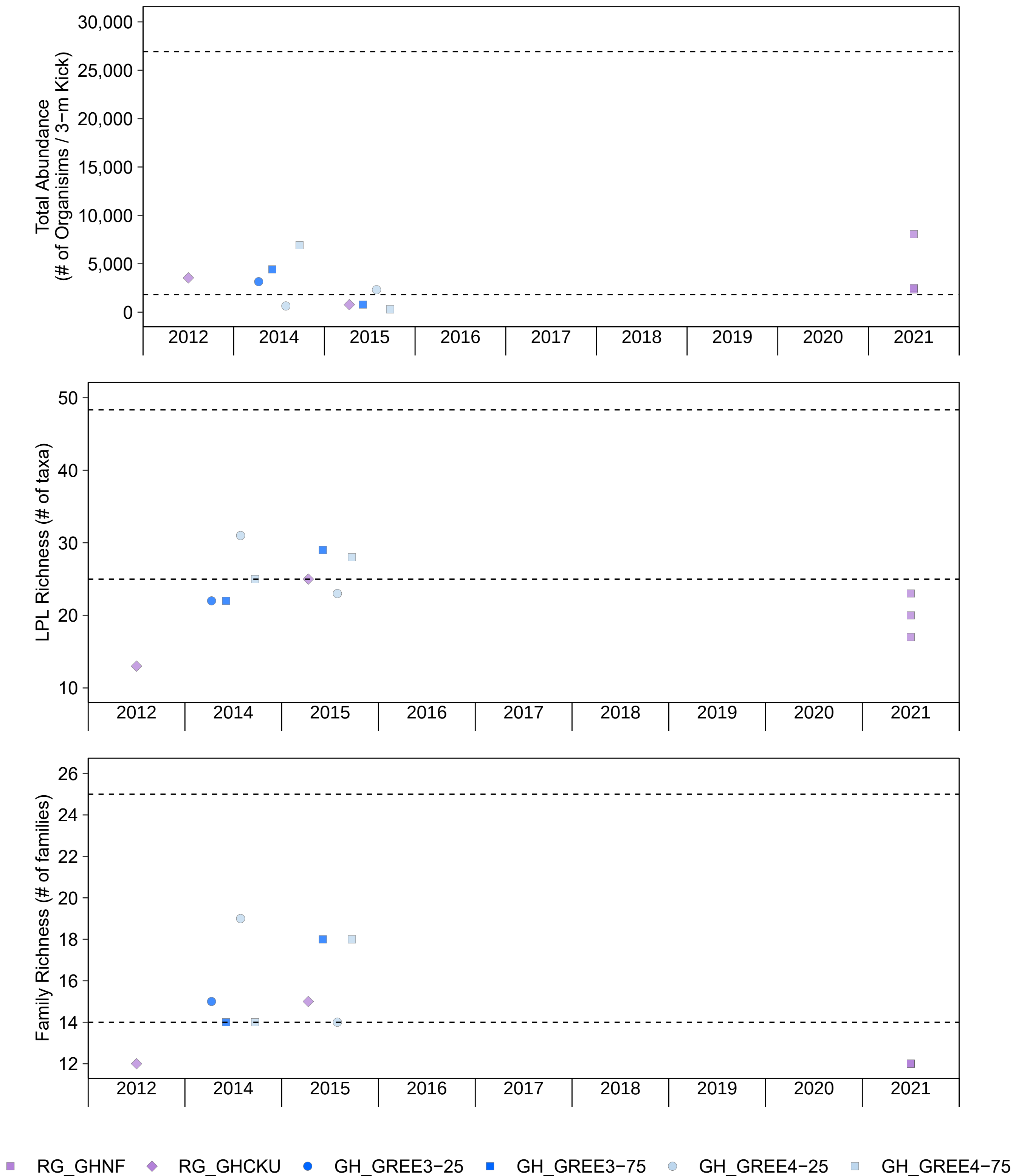


Figure 3.11: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Upper Greenhills Creek, September 2012 to 2021

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).

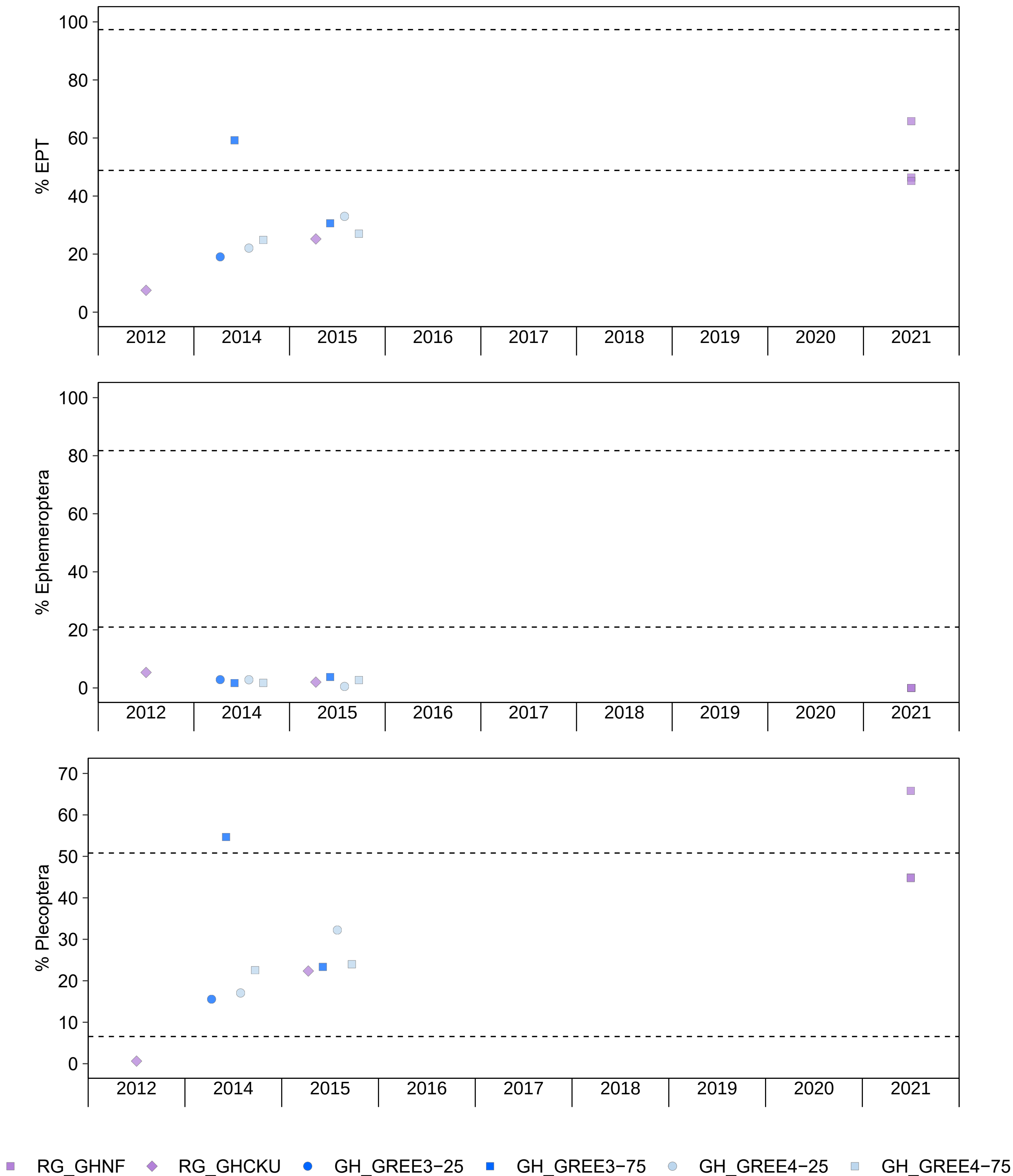


Figure 3.11: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Upper Greenhills Creek, September 2012 to 2021

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).

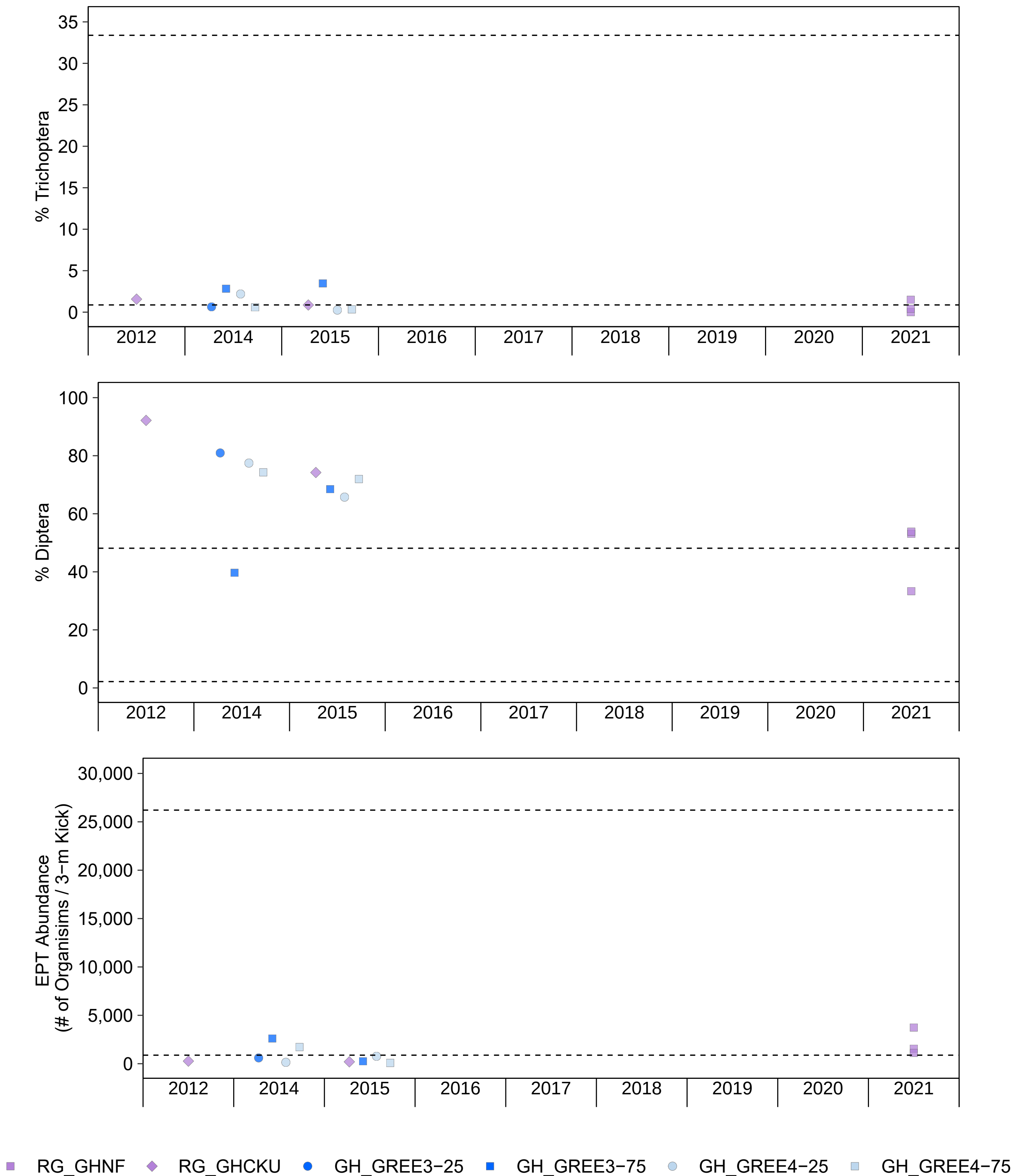


Figure 3.11: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Upper Greenhills Creek, September 2012 to 2021

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).

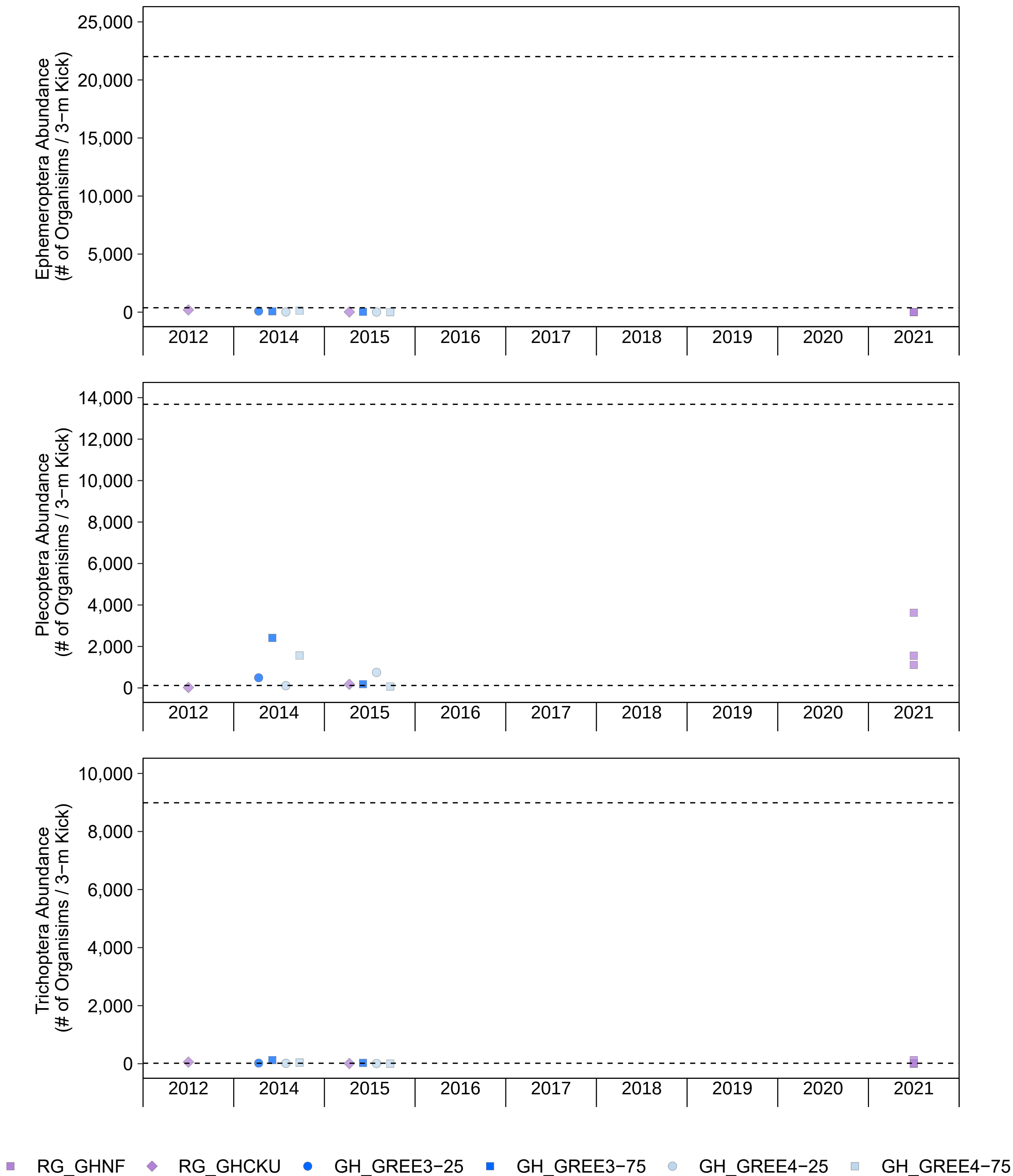


Figure 3.11: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Upper Greenhills Creek, September 2012 to 2021

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).

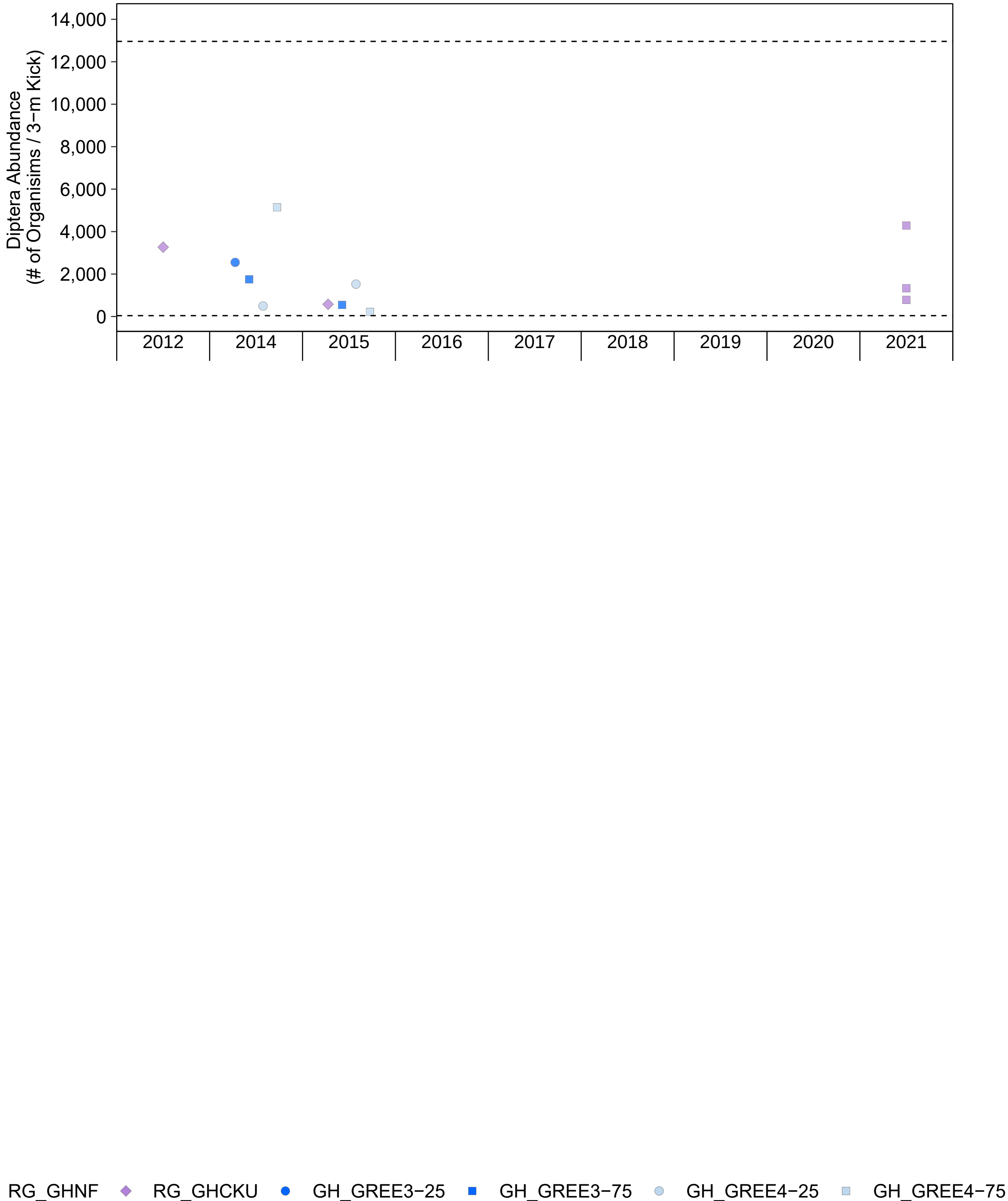


Figure 3.11: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Upper Greenhills Creek, September 2012 to 2021

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).

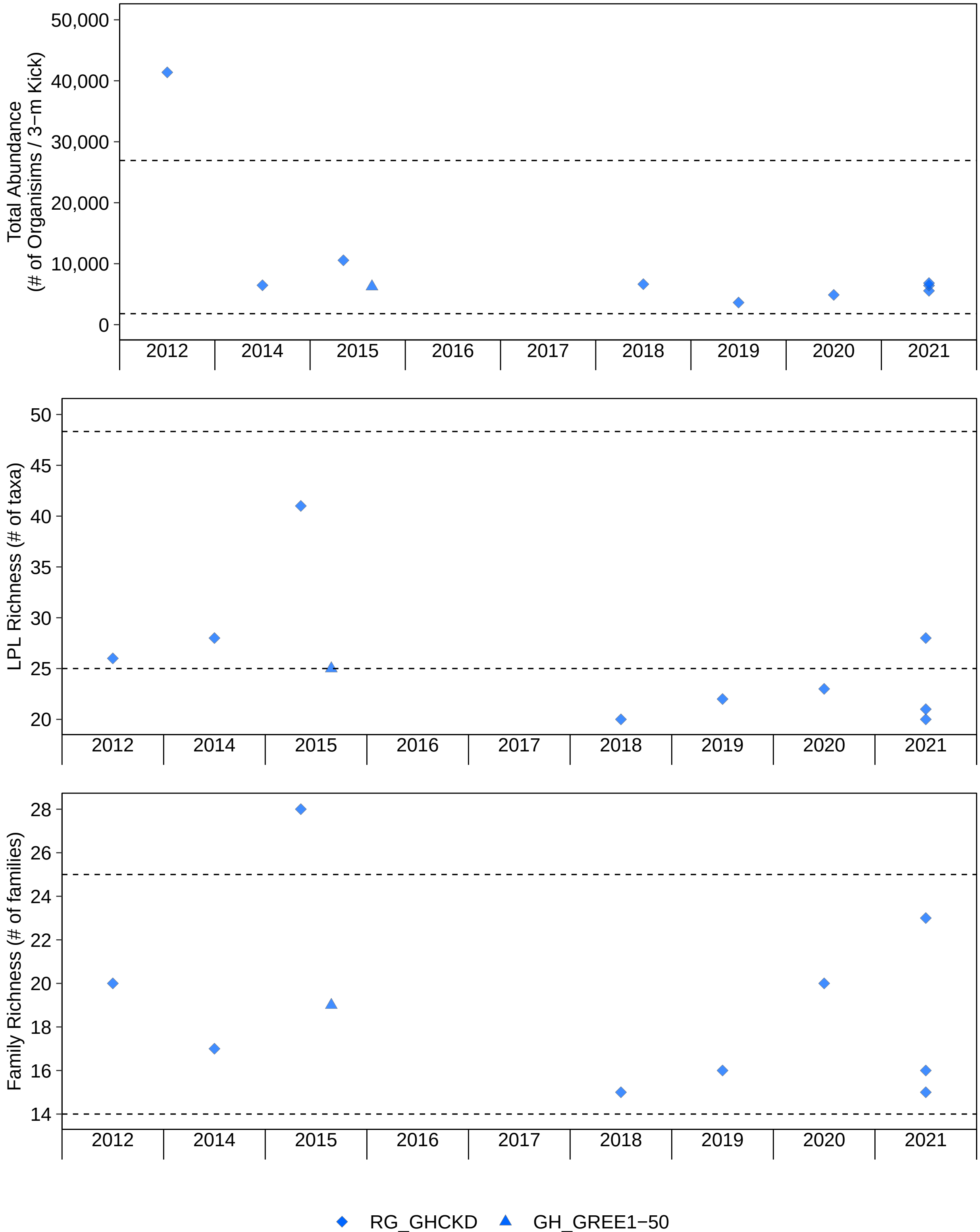


Figure 3.12: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Lower Greenhills Creek, September 2012 to 2021

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).

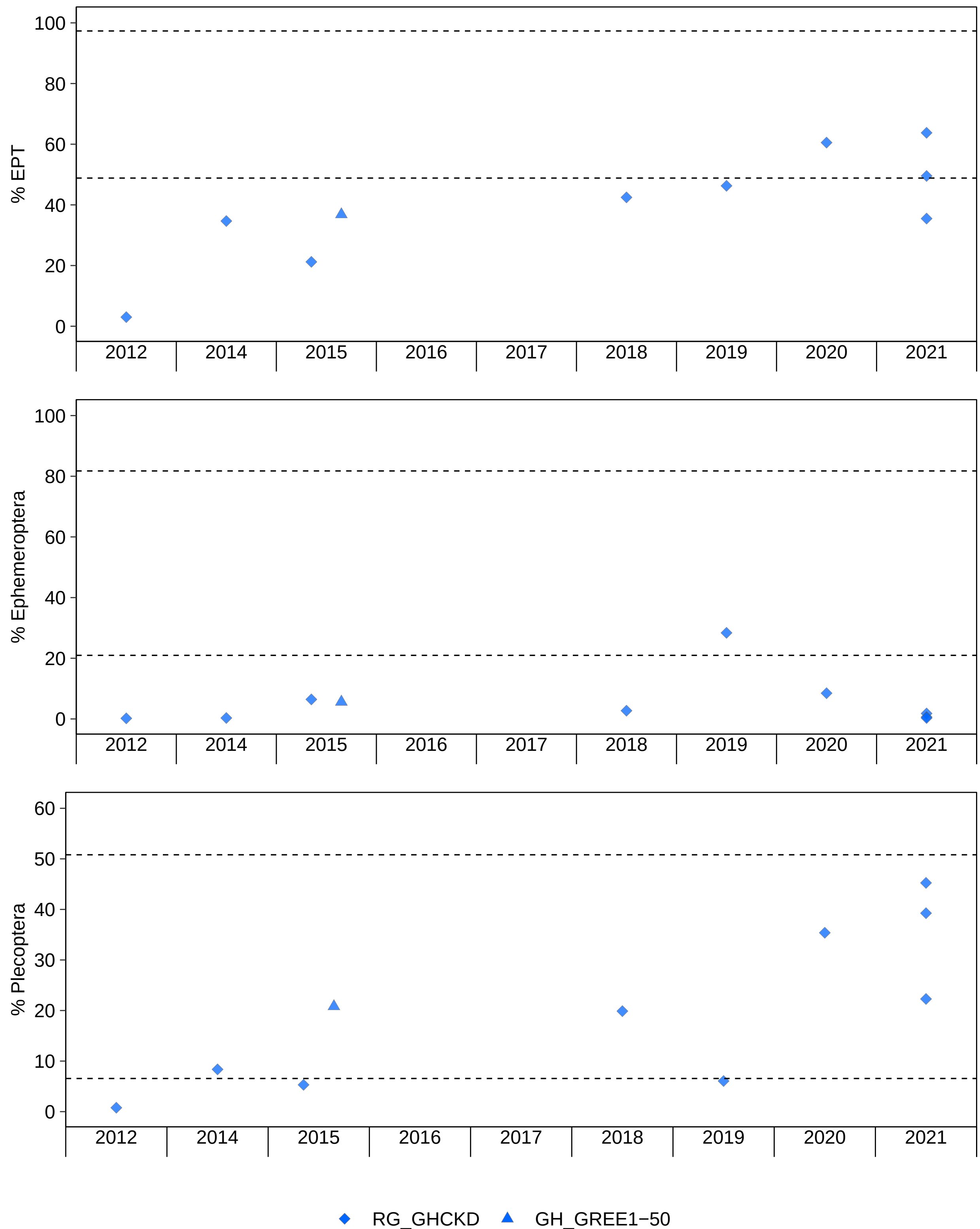


Figure 3.12: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Lower Greenhills Creek, September 2012 to 2021

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).

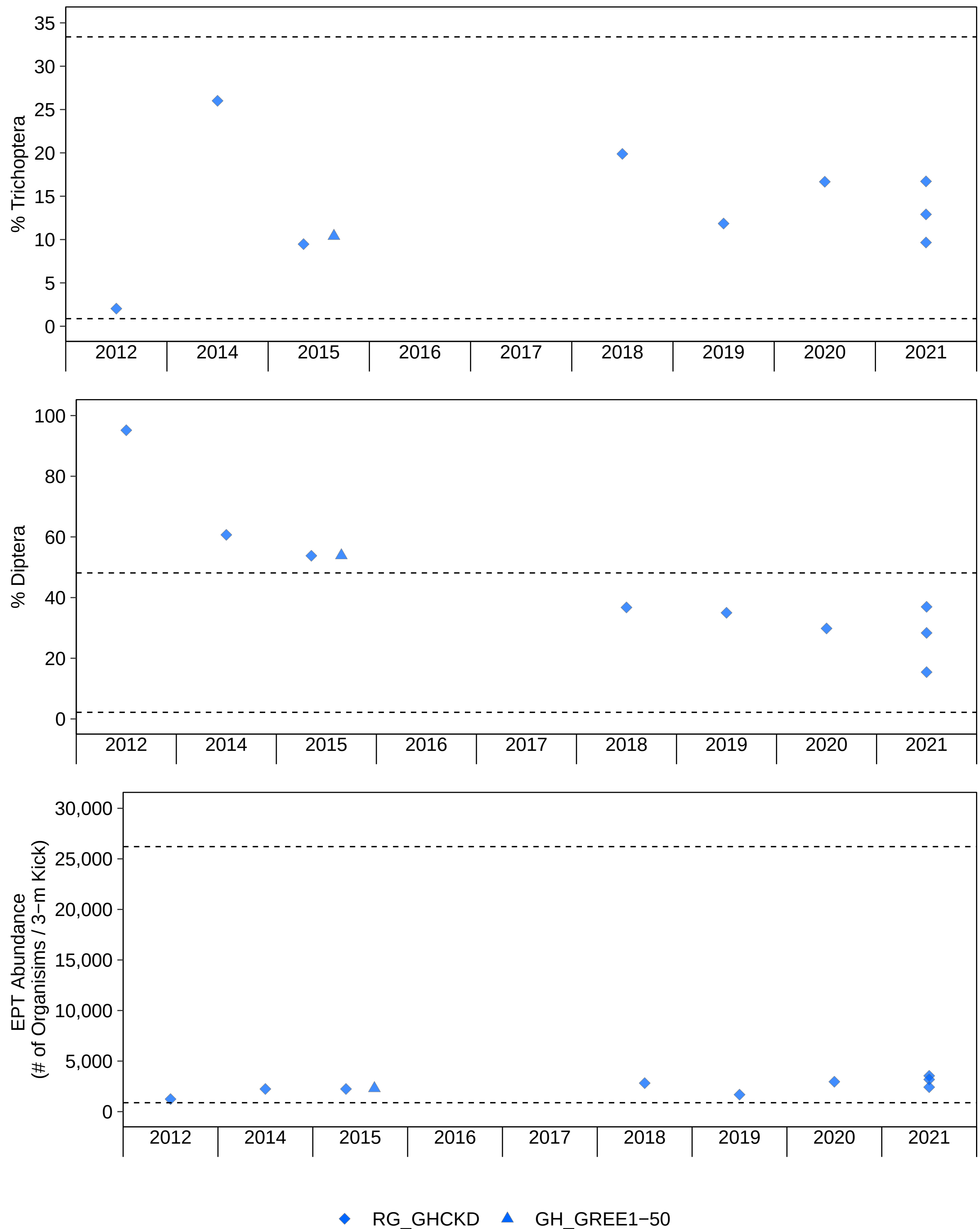


Figure 3.12: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Lower Greenhills Creek, September 2012 to 2021

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).

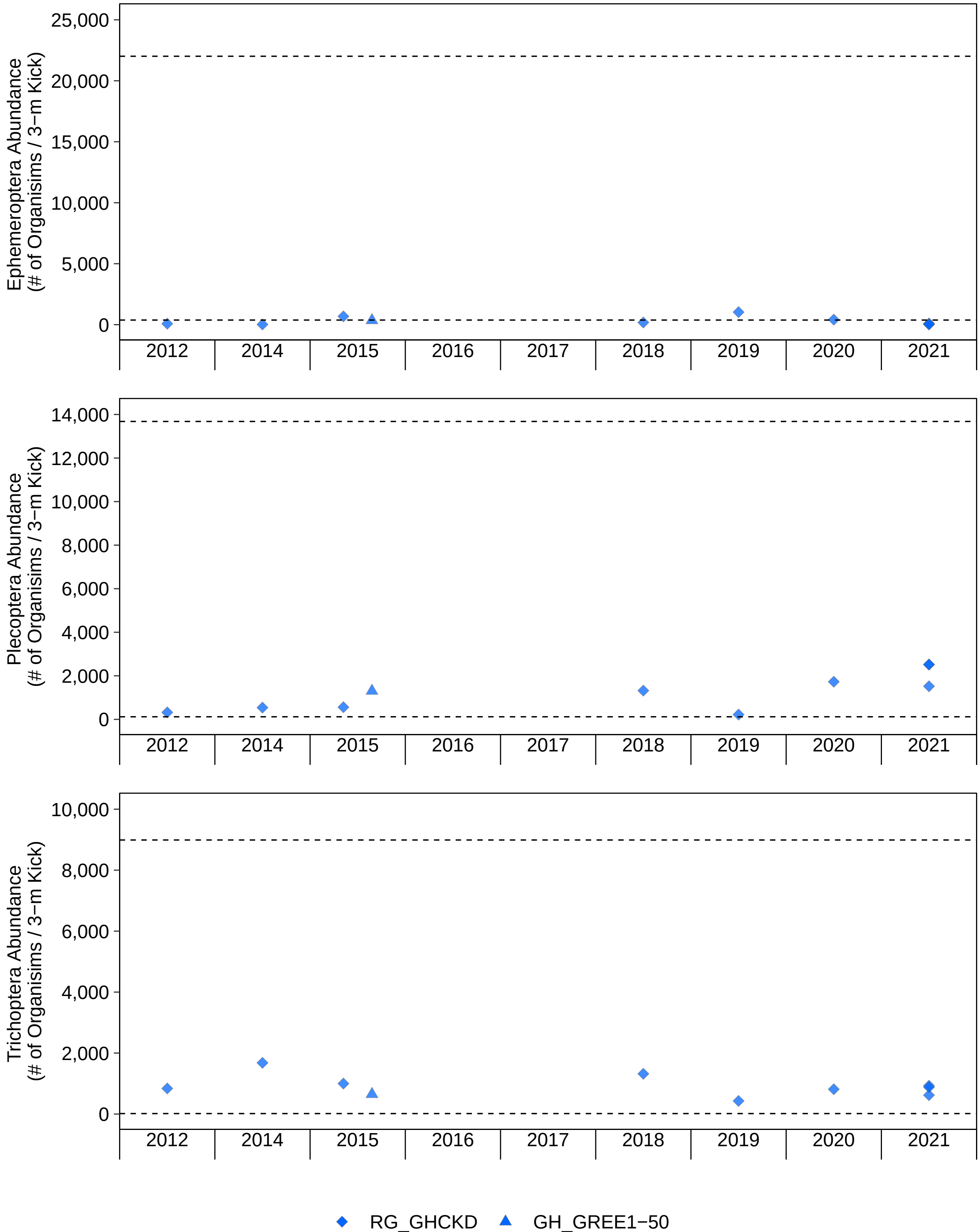


Figure 3.12: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Lower Greenhills Creek, September 2012 to 2021

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).

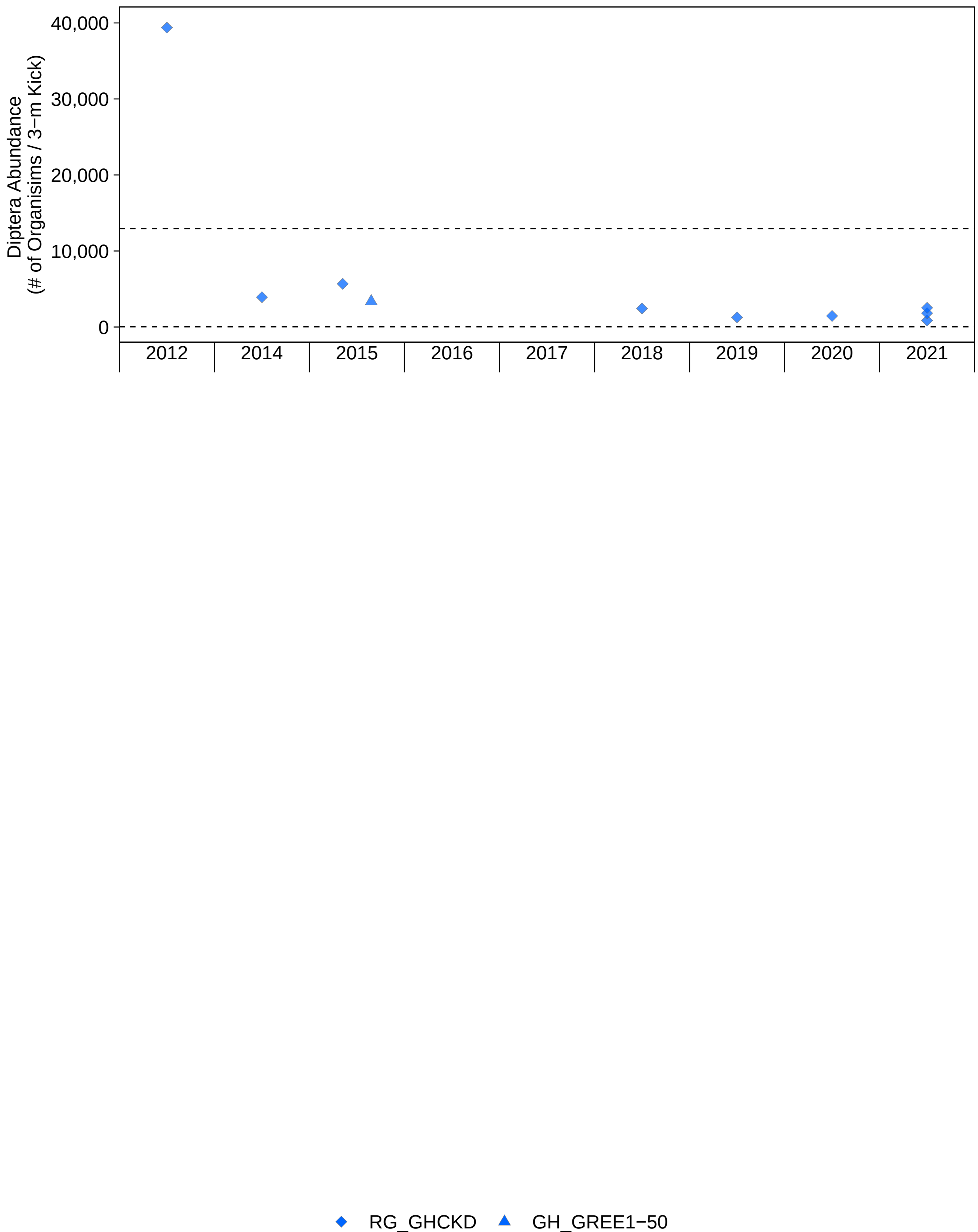


Figure 3.12: Benthic Invertebrate Community Endpoints for Timed Kick Samples on Lower Greenhills Creek, September 2012 to 2021

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).

versus %Diptera (Appendix Table E.20). Concomitant decreases in %Plecoptera and increases in %Diptera also occurred over time (from 2019 to 2021) at RG_GHUT, which is the furthest upstream station on Upper Greenhills Creek. At the furthest upstream station on Gardine Creek (RG_GAUT), benthic invertebrate densities and LPL richness were lower in 2021 relative to 2019 and 2020; biomass was also lower in 2021 than 2020 (Figure E.1; Appendix Table E.21). Unlike RG_GAUT, benthic invertebrate densities and LPL richness were unchanged over time (i.e., from 2019 to 2021) at RG_GANF in Reach 1 of Gardine Creek, downstream from the seeps (Figure E.2; Appendix Table E.21). There was an apparent increase in %EPT and %Ephemeroptera at RG_GANF in 2021 that was likely driven by higher numbers of *Baetis* in some of the samples (Figure E.2).

The higher abundances of *Baetis* in samples from RG_GANF in 2021 may have been attributed to inter-annual differences in the timing of invertebrate development given that the timing of sampling was consistent among years (i.e., mid-September). For example, temperature, and to a lesser extent flow, are the environmental cues for metamorphosis (e.g., Harper and Peckarsky 2006). Cooler winter and summer temperatures can delay the development and emergence of *Baetis*, which are typically bivoltine (i.e., have two generations/emergence events per year; Bergman and Hilsenhoff 1978). It is therefore possible that the second emergence, which would be expected to occur in late summer, prior to sampling (Bergman and Hilsenhoff 1978), was delayed until after the September 2021 field program.

Comparisons of benthic invertebrate endpoints from before (2016 and 2017) and after (2018 to 2021) initiation of antiscalant addition showed that, overall, density, biomass, and LPL and family richness have not changed significantly in Lower Greenhills Creek, relative to Upper Greenhills Creek, since the initiation of treatment (Figure 3.13; Appendix Tables E.22 and E.23). However, there was a small number of differences among specific areas and years for these endpoints. For example, LPL richness at RG_GHBP decreased relative to RG_GHUT and RG_GHNF based on specific comparisons to 2016 and 2017, respectively (Appendix Table E.23).[36] Larger overall differences in %Ephemeroptera between treated and untreated areas were identified for 2018, 2019, and 2020 relative to 2016 and in 2019 and 2020 relative to 2017, due to higher %Ephemeroptera in the treated area in 2018 to 2020 (Appendix Table E.22). These results are supported by the spatial and temporal comparisons described above for the area-based and timed kick samples.

[36] The samples that were collected from RG_GHBP on Lower Greenhills Creek prior to initiation of antiscalant addition (i.e., in 2016 or 2017) had greater numbers of different chironomid species than samples collected after treatment with antiscalant was initiated (i.e., from 2018 to 2021; Appendix Table E.24).

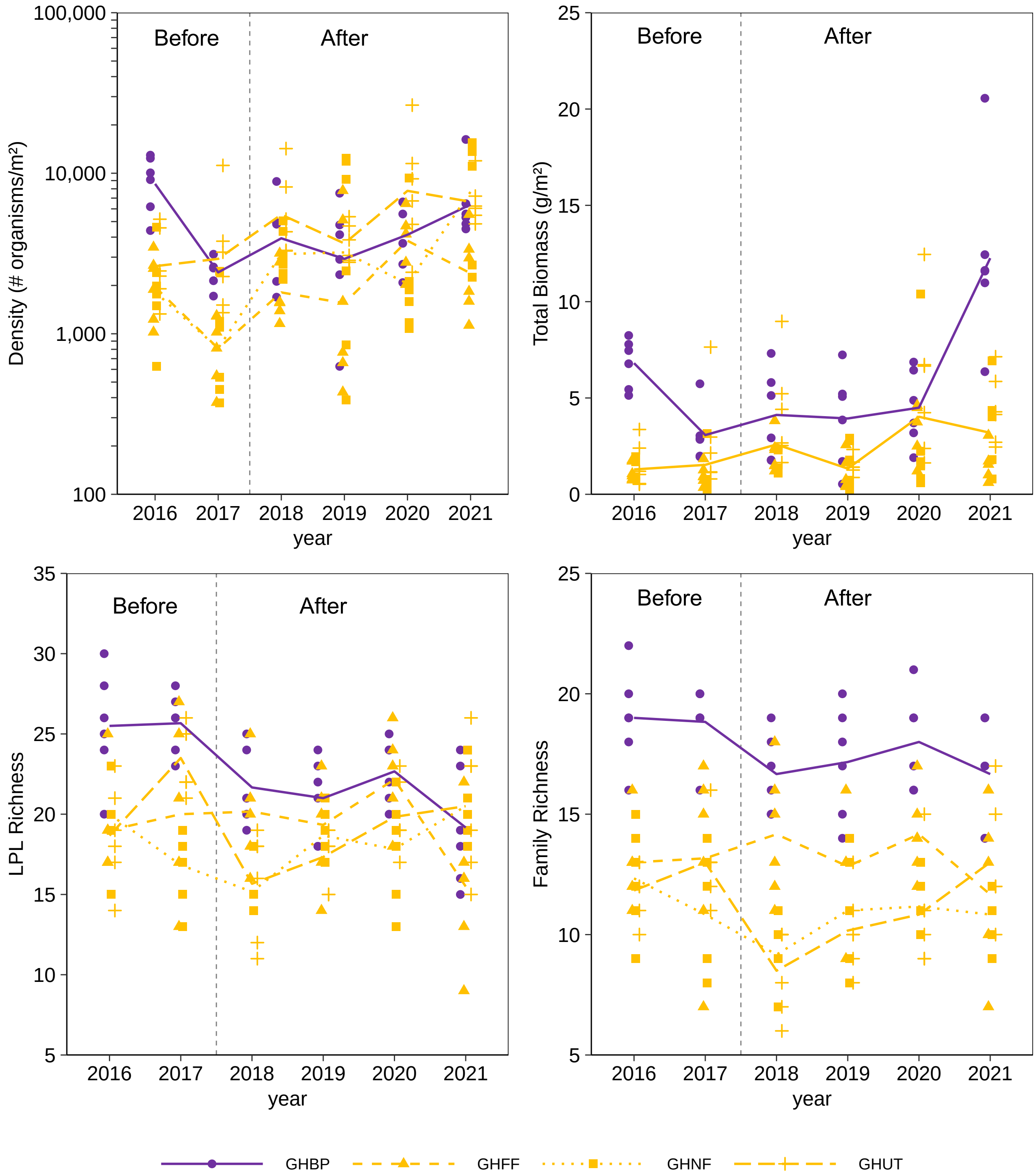


Figure 3.13: Benthic Invertebrate Endpoint Comparisons Before and After the Initiation of Antiscalant Treatment, Greenhills Creek, 2016 to 2021

Notes: Purple represents treated areas and orange represents untreated areas. Dashed or solid lines connect annual means of 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 orange line.

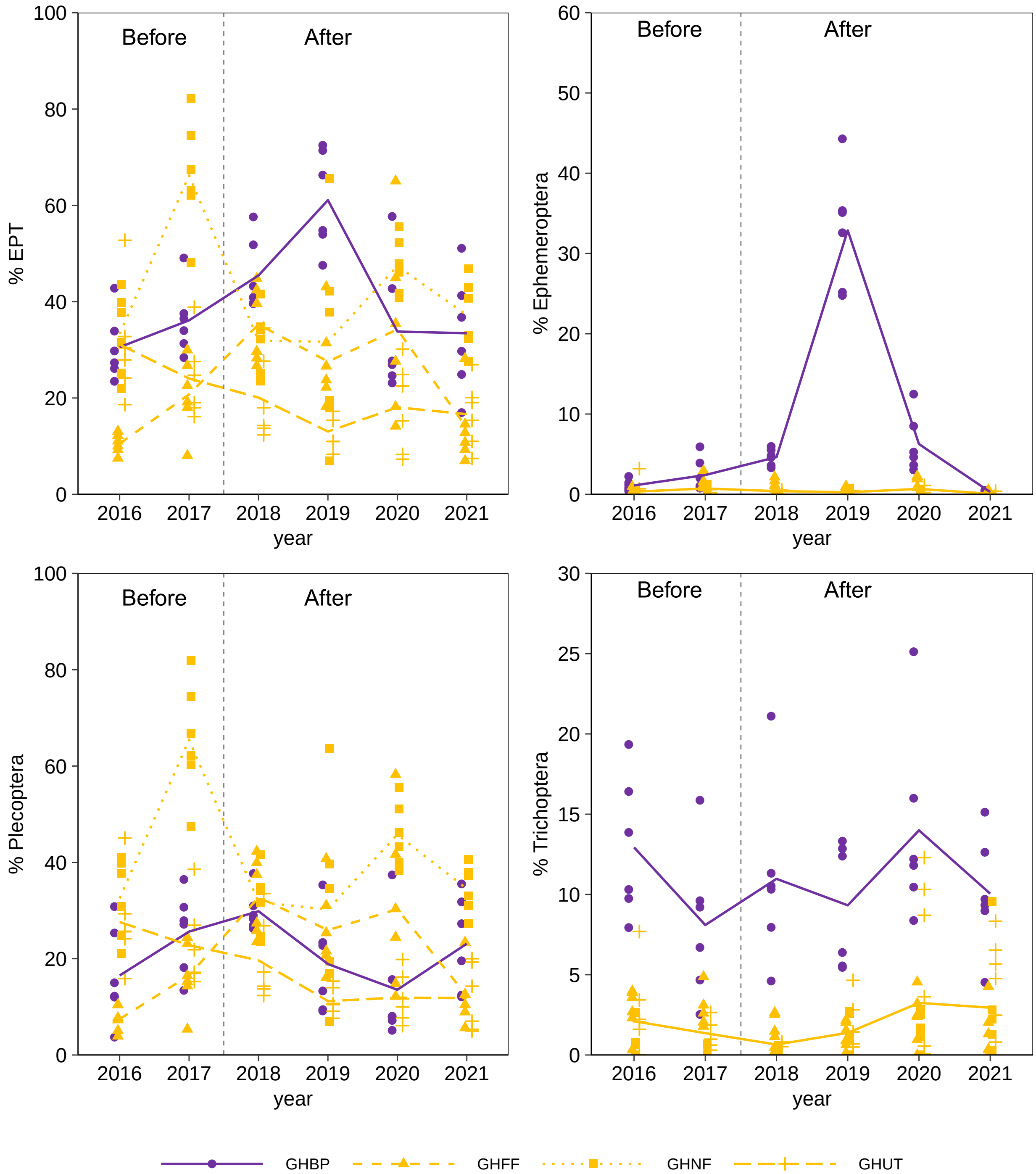


Figure 3.13: Benthic Invertebrate Endpoint Comparisons Before and After the Initiation of Antiscalant Treatment, Greenhills Creek, 2016 to 2021

Notes: Purple represents treated areas and orange represents untreated areas. Dashed or solid lines connect annual means of 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 orange line.

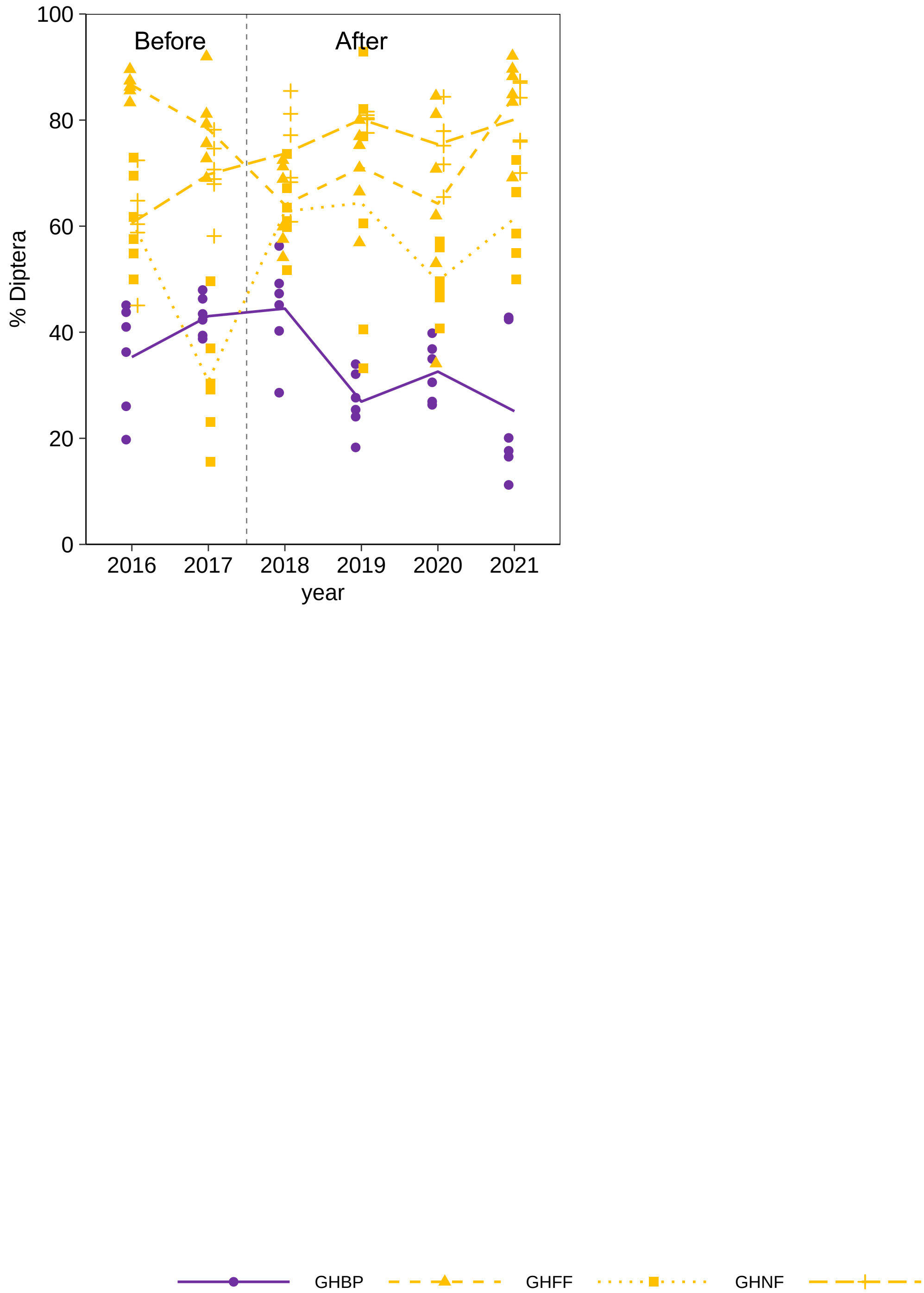


Figure 3.13: Benthic Invertebrate Endpoint Comparisons Before and After the Initiation of Antiscalant Treatment, Greenhills Creek, 2016 to 2021

Notes: Purple represents treated areas and orange represents untreated areas. Dashed or solid lines connect annual means of 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 orange line.

Overall, some differences in benthic invertebrate community endpoints among areas and over time were identified for Greenhills and Gardine Creeks and observed differences between Upper and Lower Greenhills Creek are likely attributed to antiscalant addition. Invertebrate biomass was higher on Lower Greenhills Creek versus Upper Greenhills Creek, and benthic invertebrate densities were similar, if not higher. Multiple lines of evidence indicate that %Diptera, which are more tolerant of degraded environmental conditions, was lower on Lower Greenhills Creek versus untreated areas on Upper Greenhills Creek. Increases in %EPT and %Ephemeroptera at the treated area (RG_GHBP) relative to untreated areas during a number of post-treatment years (i.e., 2018, 2019, and 2020) may indicate a slight improvement in environmental conditions downstream of the treatment facility. Overall observed differences or changes in the benthic invertebrate communities are generally as expected.

In addition to evaluating benthic invertebrate community endpoints to address the general questions identified in Section 2.4.3, relationships between benthic invertebrate community endpoints and water quality analytes with EWTs (see Section 2.2.3) were evaluated. Data for the area-based kick samples were used. In 2021, strong significant ($r_s \leq -0.6$ or r_s greater than or equal to [≥] 0.6) relationships between density, biomass, %EPT, %Ephemeroptera, %Plecoptera, and %Diptera and a number of water quality analytes were identified (Figure 3.14; Table 3.3).[37] Strong positive relationships were observed between density and concentrations of TDS, nitrate, nitrite, sulphate, and total antimony, boron, molybdenum, nickel, selenium, uranium and zinc in 2021. Strong positive relationships were also identified between %Diptera and concentrations of TDS, nitrate, sulphate, and total nickel, selenium, and uranium (Figure 3.14; Table 3.3). Conversely, strong negative relationships were observed between %EPT, %Ephemeroptera, and %Plecoptera and these same analytes in 2021. Correlation analyses using data from 2017 to 2021 identified a strong significant negative relationship between %EPT and concentrations of total uranium and strong significant positive relationships between %Diptera and concentrations of sulphate and total nickel, selenium, and uranium (Figure 3.15; Table 3.4). No other significant positive or negative relationships that explained a sufficient (i.e., more than 60%) amount of variability in the observed benthic invertebrate endpoints were identified (Figure 3.15; Table 3.4).

Comparisons between key endpoints and calcite measures were completed for all area-based kick samples collected from biological monitoring areas on Greenhills and Gardine creeks. In 2021, %EPT and %Trichoptera were strongly ($r_s \leq -0.6$) negatively correlated to CI, CI', and concretion and %Diptera was strongly ($r_s \geq 0.6$) positively correlated with CI, CI', and concretion

[37] 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., $r_s \leq -0.6$ or $r_s \geq 0.6$ were considered indicative of strong, significant relationships).

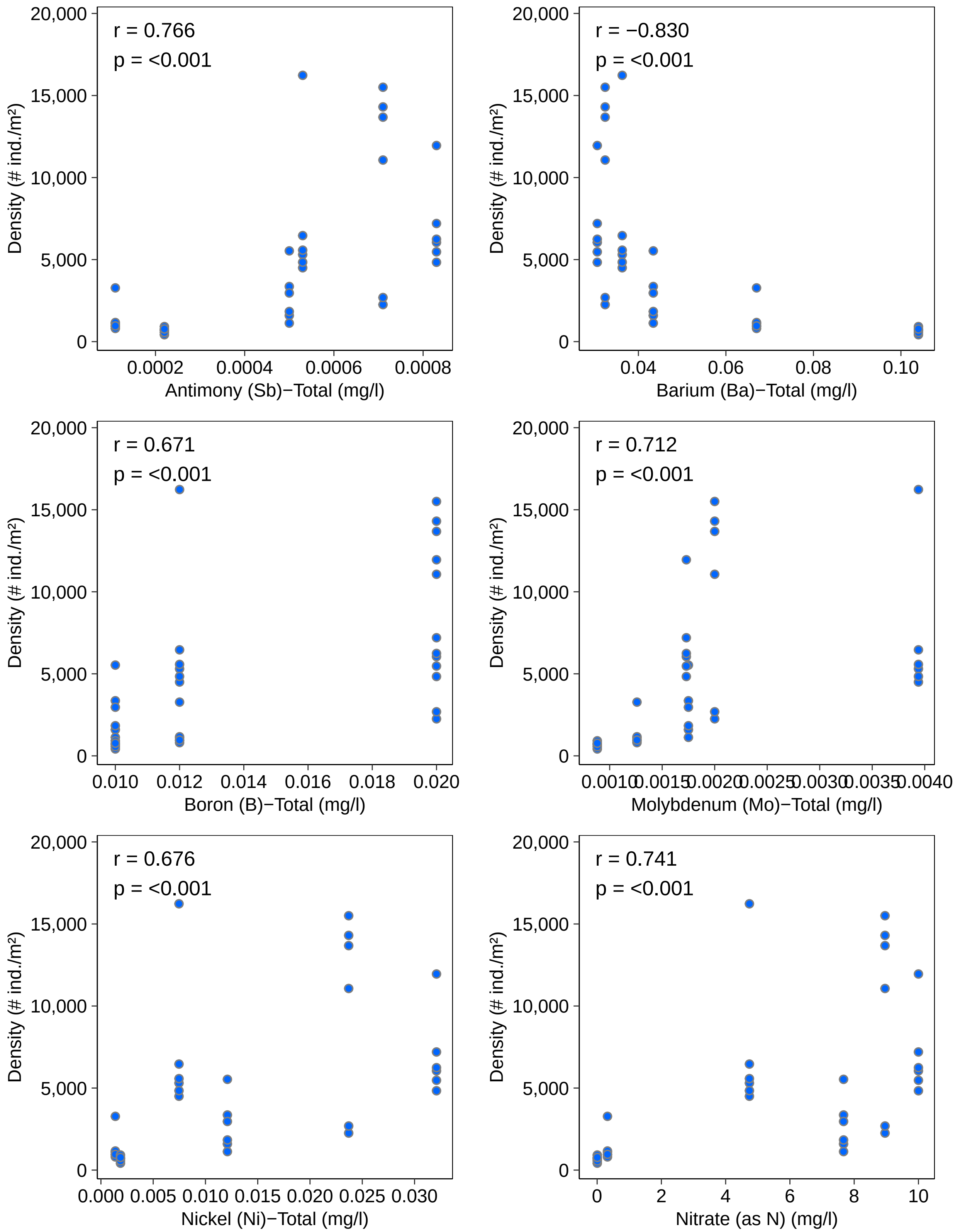


Figure 3.14: Significant Spearman's Correlation Relationships ($r \le -0.6$ or $r \ge 0.6$) Between Benthic Invertebrate Community Endpoints and Water Chemistry Analytes with Early Warning Triggers, Greenhills and Gardine Creeks, 2021

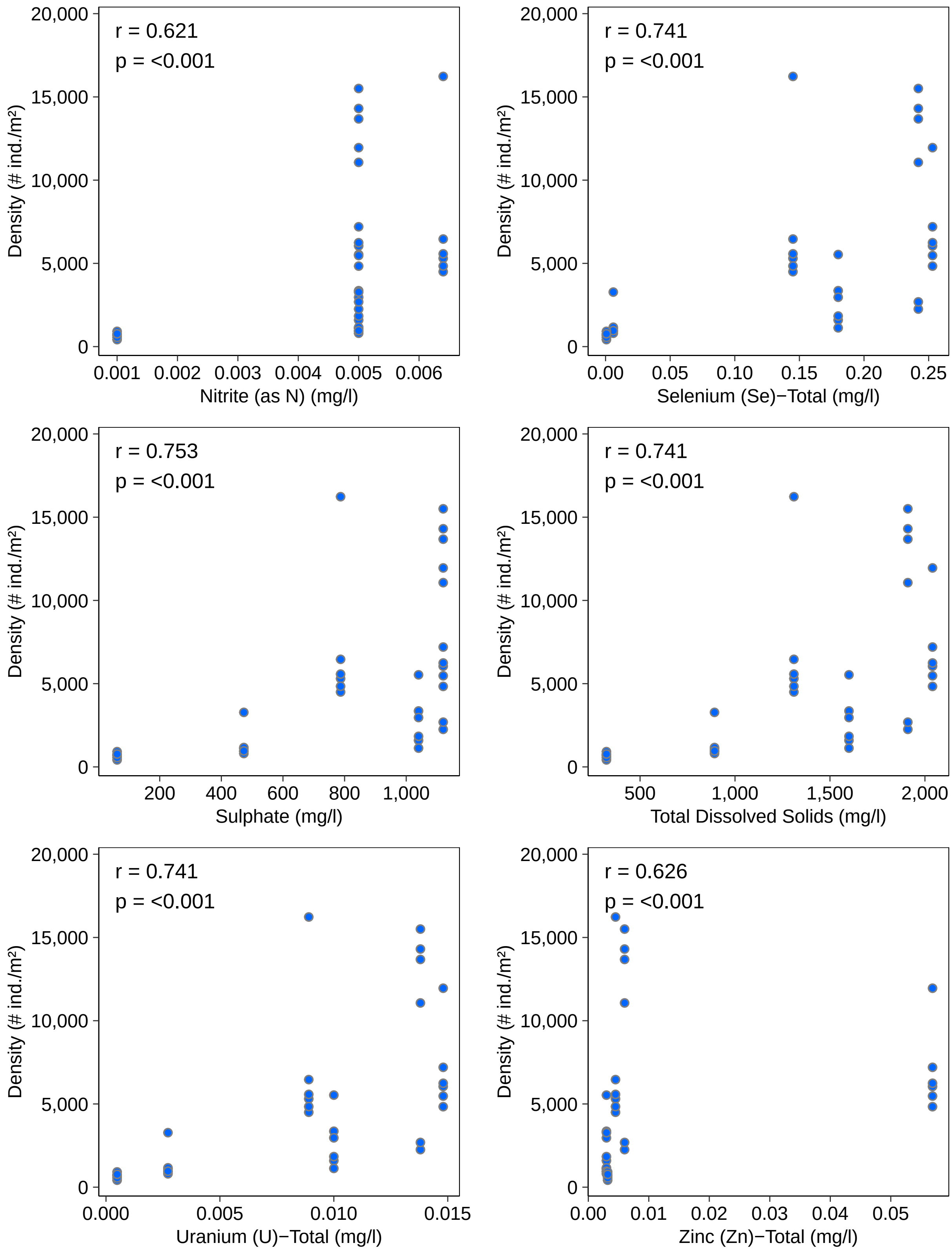


Figure 3.14: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Water Chemistry Analytes with Early Warning Triggers, Greenhills and Gardine Creeks, 2021

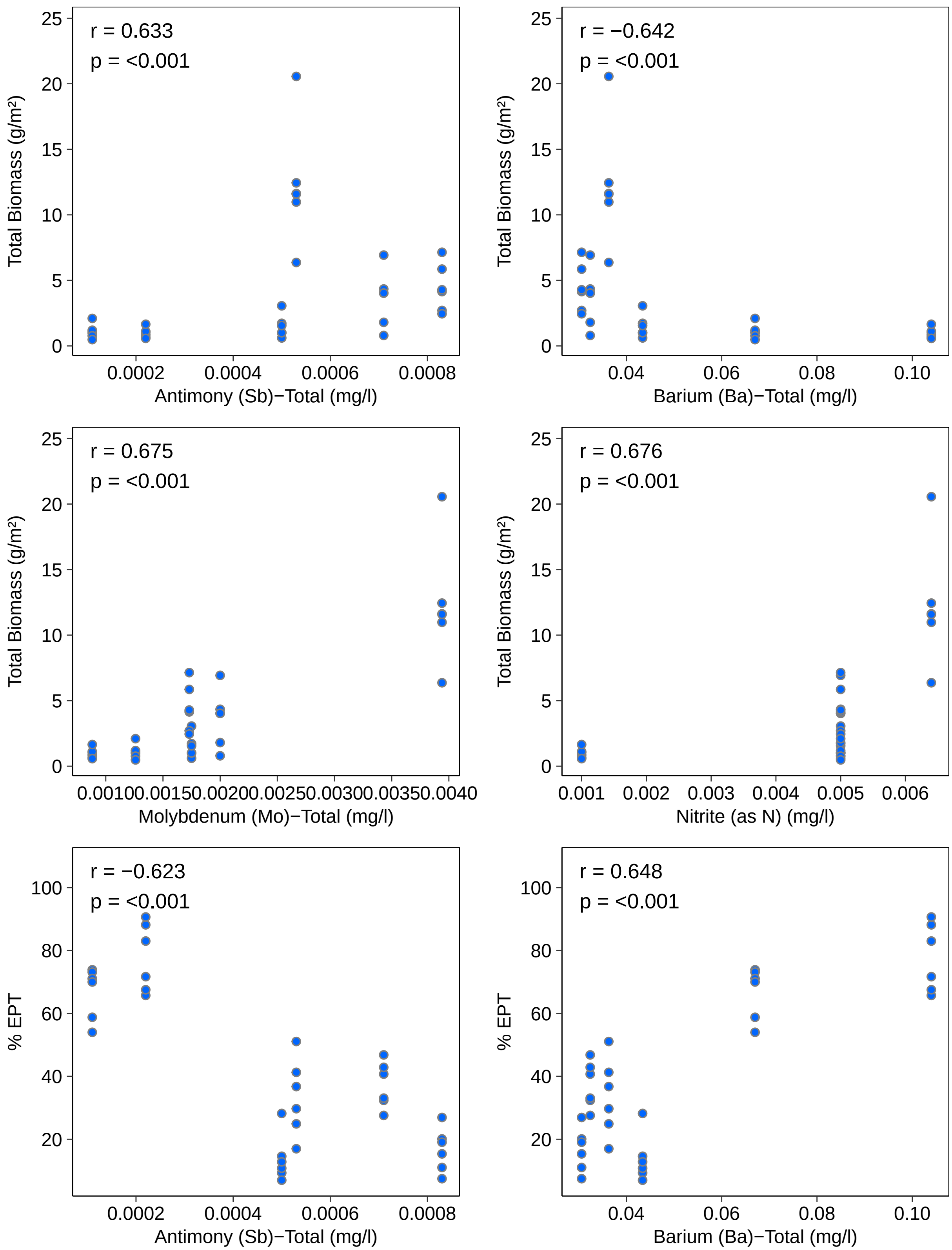


Figure 3.14: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Water Chemistry Analytes with Early Warning Triggers, Greenhills and Gardine Creeks, 2021

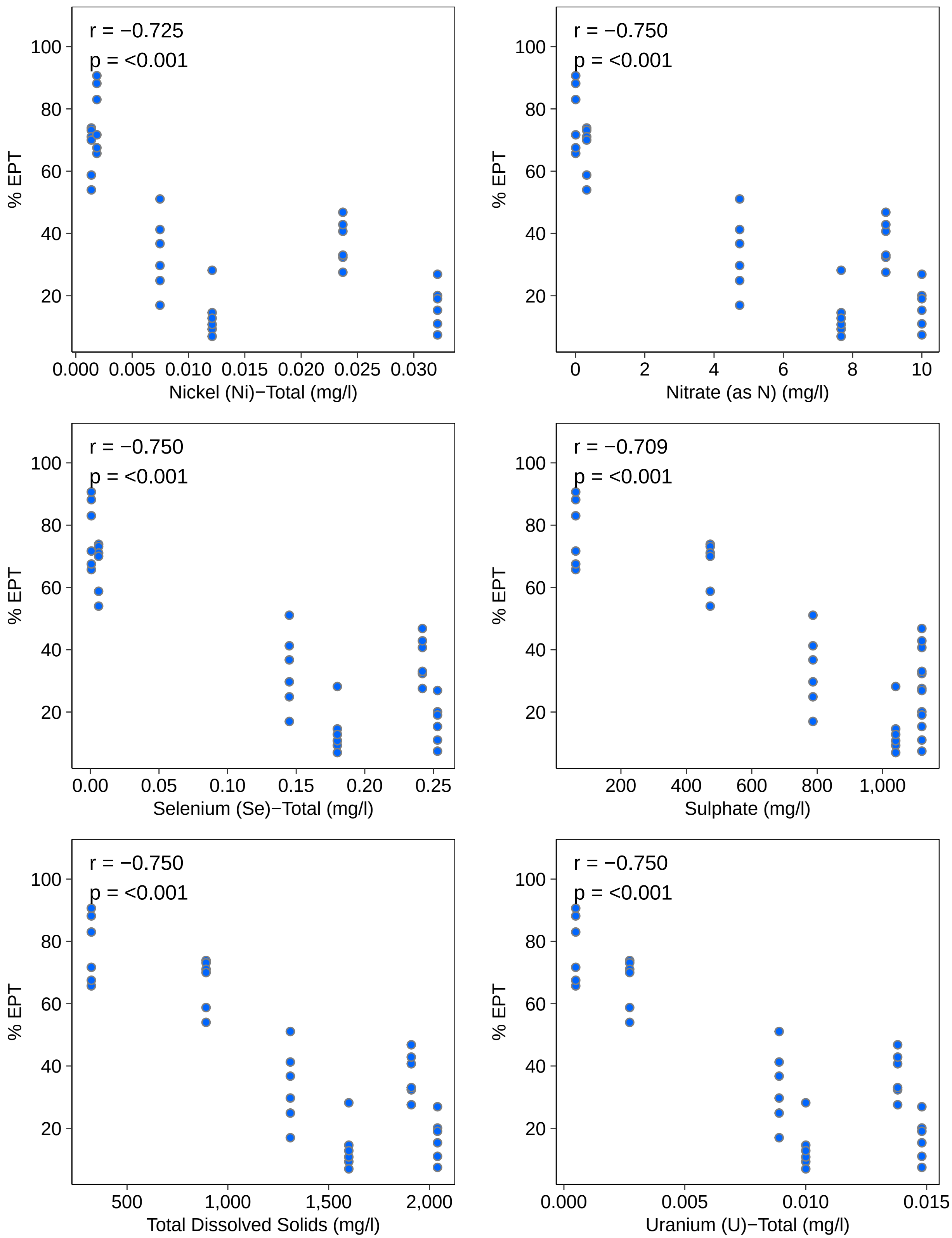


Figure 3.14: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Water Chemistry Analytes with Early Warning Triggers, Greenhills and Gardine Creeks, 2021

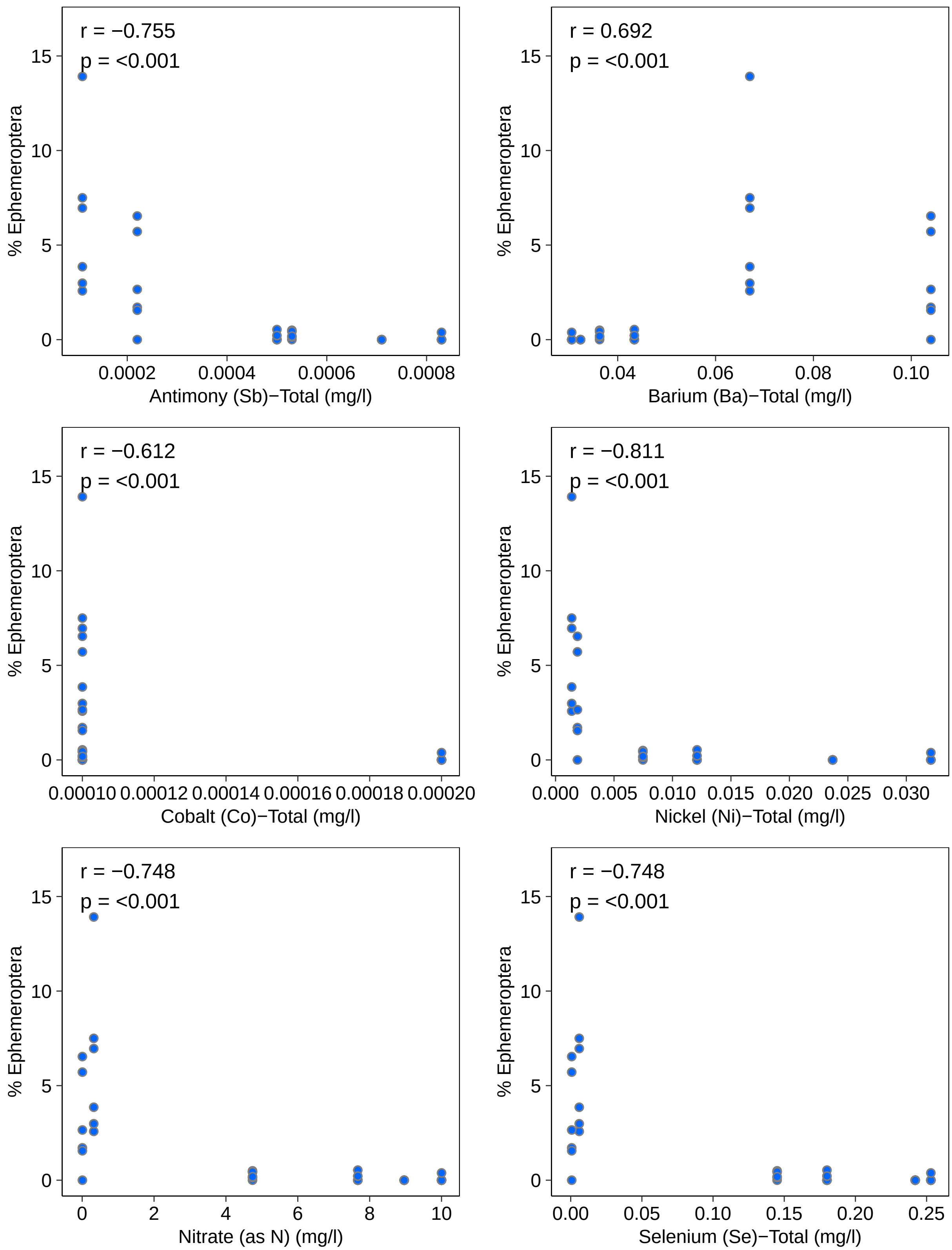


Figure 3.14: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Water Chemistry Analytes with Early Warning Triggers, Greenhills and Gardine Creeks, 2021

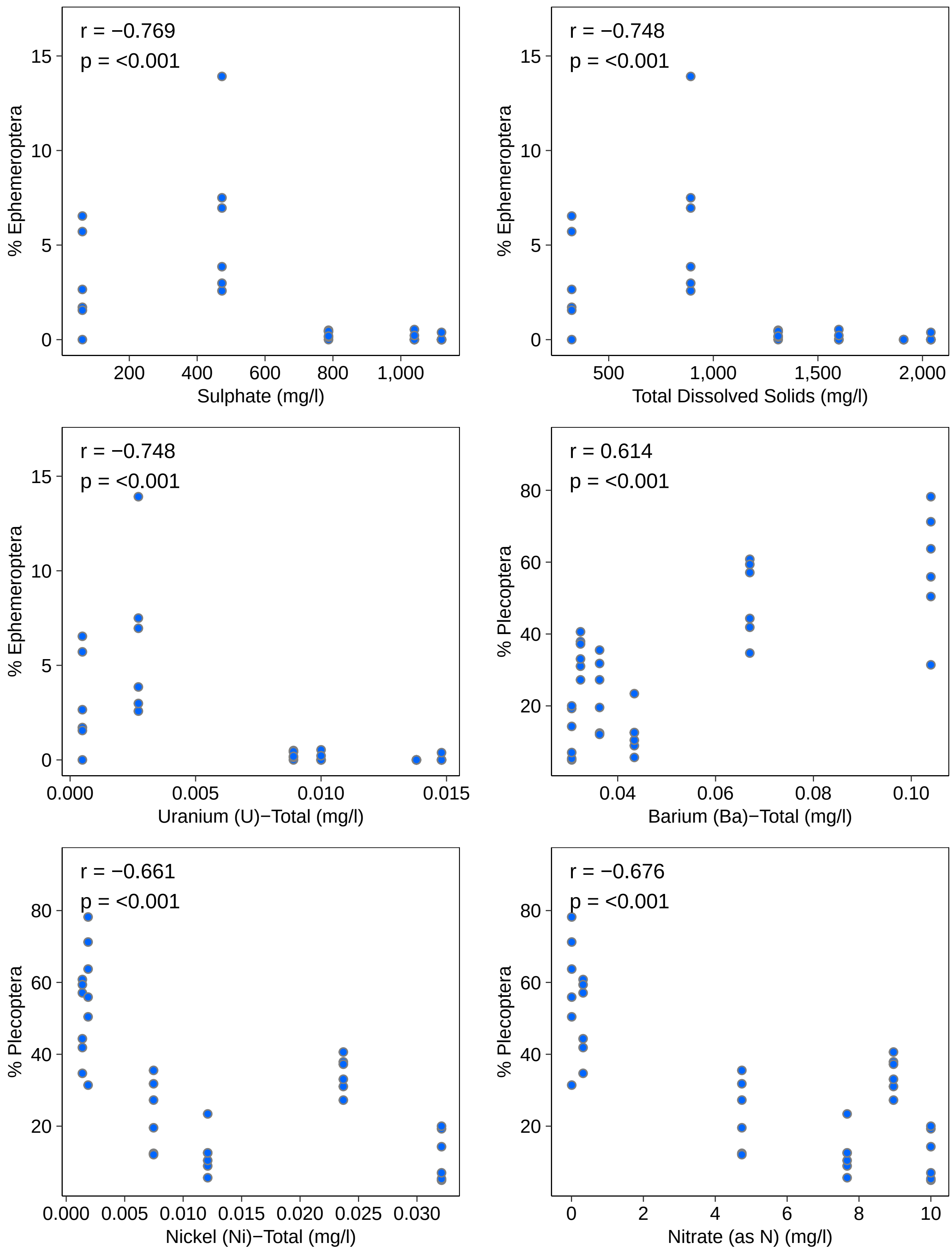


Figure 3.14: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Water Chemistry Analytes with Early Warning Triggers, Greenhills and Gardine Creeks, 2021

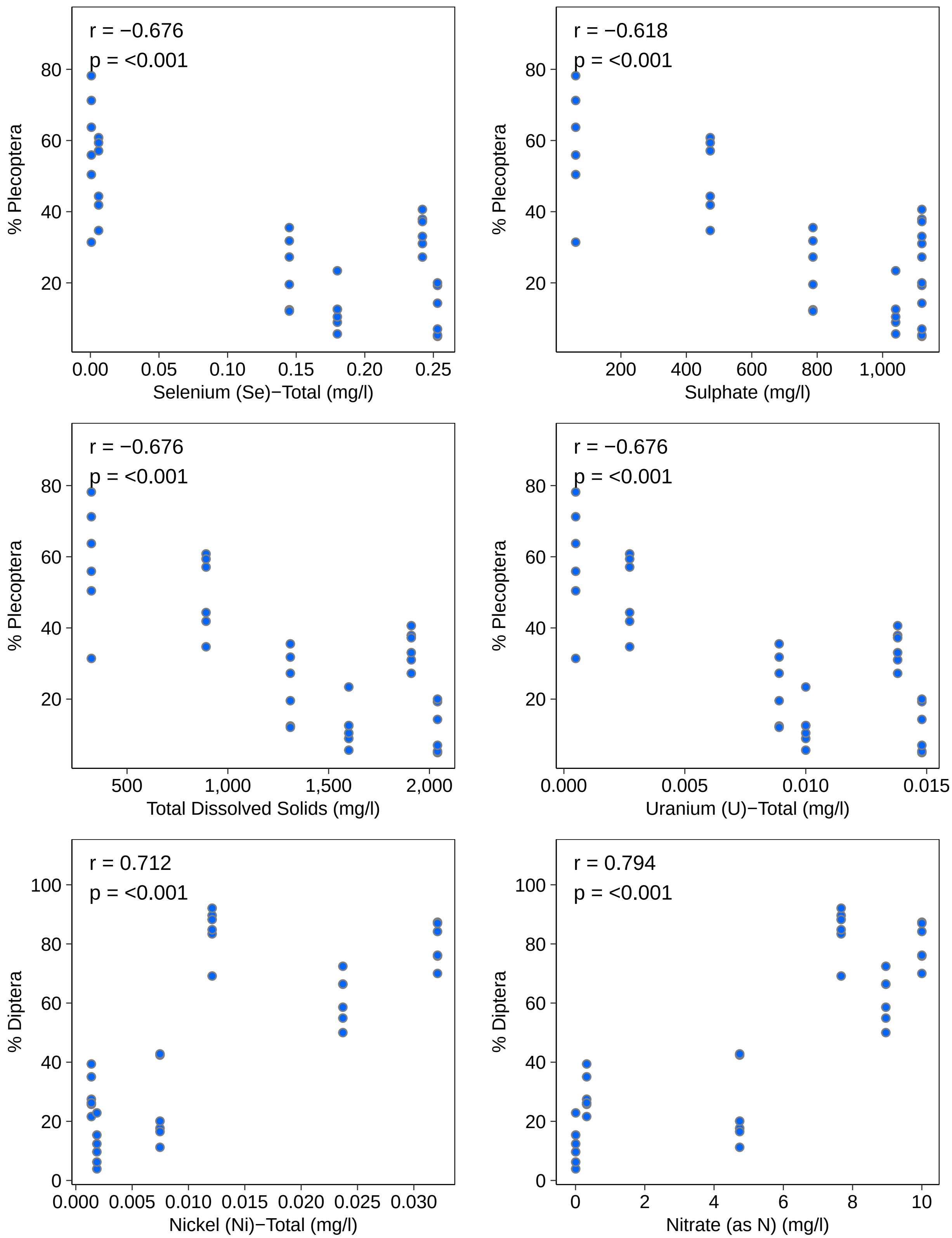


Figure 3.14: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Water Chemistry Analytes with Early Warning Triggers, Greenhills and Gardine Creeks, 2021

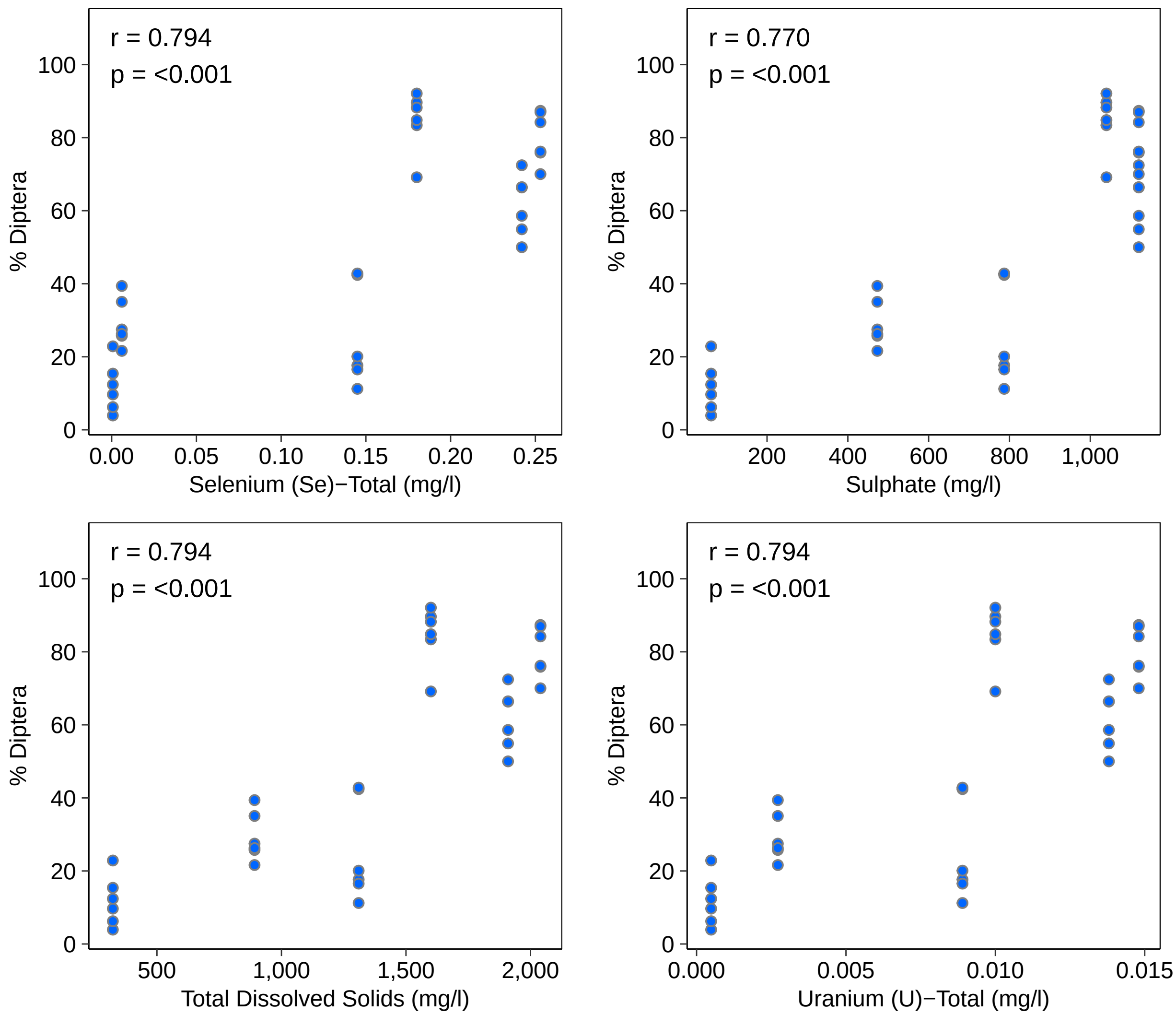


Figure 3.14: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Water Chemistry Analytes with Early Warning Triggers, Greenhills and Gardine Creeks, 2021

Table 3.3: Spearman Rank Correlations Between Benthic Invertebrate Endpoints and Water Quality Analytes with Early Warning Triggers, 2021

Analyte	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	0.766	<0.001	0.633	0.265	0.191	0.181	-0.228	<0.001	-0.623	<0.001	-0.755	<0.001	-0.598	0.151	-0.244	0.001	0.515
Barium - Total (mg/L)	<0.001	-0.830	<0.001	-0.642	0.070	-0.306	0.561	0.100	<0.001	0.648	<0.001	0.692	<0.001	0.614	0.062	0.315	<0.001	-0.597
Boron - Total (mg/L)	<0.001	0.671	0.002	0.491	0.005	0.460	1.00	0	0.220	-0.210	0.014	-0.405	0.276	-0.187	0.360	-0.157	0.085	0.291
Cadmium - Dissolved (mg/L)	0.212	0.213	0.141	0.251	0.993	-0.002	0.062	-0.314	0.489	-0.119	0.018	-0.394	0.367	-0.155	0.428	0.136	0.786	0.047
Cobalt - Total (mg/L)	<0.001	0.590	0.054	0.323	0.077	0.299	0.053	-0.326	0.046	-0.335	<0.001	-0.612	0.108	-0.272	0.067	-0.309	0.003	0.476
Lithium - Total (mg/L)	0.180	0.229	0.624	-0.085	0.018	0.392	0.651	0.078	0.899	-0.022	0.969	-0.007	0.744	0.056	0.035	-0.352	0.035	0.352
Manganese - Total (mg/L)	0.008	0.435	0.027	0.368	0.517	0.112	0.034	-0.354	0.159	-0.240	<0.001	-0.563	0.162	-0.238	0.860	-0.031	0.223	0.208
Molybdenum - Total (mg/L)	<0.001	0.712	<0.001	0.675	0.413	0.141	0.715	0.063	0.002	-0.506	0.002	-0.505	0.004	-0.470	0.164	-0.237	0.114	0.268
Nickel - Total (mg/L)	<0.001	0.676	0.007	0.440	0.511	0.113	0.027	-0.370	<0.001	-0.725	<0.001	-0.811	<0.001	-0.661	0.011	-0.420	<0.001	0.712
Nitrate as N (mg/L)	<0.001	0.741	0.006	0.449	0.181	0.228	0.155	-0.242	<0.001	-0.750	<0.001	-0.748	<0.001	-0.676	0.002	-0.491	<0.001	0.794
Nitrite as N (mg/L)	<0.001	0.621	<0.001	0.676	0.173	0.232	0.017	0.396	0.011	-0.417	0.240	-0.201	0.007	-0.440	0.747	-0.056	0.345	0.162
Selenium - Total (mg/L)	<0.001	0.741	0.006	0.449	0.181	0.228	0.155	-0.242	<0.001	-0.750	<0.001	-0.748	<0.001	-0.676	0.002	-0.491	<0.001	0.794
Sulphate (mg/L)	<0.001	0.753	0.008	0.438	0.170	0.234	0.095	-0.282	<0.001	-0.709	<0.001	-0.769	<0.001	-0.618	<0.001	-0.530	<0.001	0.770
Total Dissolved Solids (mg/L)	<0.001	0.741	0.006	0.449	0.181	0.228	0.155	-0.242	<0.001	-0.750	<0.001	-0.748	<0.001	-0.676	0.002	-0.491	<0.001	0.794
Uranium - Total (mg/L)	<0.001	0.741	0.006	0.449	0.181	0.228	0.155	-0.242	<0.001	-0.750	<0.001	-0.748	<0.001	-0.676	0.002	-0.491	<0.001	0.794
Zinc - Total (mg/L)	<0.001	0.626	<0.001	0.592	0.140	0.251	0.369	-0.154	0.104	-0.276	<0.001	-0.545	0.083	-0.293	0.940	0.013	0.293	0.180

P-value <0.05/n parameters = 0.05/16 = 0.00375.

$r_s \leq -0.6$ 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.

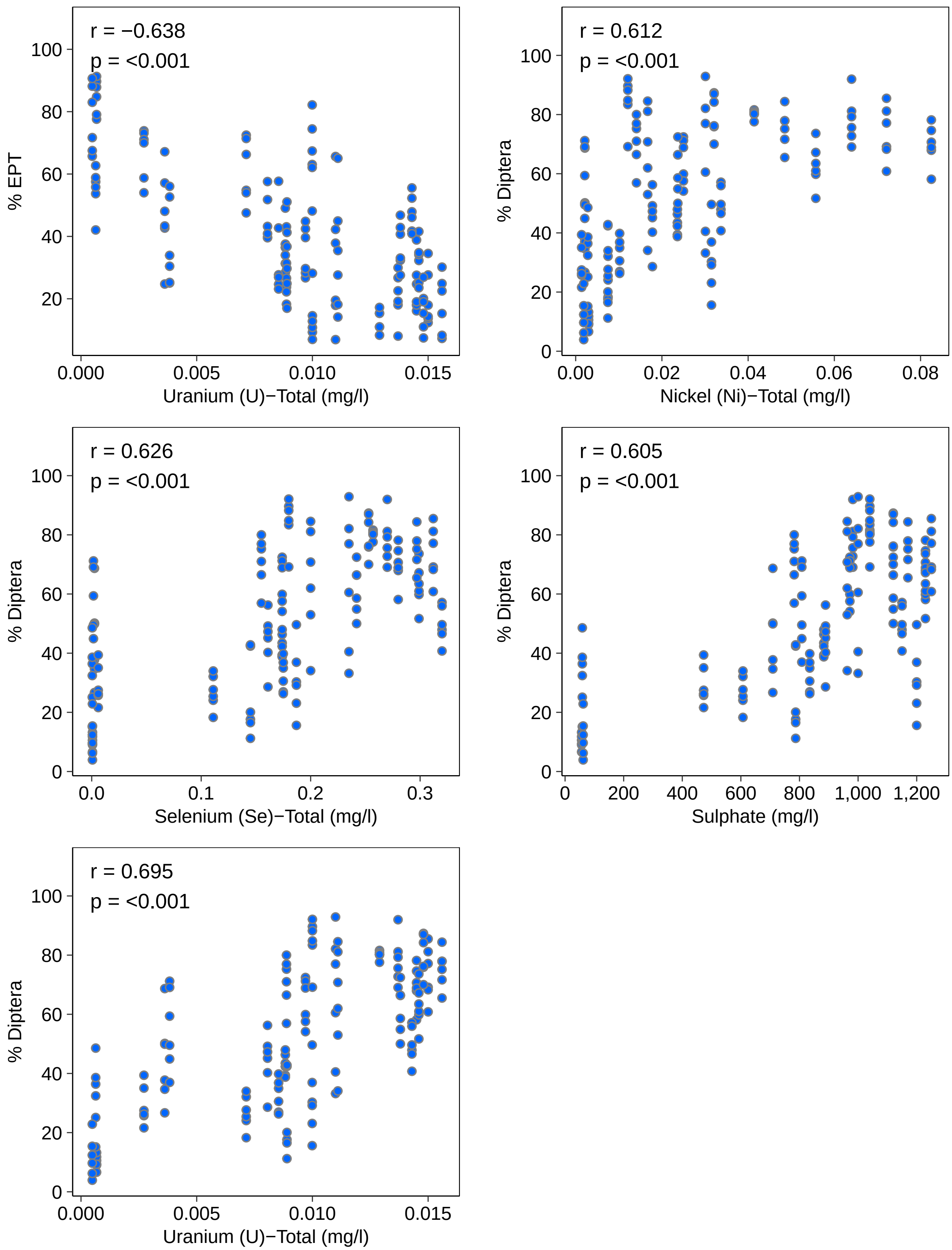


Figure 3.15: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Water Chemistry Analytes with Early Warning Triggers, Greenhills and Gardine Creeks, 2017 to 2021

Table 3.4: Spearman Rank Correlations Between Benthic Invertebrate Endpoints and Water Quality Analytes with Early Warning Triggers, 2017 to 2021

Analyte	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)	0.039	0.166	0.753	0.025	0.026	-0.178	<0.001	-0.380	<0.001	-0.447	0.002	-0.247	<0.001	-0.322	<0.001	-0.345	<0.001	0.485
Barium - Total (mg/L)	<0.001	-0.450	0.004	-0.231	0.005	0.224	<0.001	0.349	<0.001	0.483	<0.001	0.340	<0.001	0.491	0.047	0.159	<0.001	-0.459
Boron - Total (mg/L)	0.024	0.181	<0.001	0.271	<0.001	0.323	<0.001	0	<0.001	0.269	0.517	0.052	0.063	0.149	<0.001	0.339	<0.001	-0.327
Cadmium - Dissolved (mg/L)	0.108	0.129	0.159	0.113	0.430	0.064	0.329	-0.079	0.110	-0.128	0.897	-0.011	<0.001	-0.268	0.247	0.093	0.473	0.058
Cobalt - Total (mg/L)	0.020	0.186	0.018	0.189	0.113	0.127	0.078	-0.142	<0.001	-0.275	0.002	-0.244	0.023	-0.182	0.297	-0.084	<0.001	0.324
Lithium - Total (mg/L)	0.016	0.192	0.251	0.093	0.969	0.003	0.533	-0.050	0.016	-0.193	0.001	-0.261	0.369	-0.072	0.482	-0.057	0.002	0.244
Manganese - Total (mg/L)	0.007	0.215	0.051	0.157	0.999	0	0.003	-0.237	<0.001	-0.357	<0.001	-0.275	<0.001	-0.305	0.715	-0.029	<0.001	0.294
Molybdenum - Total (mg/L)	0.005	0.226	0.002	0.244	0.793	-0.021	0.268	0.089	0.009	-0.209	0.008	0.212	<0.001	-0.372	0.306	0.083	0.567	0.046
Nickel - Total (mg/L)	0.008	0.212	0.927	0.007	0.003	-0.235	<0.001	-0.485	<0.001	-0.543	<0.001	-0.401	<0.001	-0.364	<0.001	-0.447	<0.001	0.612
Nitrate as N (mg/L)	0.008	0.210	0.631	-0.039	<0.001	-0.305	<0.001	-0.527	<0.001	-0.516	<0.001	-0.445	<0.001	-0.314	<0.001	-0.516	<0.001	0.591
Nitrite as N (mg/L)	0.003	0.238	0.004	0.232	0.430	0.064	<0.001	0.274	0.047	-0.160	0.002	0.242	<0.001	-0.351	0.006	0.218	0.955	-0.005
Selenium - Total (mg/L)	<0.001	0.265	0.861	0.014	<0.001	-0.298	<0.001	-0.519	<0.001	-0.564	<0.001	-0.441	<0.001	-0.385	<0.001	-0.431	<0.001	0.626
Sulfate (mg/L)	0.002	0.241	0.993	0.001	<0.001	-0.302	<0.001	-0.531	<0.001	-0.527	<0.001	-0.528	<0.001	-0.310	<0.001	-0.492	<0.001	0.605
Total Dissolved Solids (mg/L)	0.002	0.246	0.898	0.010	0.002	-0.244	<0.001	-0.502	<0.001	-0.509	<0.001	-0.491	<0.001	-0.320	<0.001	-0.467	<0.001	0.598
Uranium - Total (mg/L)	<0.001	0.355	0.218	0.099	<0.001	-0.273	<0.001	-0.515	<0.001	-0.638	<0.001	-0.529	<0.001	-0.444	<0.001	-0.426	<0.001	0.695
Zinc - Total (mg/L)	<0.001	0.376	0.002	0.244	0.107	-0.130	<0.001	-0.320	<0.001	-0.395	<0.001	-0.399	<0.001	-0.327	0.628	-0.039	<0.001	0.309

P-value <0.05/n parameters = 0.05/16 = 0.00375.

$r_s \leq -0.6$ 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.

(Figure 3.16; Table 3.5). This means that Diptera tended to make up a greater proportion of the samples collected from areas with greater calcification of the substrates and proportions of Trichoptera would be expected to be lower in these same samples in 2021. In considering data from 2017 to 2021, biomass, LPL and family richness, %EPT, and %Ephemeroptera each had moderately (i.e., r_s -0.3 to -0.6) negative relationships with CI[38] and concretion scores, whereas %Trichoptera were strongly ($r_s \leq$ -0.6) negatively correlated to CI, and concretion (Figure 3.17; Table 3.6). Proportions of Diptera in the samples from 2017 to 2021 had a moderately positive (i.e., r_s 0.3 to 0.6) relationship with both CI and concretion scores (Table 3.6).

Because benthic invertebrate community endpoints are correlated with multiple water quality analytes, calcite indices (CI and CI'), and concretion scores, it is challenging to identify causal relationships. However, a significant decrease in concretion scores was observed in Lower Greenhills Creek since initiation of antiscalant addition, and few significant changes in a concentrations of water quality analytes have been identified at that location over the same period. It is therefore considered likely that the observed changes in the benthic invertebrate community (namely, increases in %Ephemeroptera and %Plecoptera and decreases in %Diptera relative to untreated areas) in Lower Greenhills Creek are attributable to changes in concretion and, subsequently, successful application of antiscalant.

3.3.2 Greenhills Creek Sedimentation Pond

Data collected in 2021 represent the fourth year of pre-treatment benthic invertebrate community data for Greenhills Creek Sedimentation Pond (Appendix Tables E.25 to E.29). Results for each endpoint were generally comparable from 2018 to 2021 (Figure 3.18).[39] 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 3.18; Appendix Table E.30). Bivalves were the predominant taxonomic group in each of the n = 6 samples from Greenhills Creek Sedimentation Pond (i.e., at 41 to 89% of organisms) and gastropods (snails) comprised 39% of the sample from RG_GHP-2 (Figure 3.18; Appendix Table E.30).

[38] Calcite index prime (CI') was not included in the 2017 to 2021 comparisons because only one year of C_p' and CI' data has been collected to date (i.e., in 2021; see Section 2.3.1).

[39] The apparent decrease in %Diptera over time from 2018 to 2021 might be considered "essentially" significant (*Year* term p-value = 0.1005); however, the only significant pairwise contrast at alpha = 0.1 was the 2021 to 2018 contrast (p-value = 0.077).

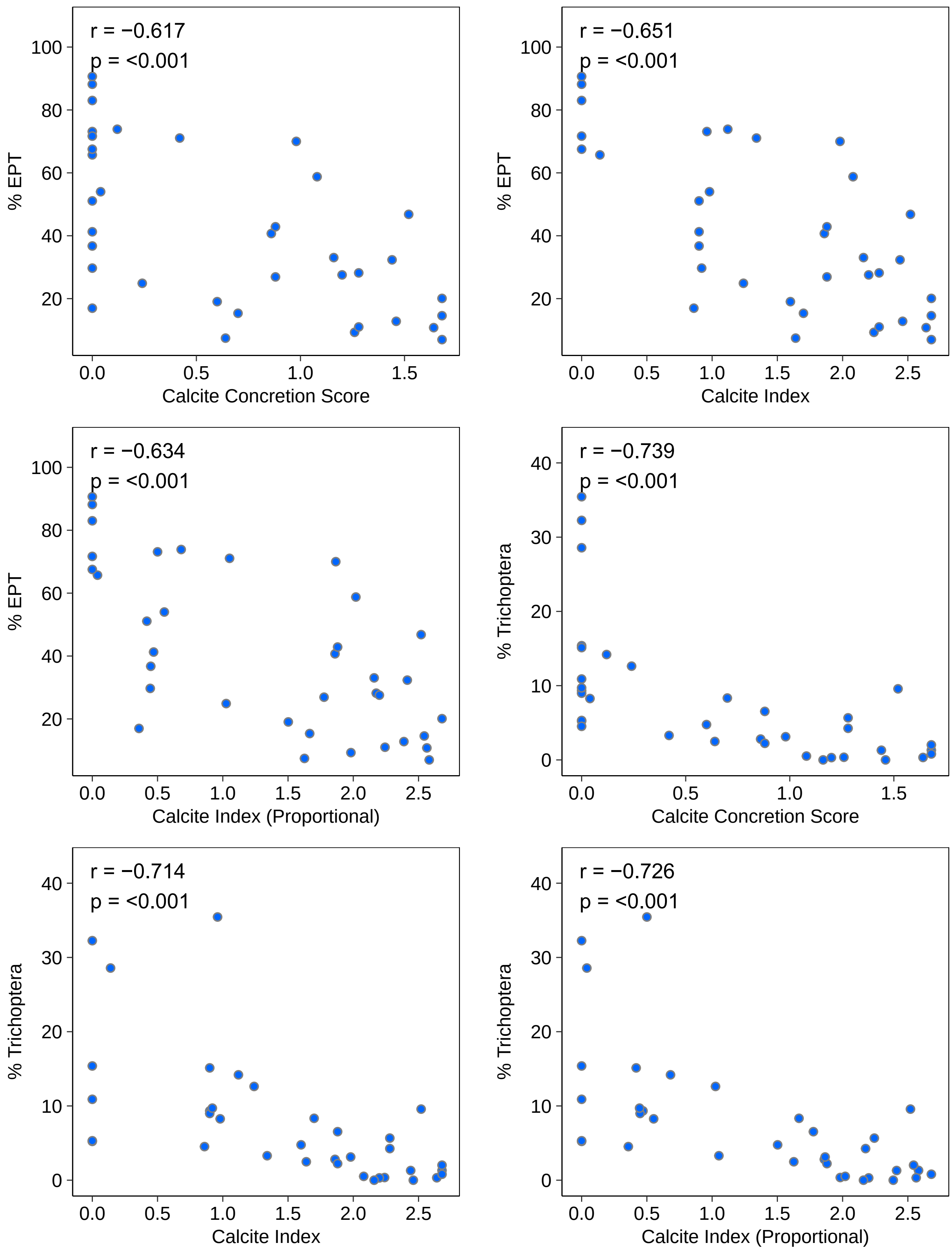


Figure 3.16: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Calcite Index and Concretion Scores, Greenhills Creek and Gardine Creek, 2021

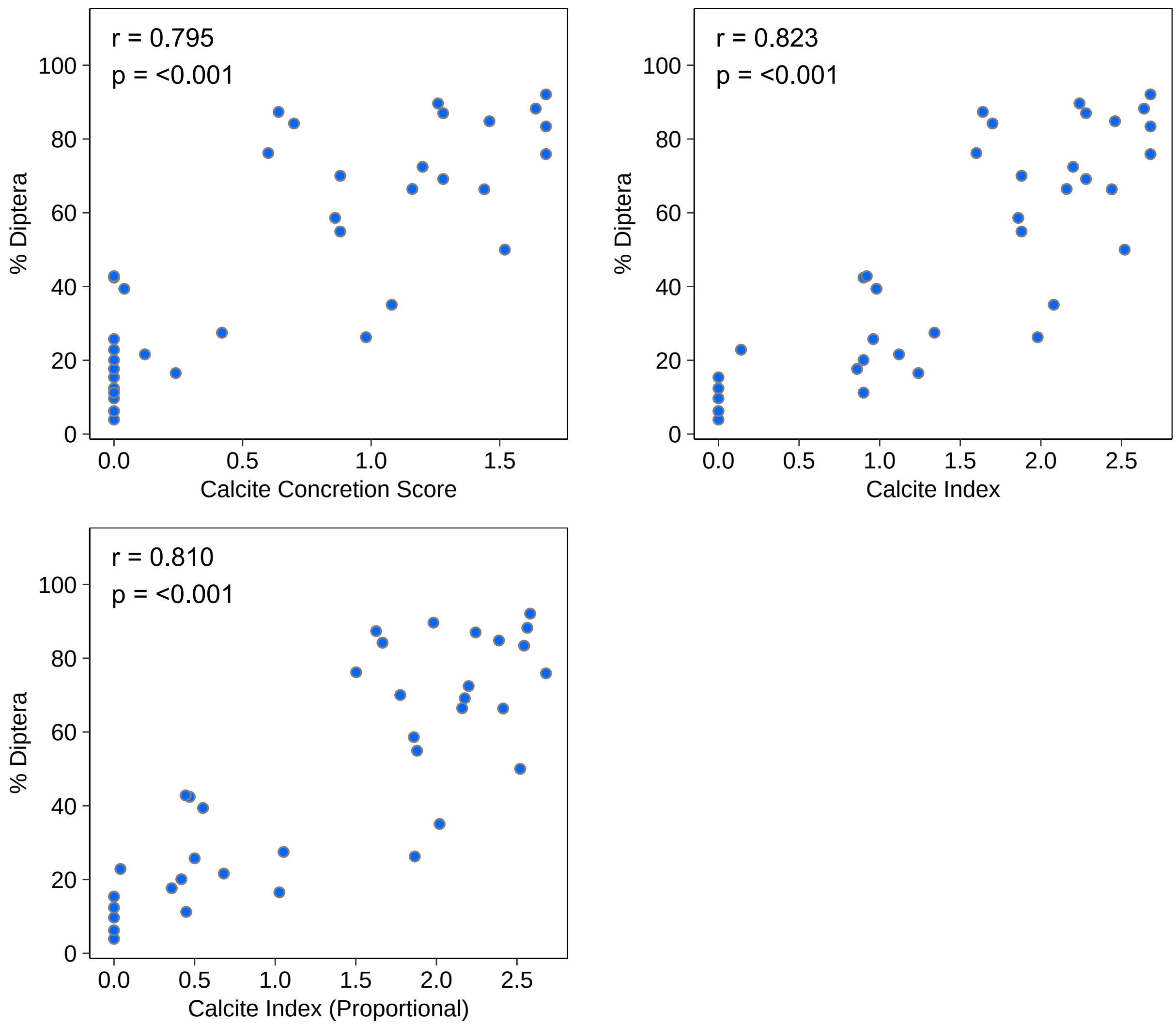


Figure 3.16: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Calcite Index and Concretion Scores, Greenhills Creek and Gardine Creek, 2021

Table 3.5: Spearman's Correlation Relationships between Benthic Invertebrate Community Metrics and Calcite, Greenhills and Gardine Creeks, 2021

Endpoint	Calcite Index (CI)		Proportional Calcite Index (CI'I)		Concretion Score	
	r_s	P-value	r_s	P-value	r_s	P-value
Density (No. organisms/m²)	0.414	0.012	0.426	0.010	0.342	0.041
Total Biomass (g/m²)	-0.021	0.901	-0.009	0.960	-0.100	0.563
LPL Richness	0.064	0.709	0.089	0.604	-0.008	0.962
Family Richness	-0.258	0.128	-0.270	0.111	-0.344	0.040
%EPT	-0.651	<0.001	-0.634	<0.001	-0.617	<0.001
%Ephemeroptera	-0.493	0.002	-0.509	0.002	-0.497	0.002
%Plecoptera	-0.523	0.001	-0.504	0.002	-0.467	0.004
%Trichoptera	-0.714	<0.001	-0.726	<0.001	-0.739	<0.001
%Diptera	0.823	<0.001	0.810	<0.001	0.795	<0.001

[grey shading] P-value <0.025 (0.05/2 for Bonferroni correction).

[blue shading] $r_s \leq -0.6$ or $r_s \geq 0.6$.

Notes: r_s = 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.

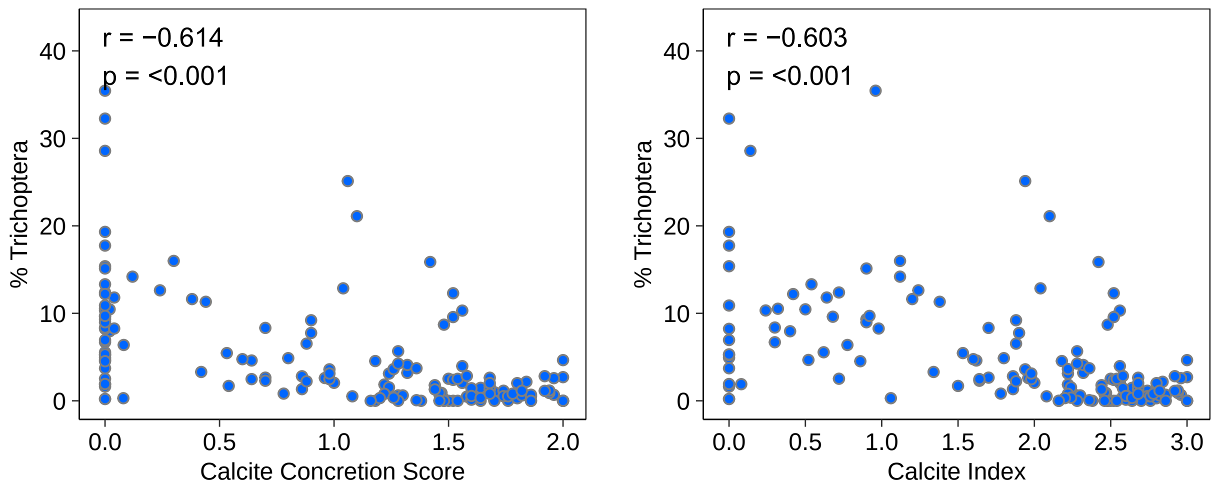


Figure 3.17: Significant Spearman's Correlation Relationships (r ≤ -0.6 or r ≥ 0.6) Between Benthic Invertebrate Community Endpoints and Calcite Index and Concretion Scores, Greenhills and Gardine Creeks, 2017 to 2021

Table 3.6: Spearman's Correlation Relationships between Benthic Invertebrate Community Metrics and Calcite, Greenhills and Gardine Creeks, 2017 to 2021

Endpoint	Calcite Index (CI)		Concretion Score	
	r_s	p-value	r_s	p-value
Density (# organisms/m²)	-0.003	0.970	-0.023	0.781
Total Biomass (g/m²)	-0.307	<0.001	-0.327	<0.001
LPL Richness	-0.337	<0.001	-0.343	<0.001
Family Richness	-0.502	<0.001	-0.524	<0.001
%EPT	-0.449	<0.001	-0.432	<0.001
%Ephemeroptera	-0.477	<0.001	-0.475	<0.001
%Plecoptera	-0.221	0.00568	-0.200	0.0128
%Trichoptera	-0.603	<0.001	-0.614	<0.001
%Diptera	0.589	<0.001	0.586	<0.001

[grey] P-value <0.025 (0.05/2 for Bonferroni correction).
[blue] $r_s \leq -0.6$ or $r_s \geq 0.6$.

Notes: r_s = 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.

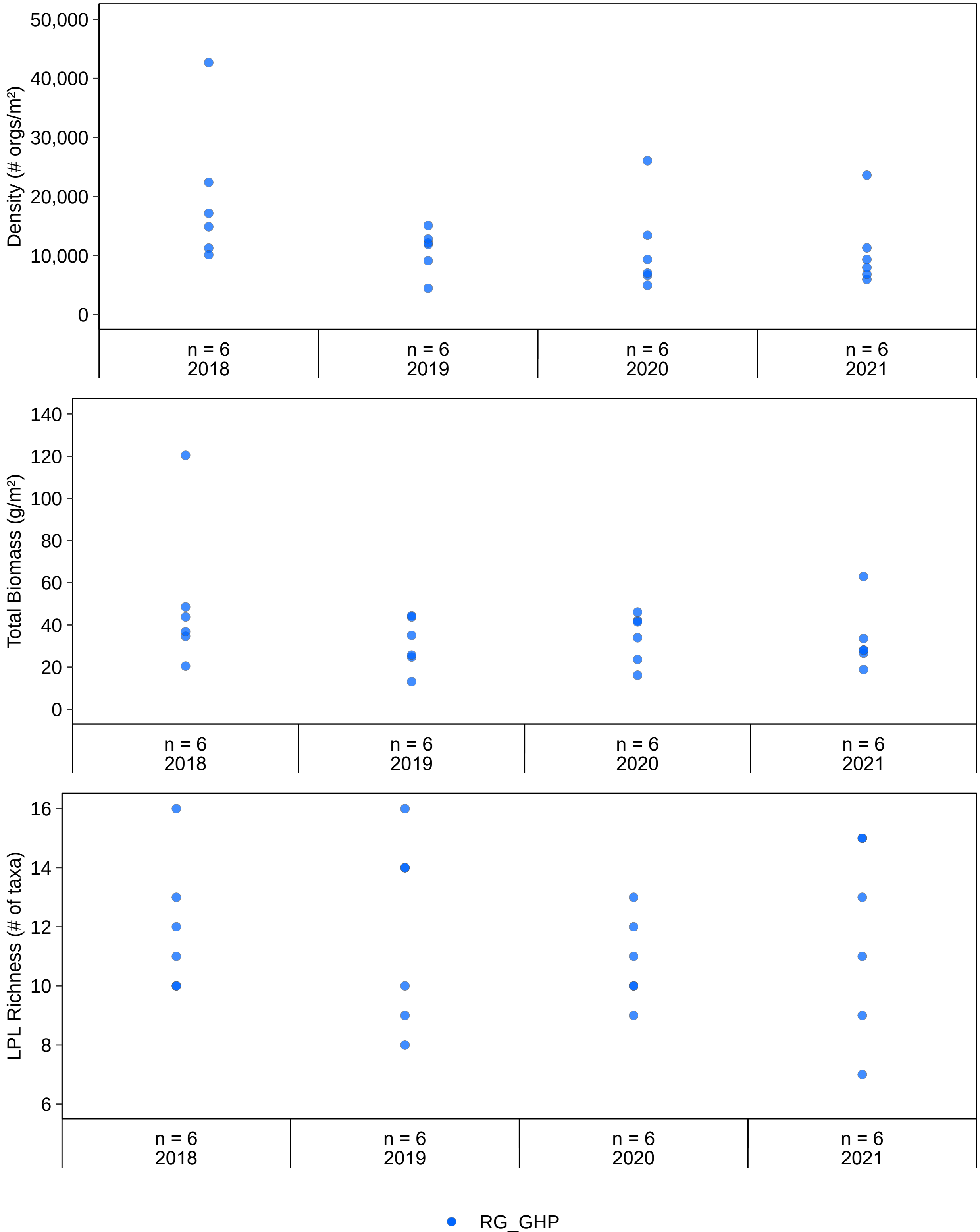


Figure 3.18: Benthic Invertebrate Community Endpoints for Greenhills Creek Sedimentation Pond, September 2018 to 2021

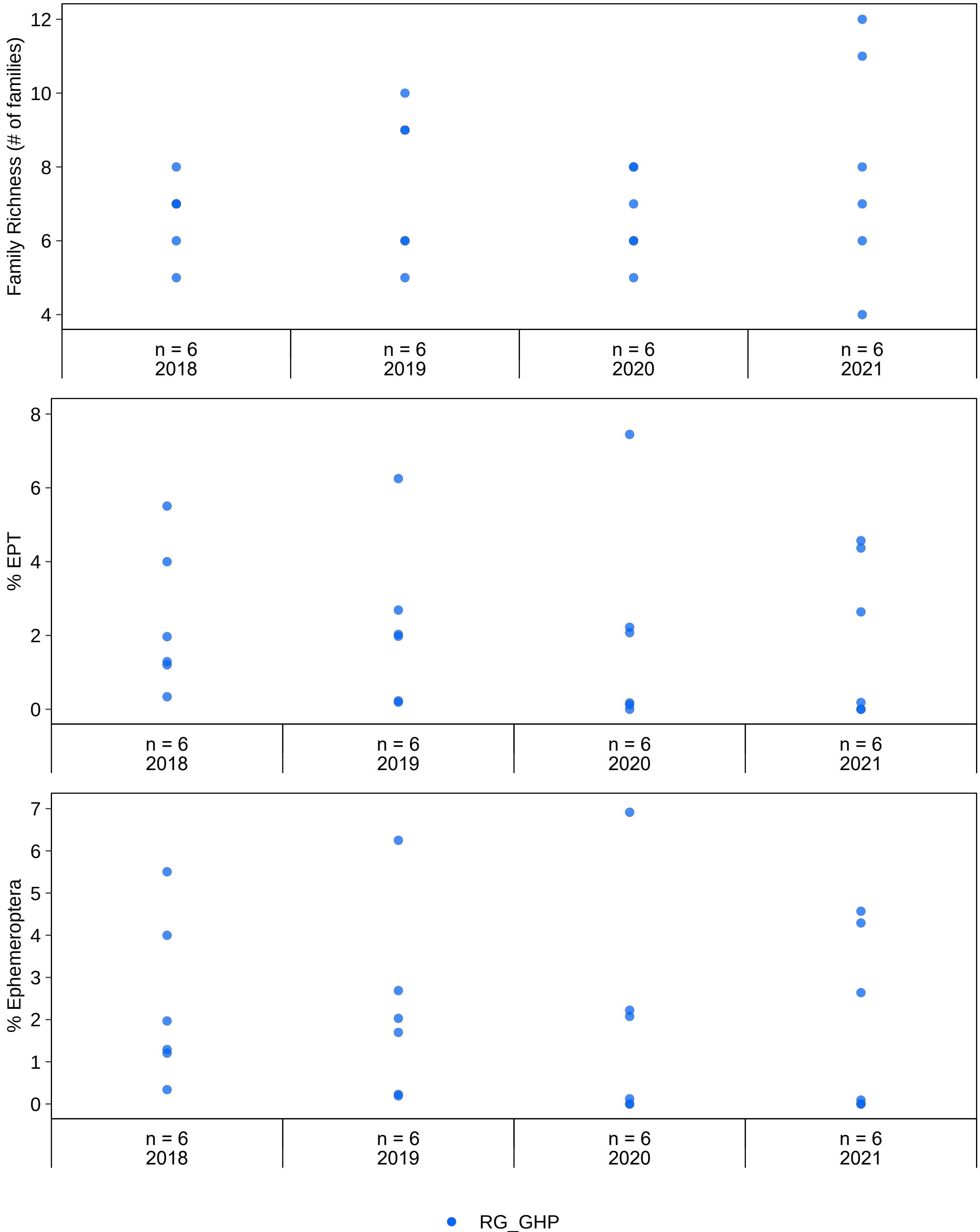


Figure 3.18: Benthic Invertebrate Community Endpoints for Greenhills Creek Sedimentation Pond, September 2018 to 2021

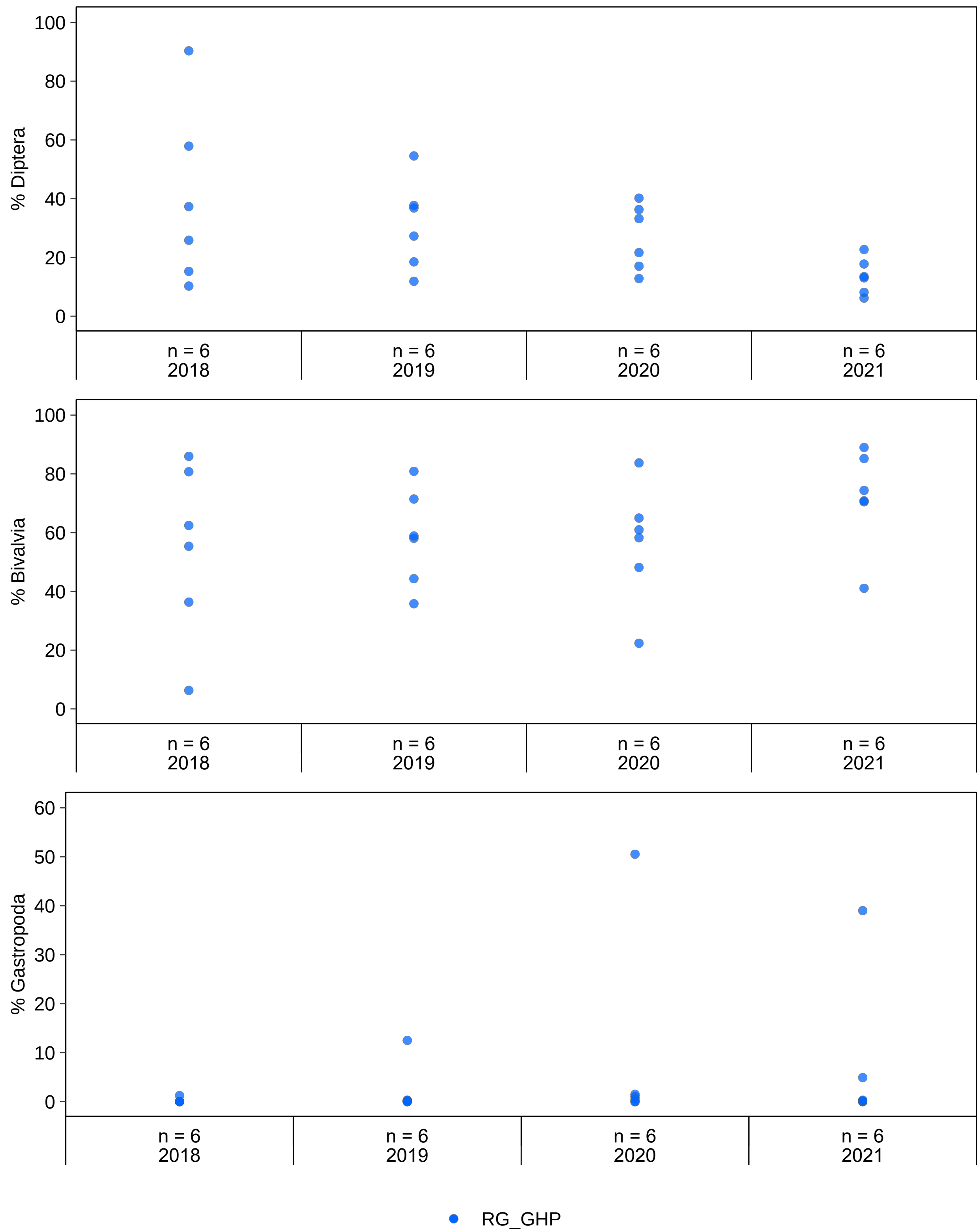


Figure 3.18: Benthic Invertebrate Community Endpoints for Greenhills Creek Sedimentation Pond, September 2018 to 2021

3.3.3 Biological Triggers

Proportions 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 G). Comparisons to biological triggers were completed based on available water quality predictions for routine water quality monitoring stations GH_HWGH_BRB (paired with RG_GHNF) and GH_GH1 (paired with RG_GHCKD). Although %EPT values for samples (n = 3 per area) collected from RG_GHNF and RG_GHCKD in 2021 were consistently below habitat-adjusted normal ranges, only one sample from RG_GHCKD exceeded the biological trigger based on the predicted Aquatic Data Integration Tool (ADIT) score for that location (Appendix G).

3.4 Benthic Invertebrate Tissue Chemistry

3.4.1 Greenhills and Gardine Creeks

No benthic invertebrate tissue chemistry samples were collected from RG_GHNF and RG_GNFF (Upper Greenhills Creek) or RG_GAUT and RG_GANF (Gardine Creek) in February 2021 due to unsafe access, an absence of flow, and/or the presence of anchor ice; however, samples were collected from each of the targeted areas in September 2021 (see Section 2.5.1; Appendix Table H.1).

Selenium concentrations in benthic invertebrate tissue samples collected from Upper Greenhills Creek did not differ significantly among areas in 2021, which was also the case in 2020 (Figure 3.19; Appendix Table H.2). Selenium concentrations in samples collected from the furthest upstream biological monitoring area (RG_GHUT) in February and September 2021 were generally within the reference area normal range and below the lowest EVWQP benchmarks (Figure 3.19; Appendix Table H.1). Only one sample (RG_GHUT-1) from February 2021 had selenium concentrations that exceeded the 97.5th percentile of the reference area normal range. Mean selenium concentrations at RG_GHNF and RG_GHFF were greater than the reference area normal range (Figure 3.19; Appendix Table H.1). One composite-taxa sample (RG_GHFF-1) and the annelid-only sample (RG_GHFF_LUM-1) from RG_GHFF had selenium concentrations greater than the Level 1 Benchmark for dietary effects to juvenile fish (Figure 3.19; Appendix Table H.1).[40]

Selenium concentrations in benthic invertebrate tissues collected from Lower Greenhills Creek in September of each year were generally greater (by 46 to 77%) than those from Upper

[40] However, as noted in Table 2.4, the 11 µg/g dw benchmark for dietary effects to juvenile fish does not apply to WCT, which are the only fish species present in Greenhills and Gardine creeks (Teck 2014).

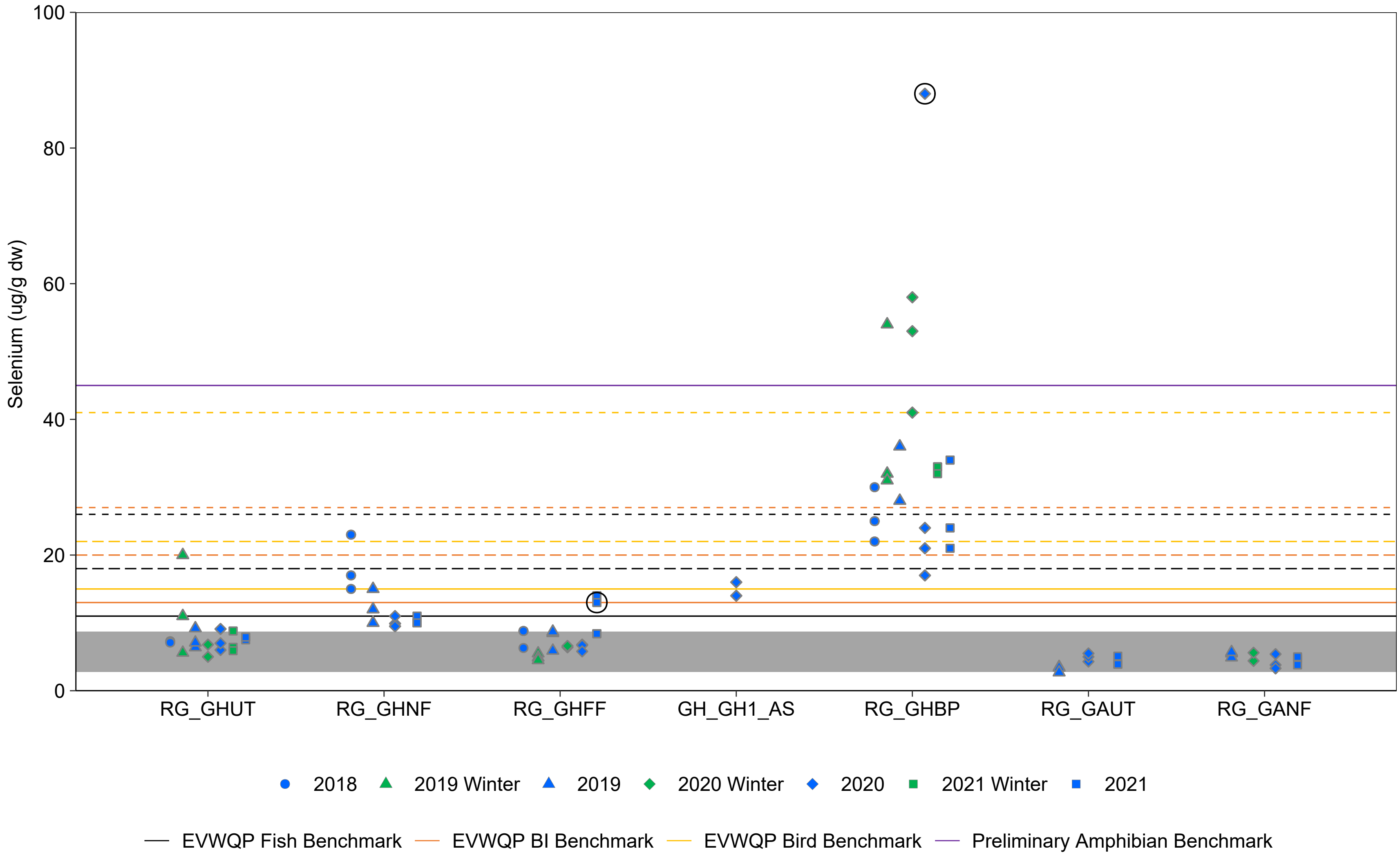


Figure 3.19: Selenium Concentrations in Composite-taxa Benthic Invertebrate Tissue Samples from Greenhills and Gardine Creeks, 2018 to 2021

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) reported in 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.

Greenhills Creek (Figures 3.19 and 3.20; Appendix Table H.2). All samples from RG_GHBP in February 2021 had selenium concentrations greater than the EVWQP Level 3 Benchmark for effects to benthic invertebrates (Figure 3.19; Appendix Table H.1) and the EVWQP Level 2 Benchmarks for effects to benthic invertebrates and dietary effects to juvenile fish in September 2021 (Golder 2014; Figure 3.19; Appendix Table H.1). Additionally, Level 3 Benchmarks for effects to benthic invertebrates and dietary effects juvenile fish and birds and Level 2 Benchmarks for effects to benthic invertebrates and dietary effects to fish and birds were exceeded in one sample each from RG_GHBP (Figure 3.19; Appendix Table H.1).

Each of the benthic invertebrate tissue samples collected from RG_GAUT and RG_GANF on Gardine Creek in September 2021 had selenium concentrations that were within the reference area normal range and less than applicable benchmarks (Figure 3.19; Appendix Tables H.1). Overall, selenium concentrations in tissue samples from Gardine Creek were significantly and consistently lower than those from Upper and Lower Greenhills Creek in 2021 (Figures 3.19 and 3.20; Appendix Table H.2). Concentrations did not differ significantly among areas on Gardine Creek in 2021. The results for Gardine Creek are supported by aqueous selenium speciation data, which indicate there were relatively low concentrations of selenite and no detectable organoselenium species in water samples from RG_GAUT and RG_GANF (Figure 3.21).

Although the ANOVA results indicate that there were some key differences among areas in terms of selenium concentrations in benthic invertebrate tissues (i.e., $Se_{\text{Lower Greenhills}} >> Se_{\text{Upper Greenhills}} > Se_{\text{Gardine}}$; Question 1 from Section 2.5.3), few significant changes in concentrations over time were identified for any of the biological monitoring areas (Question 2 from Section 2.5.3; Figure 3.20; Appendix Table H.3). Selenium concentrations in benthic invertebrate tissues collected from RG_GHNF in September 2019 and 2021 were lower than those collected in September 2018 and 2020 (Appendix Table H.3). Concentrations in samples collected from RG_GAUT in 2020 (mean = 4.9 µg/g dw) were higher, albeit only marginally, than in 2019 (mean = 3.2 µg/g dw) and 2020 (mean = 3.2 µg/g dw) but still well within the normal range and below benchmarks. The overall absence of change over time for RG_GHBP on Lower Greenhills Creek suggests that selenium concentrations in benthic invertebrate tissues at that location are likely unrelated to antiscalant addition (Appendix Table H.3). Rather, the observed concentrations are likely attributed to RG_GHBP being located downstream from Greenhills Creek Sedimentation Pond, as well as the greater prevalence of depositional habitat (and more sediment accumulation) relative to other areas on Greenhills and Gardine creeks.

Selenium concentrations in benthic invertebrate tissues were generally comparable within a given biological monitoring area and year, regardless of whether samples were collected in February or September (Appendix Table H.4). The only exceptions included RG_GHFF on Upper

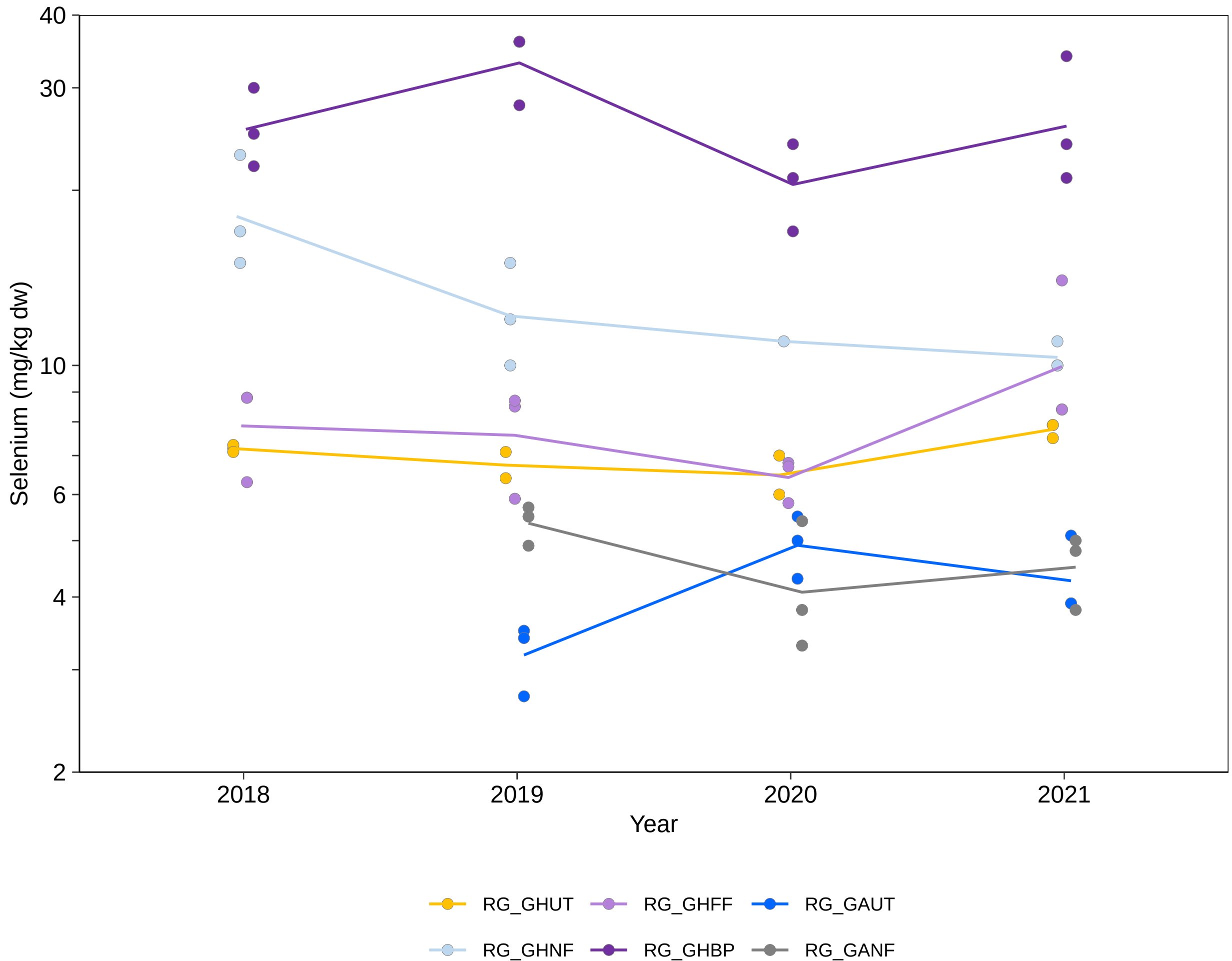


Figure 3.20: Comparisons of Selenium Concentrations in Composite−taxa Benthic Invertebrate Tissue Samples from Greenhills and Gardine Creeks, September 2018 to 2021

Note: Solid lines connect the means for each area.

Greenhills Creek in 2019 (mean selenium concentrations were 35% lower in February versus September) and RG_GHBP on Lower Greenhills Creek in 2020 (mean selenium concentrations were 145% higher in February versus September) (Appendix Table H.4). The higher concentrations observed at RG_GHBP in 2020 were the driving force behind continuing to complete winter benthic invertebrate tissue chemistry sampling at Lower Greenhills Creek in 2022 (Minnow 2021b). The goal was to confirm whether the presence of annelids could have contributed to the higher selenium concentrations observed in the samples from February 2020. Although there is still uncertainty around the taxonomic composition of the samples collected in February 2020, the study team was able to confirm that the benthic invertebrate tissue chemistry samples collected from RG_GHBP from September 2020 to September 2021 did not contain annelids.

Selenium accumulation in aquatic food webs tends to be greater in lentic versus lotic systems with similar concentrations of selenium in water (EPA 2016; Deforest et al. 2017; Golder 2021b). This is because conditions within lentic areas are typically more conducive to formation of organoselenium species and enhanced cycling of selenium via microbially-mediated detrital pathways (Orr et al. 2006). Although Greenhills Creek Sedimentation Pond is not a natural or naturalized lentic area, it possesses some lentic characteristics (e.g., slower flow and abundant vegetation) and its effects on selenium speciation may carry over into lotic habitats immediately downstream (e.g., RG_GHBP) (ADEPT 2022; Golder 2021a). Concentrations of more bioavailable forms of aqueous selenium were highest in Greenhills Creek Sedimentation Pond (see Section 3.4.2, below) and downstream in Lower Greenhills Creek in September 2021, where the highest selenium concentrations in benthic invertebrate tissues were also observed (Figure 3.21; see also Appendix Table C.4). Combined concentrations of dimethylselenoxide and methylseleninic acid in water samples from RG_GHBP in 2021 were consistently greater than the draft screening value (0.025 µg/L) for potential incremental increases in selenium bioaccumulation, regardless of whether the samples were collected in February or August through December (Appendix Table C.4; ADEPT 2022).

Use of the regional one-step water-to-invertebrate lotic selenium bioaccumulation model (Golder 2020) and the B-tool (de Bruyn and Luoma 2021) provided some insight into relationships between aqueous selenium (total selenium and selenium speciation, respectively) and benthic invertebrate tissue selenium concentrations. Additionally, the observed results for Upper and Lower Greenhills Creek are supported by the assessment of biological triggers (Section 3.4.3, below). In 2021, selenium concentrations in benthic invertebrate tissues from Upper Greenhills and Gardine creeks were consistent with predictions based on the lotic bioaccumulation model (Figure 3.22; Appendix Table H.5). These results for 2021 are in good agreement with those for previous years (Appendix Table H.5). Although selenium concentrations

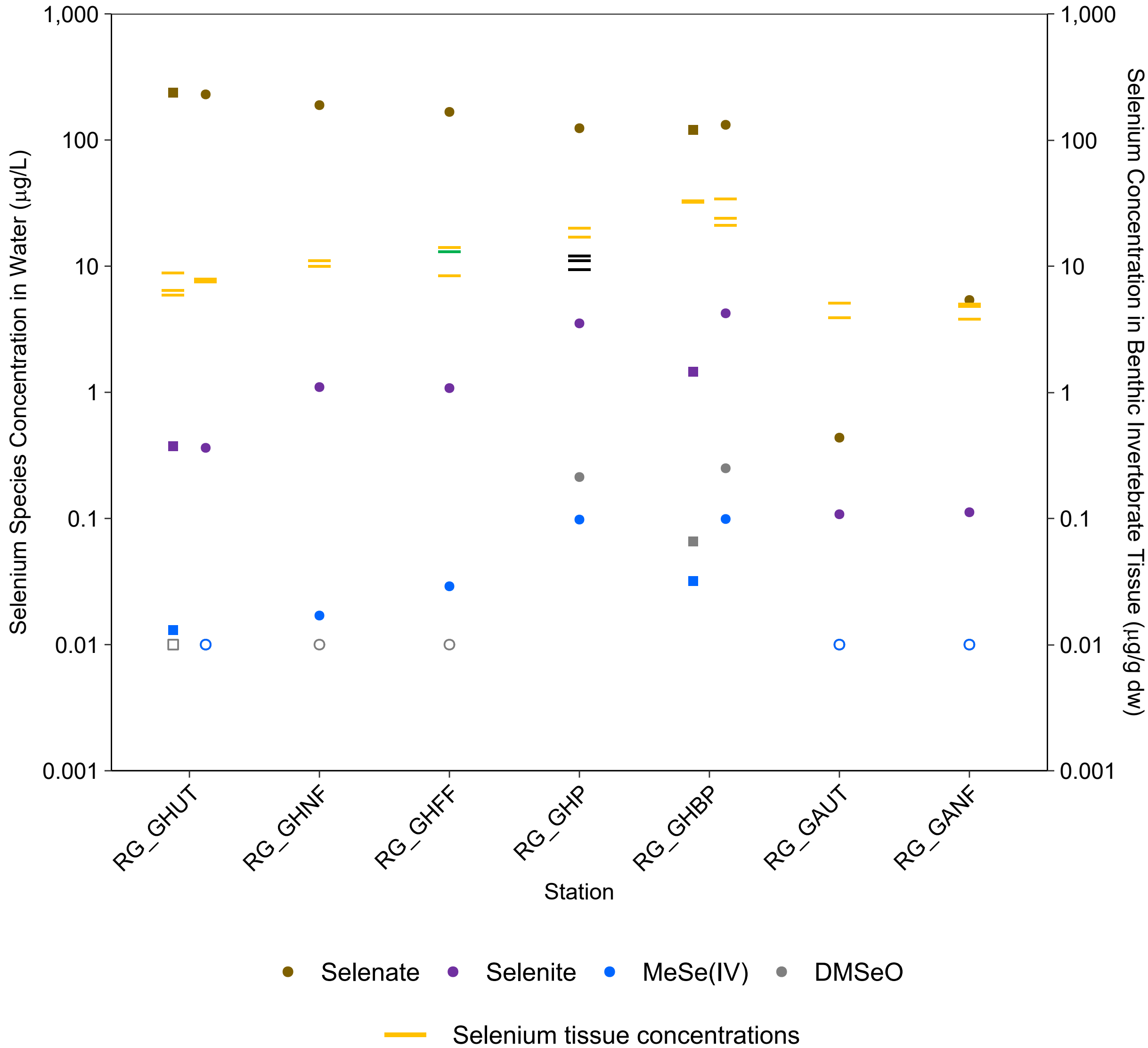


Figure 3.21: Concentrations of Selenium Species Measured in Water Samples Collected Concurrently with Benthic Invertebrate Tissue Samples, February (Squares) and September (Circles), 2021

Notes: Only species with detected values are shown and samples with concentrations at the laboratory reporting limit (LRL) are plotted with an open symbol at the LRL. All selenium concentrations in tissue are for composite-taxa samples (orange), except one annelid-only sample (green) and three clam-only samples (black).

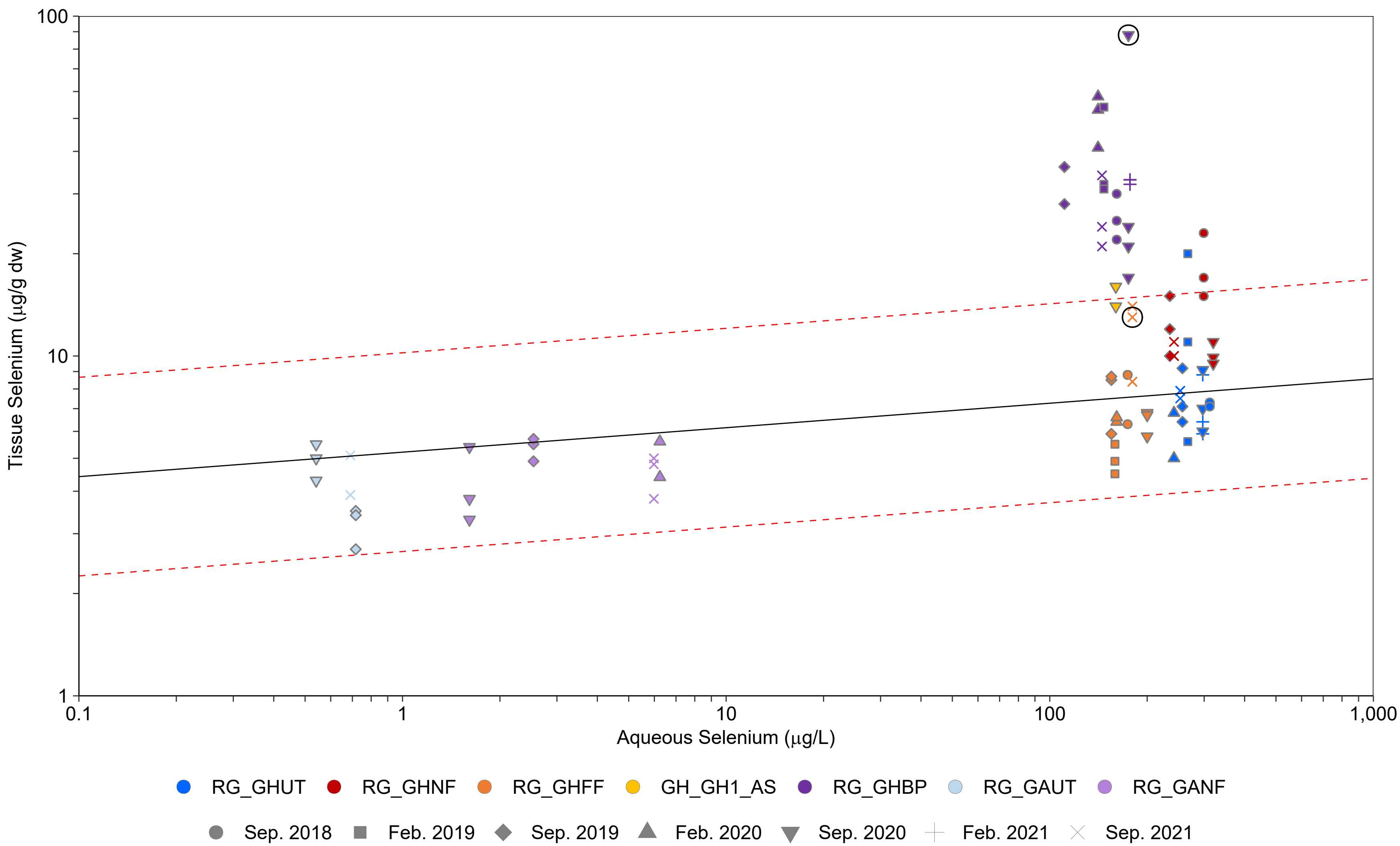


Figure 3.22: Selenium Concentrations in Benthic Invertebrate Tissues Relative to Predictions and Aqueous Selenium Concentrations, 2018 to 2021

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

in benthic invertebrate tissues collected from Upper Greenhills and Gardine creeks in September 2021 were marginally higher than B-tool predictions (Appendix Table H.6), the bioaccumulation model results clearly indicate selenium concentrations in benthic invertebrate tissues from Upper Greenhills and Gardine creeks are related to aqueous total selenium concentrations. Unlike Upper Greenhills and Gardine creeks, selenium concentrations in benthic invertebrate tissues collected from Lower Greenhills Creek in 2021 were higher than expected, based on the lotic bioaccumulation model (Figure 3.22; Appendix Table H.5). These results are similar to conditions previously observed for Lower Greenhills Creek. The B-tool did not consistently over or under-predict benthic invertebrate tissue selenium concentrations at RG_GHBP on Lower Greenhills Creek in 2021 (Appendix Table H.6). This suggests that although the higher than expected selenium concentrations at RG_GHBP are likely attributed, in part, to this location being downstream from the pond and factors related to enhanced generation of organoselenium species, there are potentially other factors influencing selenium bioaccumulation in Lower Greenhills Creek.

3.4.2 Greenhills Creek Sedimentation Pond

Benthic invertebrate tissue samples that were collected from the Greenhills Creek Sedimentation Pond (RG_GHP) and did not contain bivalves had selenium concentrations greater than EVWQP Level 1 Benchmarks for effects to benthic invertebrates and juvenile fish and birds (Figure 3.23; Appendix Table H.7). Selenium concentrations in one of the samples (20 µg/g dw) also exceeded the EVWQP Level 2 Benchmark for dietary effects to juvenile fish. The bivalve-only samples from RG_GHP-3 and RG_GHP-5 had lower selenium concentrations than any other sample collected from the pond in 2021 (i.e., concentrations were within the reference area normal range; Figure 3.23; Appendix Table H.7).

As indicated in Section 3.4.1, concentrations of selenium in benthic invertebrate tissues collected from Greenhills Creek Sedimentation Pond (and lotic habitats downstream) may have resulted, at least in part, from the presence of aqueous selenium in more bioavailable forms. Benthic invertebrate tissue selenium concentrations predicted using the B-tool were higher than concentrations measured in composite-taxa benthic invertebrate tissue samples collected from the pond in September 2021 (Appendix Table H.6). Concentrations of inorganic (selenite) and organic (dimethylselenoxide and methylseleninic acid) forms of selenium in water were higher in the Greenhills Creek Sediment Pond (RG_GHP) than all other upstream stations (Figure 3.21).

3.4.3 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

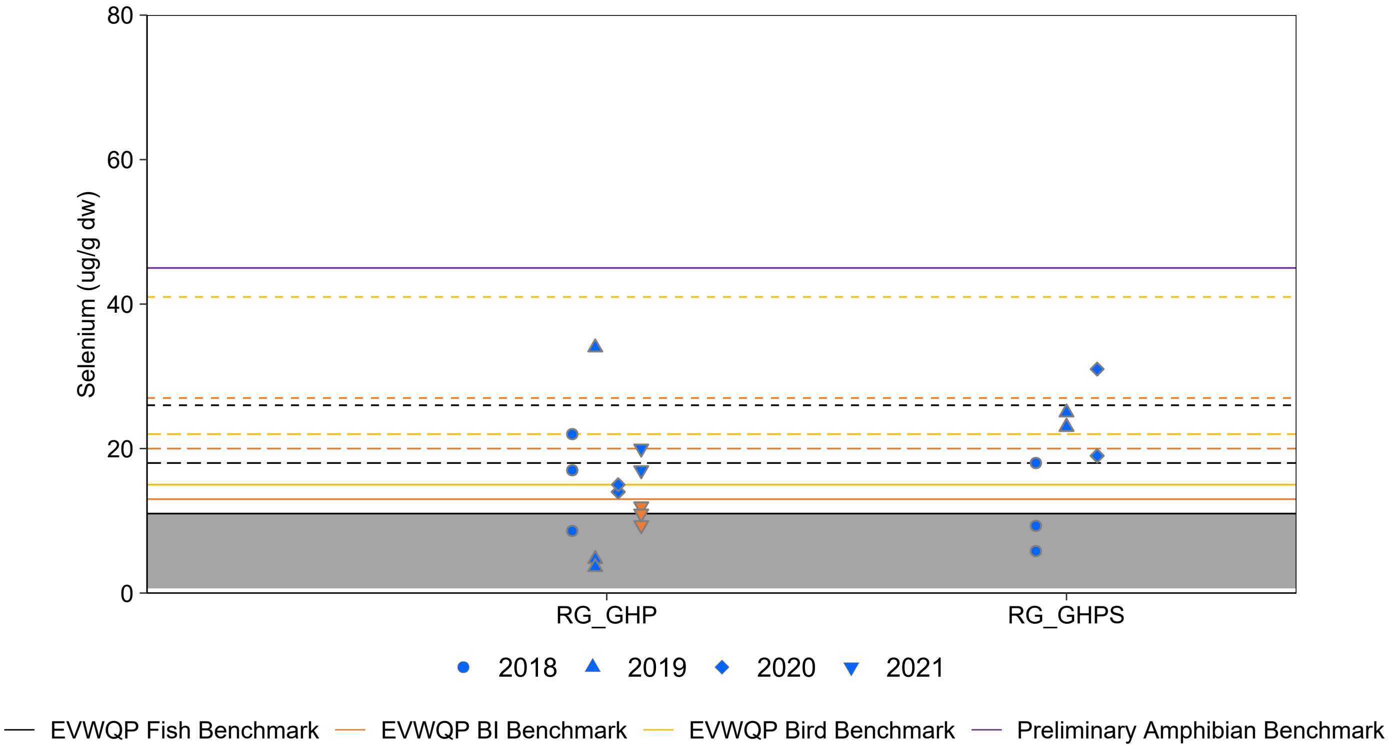


Figure 3.23: Selenium Concentrations in Composite-taxa Benthic Invertebrate Tissue Samples from Greenhills Creek Sedimentation Pond, 2018 to 2021

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. Tissue selenium concentrations are for composite-taxa samples (blue), except three samples that contained clams only (orange).

biological triggers can be found in Appendix G). This was completed for each replicate from biological monitoring areas RG_GHNF (Upper Greenhills Creek) and RG_GHCKD and RG_GHBP (Lower Greenhills Creek). Water quality predictions for routine 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 2021 (n = 3) exceeded the biological trigger for benthic invertebrate tissue selenium concentrations, but all of the samples from Lower Greenhills Creek (n = 3 at RG_GHBP in February 2021 and n = 3 per area in September 2021) exceeded the biological trigger (Appendix G). The biological trigger exceedances for these monitoring locations are likely related to a combination of the factors discussed in Sections 3.4.1 and 3.4.2, including proximity to the Greenhills Creek Sedimentation Pond discharge, which could influence selenium speciation.

3.5 Westslope Cutthroat Trout

3.5.1 Abundance, Density, Biomass, and Health

In 2021, WCT were captured from RG_GHNF and RG_GHFF on Upper Greenhills Creek and RG_GAUT and RG_GANF on Gardine Creek (Figure 2.6; Table 3.7; Appendix Tables I.1 and I.2); WCT were also captured from Lower Greenhills Creek as part of the Upper Fording River WCT Population Monitoring Program (Table 3.7; Appendix Table I.3; Thorley et al. 2022). A fish habitat assessment completed in 2007 indicated that Greenhills Creek Sedimentation Pond and Upper Greenhills Creek, to approximately river kilometre 5.9, represented connected and accessible fish habitat (KNRC 2007).[41] However, in 2021, no WCT were captured from the three closed electrofishing stations at the furthest upstream monitoring area on Upper Greenhills Creek (RG_GHUT; river kilometre 5.2), consistent with results for 2018 and 2019 and the outcomes of the recent eDNA study (Ecofish 2022) (Figure 2.6; Table 3.7; Appendix Tables I.4 to I.6). Gardine Creek was identified in 2007 as providing approximately 1.8 km of fish habitat (KNRC 2007). In 2019 and 2020, field crews noted there were isolated pools and dry sections of channel in Reaches 3 and 4 (from approximately river km 1.4 to 1.8; Appendix Table I.7; Minnow 2020a). The WCT population in Upper Greenhills (including the pond) and Gardine creeks is isolated from Lower Greenhills Creek. A culvert at approximately river kilometre 0.54, between the Stilling Basin and Fording Mine Road, acts as a barrier between the two populations. Therefore, Lower Greenhills Creek represents about 0.54 km of the estimated 88 km of connected habitat that is accessible to the Upper Fording River population of WCT (Thorley et al. 2022).

[41] A detailed description of the habitat types and conditions as they relate to use by WCT is also provided by Minnow (2018b).

Table 3.7: Westslope Cutthroat Trout Electrofishing Catch Results in Greenhills Creek and Gardine Creek, September 2015 to 2021

Parameter	Station		2015	2017	2018	2019	2021	Combined Totals				
								2015	2017	2018	2019	2021
Number of Fish Caught	RG_GHUT		-	1	0	0	0	-	1	0	0	0
	RG_GHNF		-	3	7	6	6	-	3	7	6	6
	RG_GHFF		-	8	11	11	7	-	8	11	11	7
	RG_GHBP		-	110	111	41	-	-	110	111	41	-
	Reach 1 [a]		7	105	-	18	4	7	105	-	18	4
	RG_GAUT [b]		-	-	-	12	34	-	-	-	12	34
	RG_GANF		-	-	-	34	51	-	-	-	34	51
Estimated Fish Density (no./100 m^2 ± 95% CI) by Station	RG_GHUT	GHUT-EF1	-	0	0	0	0	-	3.8	0	0	0
		GHUT-EF2	-	3.8 ± 0	0	0	0					
		GHUT-EF3	-	0	0	0	0					
	RG_GHNF	GHNF-EF1	-	2.3 ± 0	5.1 ± 0	1.6 ± 1.6	1.0 ± 2.3	-	7.1	14	7.2	6.6
		GHNF-EF2	-	2.5 ± 0	5.3 ± 0	1.9 ± 0	2.2 ± 0.84					
		GHNF-EF3	-	2.4 ± 2.4	4.1 ± 0.70	3.8 ± 0.70	2.3 ± 5.2					
	RG_GHFF	GHFF-EF1	-	1.6 ± 0	0	5.9 ± 5.8	2.1 ± 2.1	-	17	10	9.8	5.4
		GHFF-EF2	-	8.1 ± 2.2	5.8 ± 0.60	0.78 ± 0	1.7 ± 3.8					
		GHFF-EF3	-	6.9 ± 1.2	4.5 ± 0.60	3.2 ± 0	1.6 ± 0.58					
	RG_GHBP	GHBP-EF1	-	197 ± 71	25 ± 1.2	16 ± 3.0	-	-	391	190	47	-
		GHBP-EF2	-	115 ± 25	36 ± 1.3	13 ± 3.8	-					
		GHBP-EF3	-	78 ± 5.7	130 ± 7.6	18 ± 5.8	-					
	Reach 1 [a]	Reach 1-EF1	4.1 ± 0.70	55 ± 10	-	7.9 ± 0	2.0 ± 0	11	189	-	29	6.2
		Reach 1-EF2	2 ± 0	89 ± 43	-	12 ± 2.6	2.2 ± 0					
		Reach 1-EF3	4.3 ± 0	45 ± 8.0	-	8.7 ± 2.8	2.0 ± 2.0					
	RG_GANF	GANF-EF1	-	-	-	28 ± 12	23 ± 0.50	-	-	-	54	54
		GANF-EF2	-	-	-	12 ± 2.2	2.5 ± 1.4					
		GANF-EF3	-	-	-	14 ± 0	28 ± 16					

Notes: - = no data for that year/not applicable; no./100 m^2 = number of fish per 100 square metres; % = percent; CI = Confidence Interval; g/100 m^2 = grams of fish biomass per 100 square metres; Minnow = Minnow Environmental Inc.

[a] Fishing in "Reach 1" was completed by consultants other than Minnow and under separate scopes from the Greenhills and Gardine Creeks Aquatic Monitoring Program.

[b] Spot sampling was completed; therefore, pass numbers were insufficient to support estimates of density and biomass.

Table 3.7: Westslope Cutthroat Trout Electrofishing Catch Results in Greenhills Creek and Gardine Creek, September 2015 to 2021

Parameter	Station		2015	2017	2018	2019	2021	Combined Totals				
								2015	2017	2018	2019	2021
Estimated Fish Biomass (g/100 m^2 ± 95% CI) by Station	RG_GHUT	GHUT-EF1	-	0	0	0	0	-	377	0	0	0
		GHUT-EF2	-	377 ± 0	0	0	0					
		GHUT-EF3	-	0	0	0	0					
	RG_GHNF	GHNF-EF1	-	53 ± 0	272 ± 0	100 ± 100	100 ± 229	-	300	598	402	375
		GHNF-EF2	-	24 ± 0	175 ± 0	96 ± 0	183 ± 31					
		GHNF-EF3	-	222 ± 222	152 ± 26	205 ± 35	92 ± 210					
	RG_GHFF	GHFF-EF1	-	58 ± 0	0	87 ± 85	11 ± 10	-	503	618	201	47
		GHFF-EF2	-	127 ± 34	327 ± 34	38 ± 0	8.6 ± 20					
		GHFF-EF3	-	317 ± 55	291 ± 38	75 ± 0	28 ± 11					
	RG_GHBP	GHBP-EF1	-	1,547 ± 553	430 ± 20	452 ± 85	-	-	2,931	2,101	1,165	-
		GHBP-EF2	-	1,012 ± 223	472 ± 18	403 ± 77	-					
		GHBP-EF3	-	372 ± 27	1,199 ± 70	309 ± 122	-					
	Reach 1 [a]	Reach 1-EF1	17 ± 3	372 ± 70	-	100 ± 0	10 ± 0	113	1,107	-	431	73
		Reach 1-EF2	21 ± 0	369 ± 178	-	258 ± 56	31 ± 0					
		Reach 1-EF3	75 ± 0	366 ± 63	-	74 ± 24	31 ± 31					
	RG_GANF	GANF-EF1	-	-	-	310 ± 130	282 ± 6.0	-	-	-	727	758
		GANF-EF2	-	-	-	147 ± 28	28 ± 15					
		GANF-EF3	-	-	-	270 ± 0	448 ± 260					

Notes: - = no data for that year/not applicable; no./100 m^2 = number of fish per 100 square metres; % = percent; CI = Confidence Interval; g/100 m^2 = grams of fish biomass per 100 square metres; Minnow = Minnow Environmental Inc.

[a] Fishing in "Reach 1" was completed by consultants other than Minnow and under separate scopes from the Greenhills and Gardine Creeks Aquatic Monitoring Program.

[b] Spot sampling was completed; therefore, pass numbers were insufficient to support estimates of density and biomass.

Historically, Lower Greenhills Creek was considered a core area for WCT spawning (Cope et al. 2016) and redd densities were considered high in 2021 (Thorley et al. 2022).

In 2021, fork lengths of WCT captured from Upper Greenhills and Gardine creeks ranged from 8.1 to 23 cm and 4.0 to 16 cm, respectively, which is consistent with the ranges of fork lengths observed in previous years (n = 13 and n = 85 WCT, respectively, in 2021; Appendix Tables I.8 to I.11). Fork lengths of WCT captured from Lower Greenhills Creek as part of the Upper Fording River WCT Population Monitoring Program in 2021 were between 7.2 and 13 cm (n = 4), which is within the range of fork lengths reported previously for Lower Greenhills Creek (Appendix Tables I.12 and I.13). Age-1 WCT in the isolated population above the pond were estimated to have fork lengths between 5.5 and 11 cm, based on length-frequency analysis (Appendix Figure I.1; Appendix Tables I.8 and I.9). Age-1 WCT from Lower Greenhills Creek had estimated fork lengths between 7.5 and 12 cm and were therefore larger, in general, relative to age-1 WCT from Upper Greenhills and creeks, as well as the other creeks sampled as part of the Upper Fording River WCT Population Monitoring Program (Thorley et al. 2022). Additionally, Thorley et al. (2022) reported that fork lengths for age-0 fish were greatest for Lower Greenhills Creek relative to other sampling areas in the Upper Fording River population area (i.e., 5.7 cm with a 95% credible interval of 5.1 to 6.3 cm). It appears that the Greenhills Creek Sedimentation Pond, or conditions downstream from the pond, have a warming effect on the water in Lower Greenhills Creek (see Appendix Tables C.1 and E.1 as examples, as well as Ecofish 2022). This may help explain the enhanced growth and larger body sizes reported for young WCT in Lower Greenhills Creek relative to areas upstream of the pond and in other tributaries to the Fording River (Thorley et al. 2022). Growth rates of WCT in Greenhills and Gardine creeks were not calculated because no previously PIT-tagged fish were captured in 2021 (Thorley 2022, pers. comm.; Appendix Tables I.8, I.9, and I.12).

Condition (weight-at-length) of fish captured from Upper Greenhills and Gardine creeks was lower in 2021 relative to previous years, whereas condition was similar among WCT captured from Upper Greenhills Creek from 2017 to 2019 (Figures 3.24 to 3.26; Appendix Tables I.14 to I.16). Contrary to Upper Greenhills and Gardine creeks, fish condition in the Upper Fording River WCT population, which has access to habitats in Lower Greenhills Creek, was near (2019 and 2020) or above average (2021) in recent years (Thorley et al. 2022). The largest decrease in fish condition in 2021 was observed for WCT from Upper Greenhills Creek (RG_GHNF and RG_GHFF), where condition decreased by 26% (outliers removed) in 2021 relative to 2017 (Appendix Table I.14). Condition of WCT captured from the isolated pools on upper Gardine Creek (RG_GAUT) in 2021 was about 14% lower in 2021, relative to the first year of fishing in 2019 (no fishing was completed in 2020; Appendix Table I.15). The WCT captured from lower Gardine Creek (RG_GANF) in 2021 were also in lower condition relative to 2019; however, the

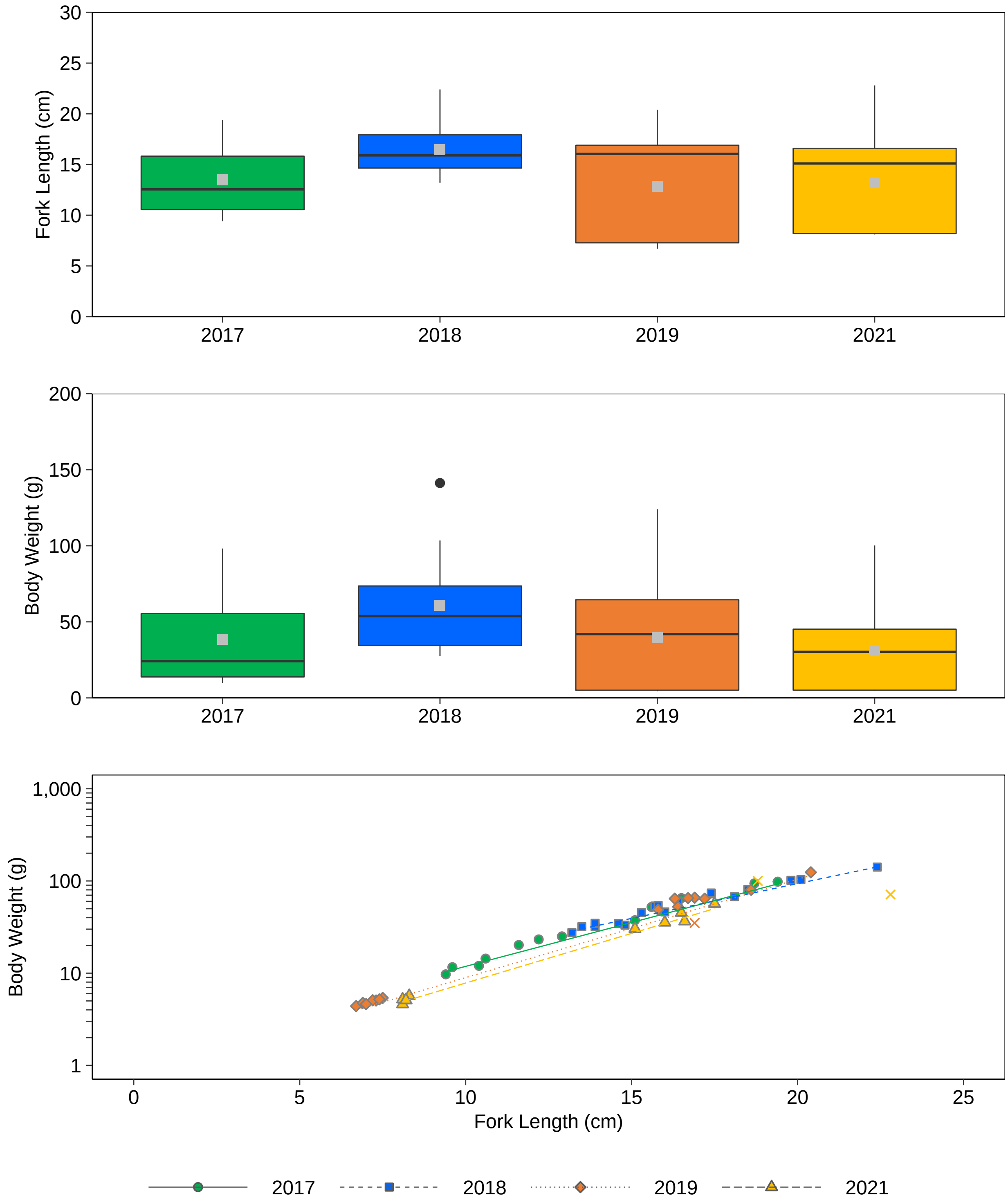


Figure 3.24: Comparisons of Length, Weight, and Weight-at-Length (Body Condition) for Westslope Cutthroat Trout Captured from Upper Greenhills Creek, 2017 to 2021

Notes: Outliers are plotted with an 'x'. Fish with fork lengths <6.5 cm were excluded from the analysis.

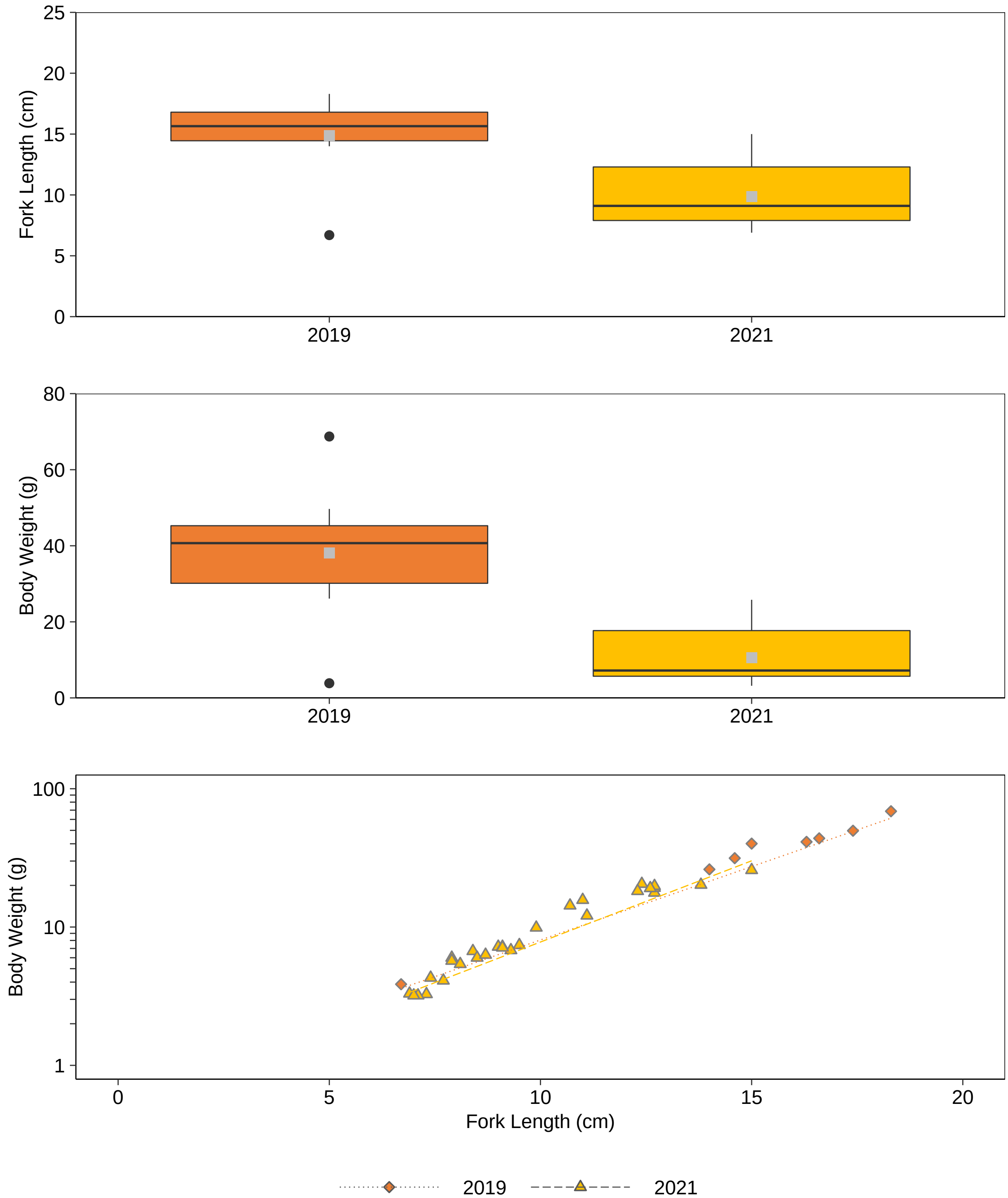


Figure 3.25: Comparisons of Length, Weight, and Weight-at-Length (Body Condition) for Westslope Cutthroat Trout Captured from Upper Gardine Creek, 2019 to 2021

Notes: Outliers are plotted with an 'x'. Fish with fork lengths <6.5 cm were excluded from the analysis.

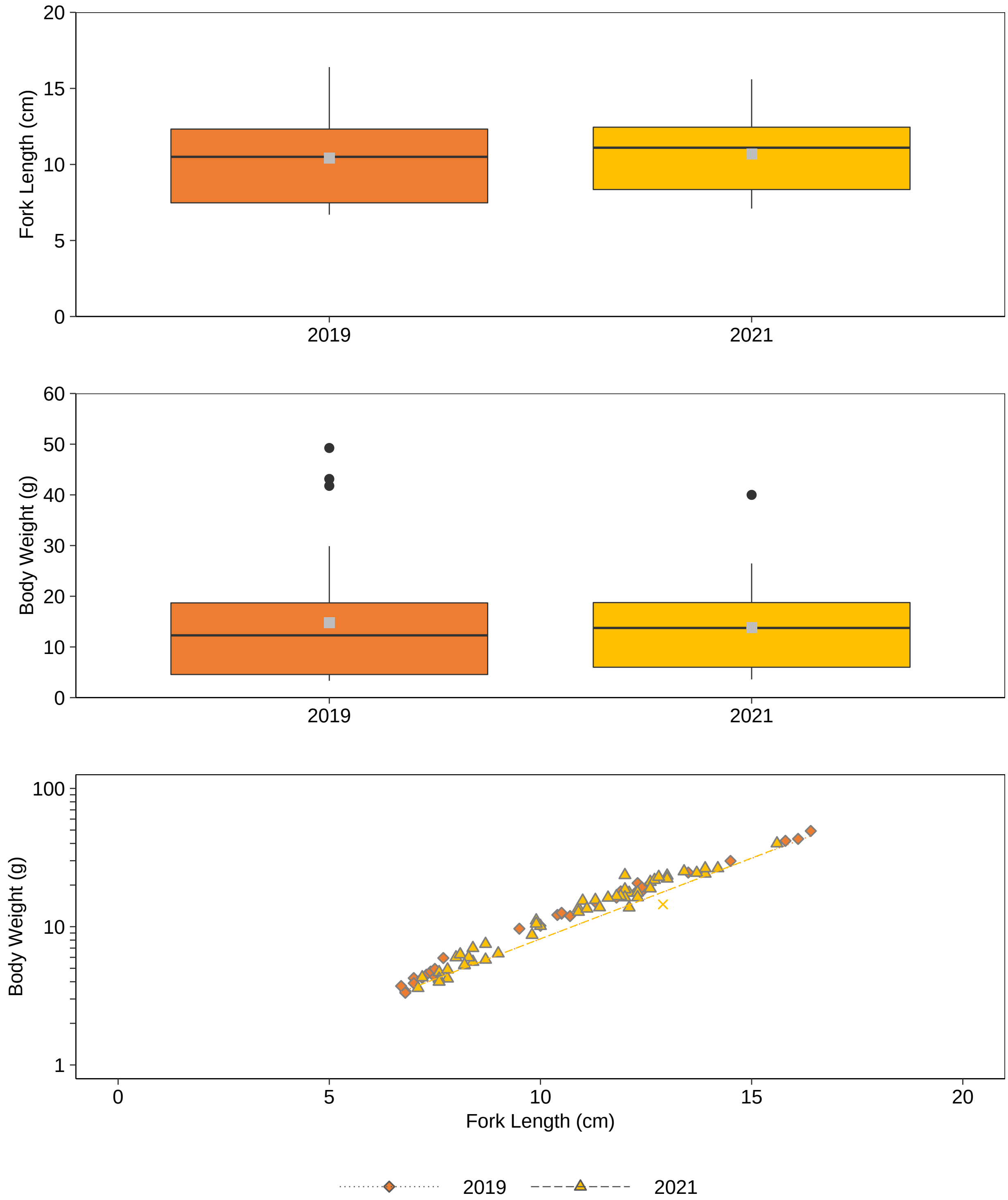


Figure 3.26: Comparisons of Length, Weight, and Weight-at-Length (Body Condition) for Westslope Cutthroat Trout Captured from Lower Gardine Creek, 2019 to 2021

Notes: Outliers are plotted with an 'x'. Fish with fork lengths <6.5 cm were excluded from the analysis.

change (i.e., a 6.1% decrease; outliers removed) was less than what might be considered biologically meaningful (i.e., could be attributed to natural, annual variability; Environment Canada 2012b). It is possible that some regional factor(s) may have depressed fish condition regionally within the isolated Upper Greenhills/Gardine creeks fish population in 2021. Additionally, the poorer water quality conditions and higher calcite concretion in Upper Greenhills Creek relative to upper and lower Gardine Creek may have contributed to the observed spatial patterns in reduced fish condition. The larger reduction in fish condition at upper versus lower Gardine Creek may be attributed to fish being isolated in pools and food resources being limited (i.e., increased competition and insufficient caloric intake). For example, n = 8 fish were captured from the isolated pool at RG_GAUT-EF1 in 2019, whereas n = 28 fish were captured from the same isolated pool in 2021 (Appendix Tables I.2 and I.17). Based on observed habitat conditions, the pool was likely a similar size in both years. The presence of more fish in the pool in 2021 would be expected to put a greater strain on food resources, potentially leading to reduced fish condition.

Two (15%) of the n = 13 WCT captured from Upper Greenhills Creek, seven (8.2%) of the n = 85 WCT captured from Gardine Creek, and none of the n = 4 WCT captured from Lower Greenhills Creek in 2021 had external anomalies (Table 3.8; see also Table 2.5). Both anomalies observed on WCT from Upper Greenhills Creek were considered minor and consisted of a nodule on one fish's lip/jaw and another fish with light active fin erosion on its dorsal and caudal fins (Appendix Table I.8). Anomalies on WCT from Gardine Creek included two incidences of minor/light active fin erosion, two incidences of deformed caudal fins, one caudal fin with a minor split in it, one severely shortened operculum, and one minor, obvious parasitic infestation (Appendix Table I.9). One fish from Gardine Creek also had a caudal fin injury that was attributed to being bitten by another fish; this injury was excluded from the count of external anomalies.

The anomaly rates for Upper Greenhills and Gardine creeks in 2021 were higher than those reported for WCT collected from Lower Greenhills Creek and from other areas sampled as part of the RAEMP in 2021 (Minnow 2023, *in prep*). Of the 96 WCT collected throughout Management Units 1 to 5 as part of the September 2021 RAEMP program, only four (4.1%) individuals were identified as having anomalies, which included three incidences of light active fin erosion and one tumour that did not show signs of sloughing or ulceration. None of the WCT collected from reference areas on the Bull (n = 8) or Flathead (n = 8) rivers in 2021 had anomalies (Minnow, *in prep*). Additionally, n = 16 WCT were captured from the Upper Fording River in June 2021 to either support the RAEMP. Two of the fish had anomalies (i.e., one case of minor caudal fin erosion and another fish with substantially shortened/missing opercula; Minnow, *in prep*).

Table 3.8: Summary of External Anomalies for Westslope Cutthroat Trout Captured from Upper Greenhills and Gardine Creeks, 2021

Study Area		2021			
		Upper Greenhills Creek		Gardine Creek	
Biological Monitoring Area		**RG_GHNF**	**RG_GHFF**	**RG_GAUT**	**RG_GANF**
Total Sample Size		6	7	34	51
Number of Fish with Anomalies		1	1	4	3
Severity of External Anomalies (% of Total Anomalies)	**0**	83%	86%	88%	94%
	1	17%	14%	6%	4%
	2	0%	0%	0%	0%
	3	0%	0%	0%	2%
	No rating [a]	0%	0%	6%	0%
Total Proportion of Fish with Anomalies (%)		**17%**	**14%**	**12%**	**6%**

Notes: % = percent. Severity of external anomalies: 0 = no anomalies, 1 = minor, 2 = moderate; 3 = severe. Only an external assessment of anomalies was completed on the sampled fish. This severity assessment replaces "DELT" (deformities, erosion, lesion, and tumor) surveys (Sanders et al. 1999) completed in previous years.

[a] Two fish had fin deformities (one with a deformed caudal fin and one with a shortened lower caudal fin lobe). However, to date, a rating system has not been developed for this type of deformity (see Minnow 2021b,c).

Visual observations of fin erosion for WCT captured from Upper Greenhills and Gardine creeks were supported by measurements of relative caudal fin lengths. For Upper Greenhills Creek, relative caudal fin lengths for captured WCT were between 11 and 15% (mean = 13%; n = 13; Appendix Table I.8). These results are comparable to those for 2019, but lower relative to 2017 (Appendix Table I.10). Relative caudal fin lengths for WCT captured from upper and lower Gardine Creek in 2021 were between 13 and 18% (mean = 15%; n = 34) and between 11 and 16% (mean = 14%; n = 51), respectively (Appendix Table I.9). These results are considered comparable to those for WCT captured from Gardine Creek in 2019 (Appendix Table I.11). Overall, the mean relative caudal fin lengths for WCT captured from Upper Greenhills and Gardine creeks in 2021 were also similar to those reported for wild-caught cutthroat trout (*Oncorhynchus clarkii*) captured in Utah (Bosakowski and Wagner 1994).

In 2021, closed-station density estimates for fry and juvenile WCT, as well as estimates of WCT abundance and biomass, were higher at RG_GANF on lower Gardine Creek than at biological monitoring areas on Upper and Lower Greenhills Creek (Figure 2.6; Table 3.7; Appendix Tables I.1 to I.3). For example, multiple-pass-removal techniques employed at RG_GANF yielded density estimates between 2.5 and 28 fish/100 m^2 in 2021, whereas using the same methods at RG_GHNF and RG_GHFF yielded fry and juvenile density estimates between 1.0 and 2.3 fish/100 m^2 (Table 3.7; Appendix Tables I.1 and I.2). Fry and juvenile density estimates for Lower Greenhills Creek were between 2.0 and 2.2 fish/100 m^2 (Table 3.7; Appendix Table I.3). In 2019, there was some indication that WCT densities within Upper Greenhills Creek increased with increasing distance downstream and proximity to the Greenhills Creek Sedimentation Pond (Minnow 2020a). Although no fish were captured at the furthest upstream monitoring area on Upper Greenhills Creek (RG_GHUT) in 2021, the data for the other two monitoring areas (RG_GHNF and RG_GHFF) were not suggestive of the same upstream-to-downstream pattern as 2019 (Table 3.7; Appendix Table I.1).

Overall, estimates of fry and juvenile densities, abundance, and biomass for lower Gardine Creek were comparable among years (i.e., in 2019 and 2021) but densities and abundances for Upper Greenhills Creek were generally lower than in previous years (Table 3.7; Appendix Tables I.1, I.2, I.4 to I.6, and I.17). Estimated WCT biomass at RG_GHFF on Upper Greenhills Creek was also lower than in previous years of monitoring; however, biomass estimates for RG_GHNF, which is further upstream, were generally comparable to previous years (Table 3.7; Appendix Tables I.1, I.2, I.4 to I.6, and I.17). Overall, it is difficult to identify the key factors and interactions driving the differences in fry and juvenile densities, abundance, and biomass over time. In lower Gardine Creek, calcite concretion scores were lower in 2021 relative to 2019, and benthic invertebrate densities and biomass, which are indicators of food availability for WCT, were similar between years (see Sections 3.2.1 and 3.3.1). Calcite concretion scores and invertebrate densities and biomass at RG_GHNF and RG_GHFF in 2021 were also similar to or better than in previous years; however, as described above, WCT densities and abundance at these same locations were lower than in previous years.

3.5.2 Tissue Chemistry

A single muscle tissue sample was collected opportunistically from one incidental WCT mortality observed in Reach 1 of Lower Greenhills Creek in September 2021. The incidental mortality was a juvenile WCT (fork length = 5.7 cm; weight = 2 g) that was in good external health (see Table 2.5). The selenium concentration in the muscle sample (29 µg/g dw) was greater than the estimated effects threshold of 15.5 µg/g dw (Appendix Table I.19) and exceeded the biological trigger (Appendix G). It was also greater than muscle selenium concentrations reported for WCT (mean = 19 µg/g dw; n = 8) that were sampled from the Greenhills Creek Sedimentation Pond in 2018 (Minnow 2020a). Based on an ovary:muscle ratio of 1.6:1.0 (Nautilus Environmental and Interior Reforestation 2011), the WCT that was sampled in 2021 had an estimated ovary selenium concentration of 46 µg/g dw, which is higher than the WCT that were sampled from the pond in 2018 (mean = 30 µg/g dw). The estimated ovary concentration for the single WCT analyzed in 2021 was also above the site-specific Level 3 Benchmark (33 µg/g dw; median effective concentration [EC_{50}] equivalent) for WCT ovaries and considered indicative of a potential for reproductive effects (Teck 2014).

4 SUMMARY

This report summarizes the 2021 results of the GGCAMP. Sampling in 2021 consisted of a sixth year of monitoring in Upper Greenhills Creek, the third year of monitoring in Gardine Creek, a fourth year of sampling in Greenhills Creek Sedimentation Pond, and a fourth year of aquatic effects monitoring following initiation of antiscalant addition in Lower Greenhills Creek. Furthermore, 2021 was the third year of winter benthic invertebrate tissue chemistry sampling.

Data collected to support the GGCAMP in 2021 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, specifically?

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 conditions within Greenhills and Gardine creeks in 2021.

Overall, concentrations of most mine-related constituents with EWTs were below water quality guidelines, benchmarks, and screening values in 2021, except for TDS, nitrate, sulphate, total nickel, total selenium, total uranium, and dissolved cadmium. Water quality was generally better in Gardine Creek than in Greenhills Creek and the Greenhills Creek Sedimentation Pond. Upstream-to-downstream differences within Greenhills Creek were largely attributed to dilution effects downstream from Gardine Creek and components of the antiscalant compound being detected at higher concentrations in Lower Greenhills Creek (see below). Specifically, Gardine Creek appears to be a source of dilution for aqueous total antimony, nickel, and selenium.

Aqueous selenium species were dominated by selenate for all areas and sampling events in 2021. Concentrations of organoselenium species tended to increase with distance downstream in Greenhills Creek; the highest concentrations were observed within the Greenhills Creek Sedimentation Pond and Lower Greenhills Creek in September 2021. These results are attributed to enhanced formation of organoselenium species within the pond and carry-over effects immediately downstream.

In 2021, calcite was present throughout Greenhills Creek and Gardine Creek within and downstream from the seeps from the GHO east spoil. The number of particles with calcite did not differ among areas on Greenhills Creek in 2021, but the proportion of calcite coverage on a given particle was lowest on Lower Greenhills Creek. Concretion was highest in Upper Greenhills Creek. Within Lower Greenhills Creek specifically, CI' and C_c decreased with increasing distance downstream to GH_GREE1-25, which is near the Greenhills Creek mouth.

Sediment particle sizes, TOC content and concentrations of metals and PAHs differed among biological monitoring areas in 2021. Sediments from Lower Greenhills, upper Gardine, and lower Gardine creeks and the Greenhills Creek Sedimentation Pond were primarily composed of silt/clay, sand, sand/silt, and silt/clay, respectively. The samples from the pond, followed by Lower Greenhills Creek, had the highest TOC content. Concentrations of cadmium, nickel, selenium, and PAHs in "bulk" sediments were generally highest in the pond and/or at Lower Greenhills Creek, which is not unexpected, given the propensity of these analytes to readily adsorb to fines and TOC. Calcium concentrations were consistently higher at areas with calcified substrates.

Exceedances of upper BC WSQG or the alert concentration for selenium in 2021 were identified for nickel, selenium, silver, acenaphthene, acenaphthylene, benzo(a)anthracene, chrysene, dibenz(a,h)anthracene, fluorene, 2-methylnaphthalene, naphthalene, and phenanthrene. Concentrations of arsenic, cadmium, iron, manganese, zinc, benzo(a)pyrene, benzo(g,h,i)perylene, fluoranthene, and pyrene exceeded the lower, but not upper, BC WSQG in at least one sample. However, concentrations of arsenic, cadmium, and iron in "bulk" sediments were within reference area normal ranges.

Overall, the distribution of metals among each of the potentially mobile sediment fractions (i.e., fractions 1 to 4) and fraction 5 (residual metals) was fairly consistent among sediment sampling areas. Additionally, guideline exceedances based on sediment fractions 1 to 4, which represent an overestimation of the bioavailable constituent concentrations in sediments, were limited to cadmium, manganese, nickel, and selenium in 2021, regardless of sampling location. Concentrations of selenium in sediment fractions 1 to 4 were elevated relative to the alert concentration at each sediment sampling location in 2021; most selenium was associated with fraction 4 (organic-bound). Cadmium concentrations in sediment fractions 1 to 4 were also elevated relative to the upper BC WSQG at Lower Greenhills Creek and relative to the lower BC WSQQG at Gardine Creek and in the Greenhills Creek Sedimentation Pond. Most cadmium was in fractions 2 (carbonate) and 3 (easily reducible and iron and manganese oxides). Concentrations of manganese (upper Gardine and Lower Greenhills creeks) and nickel (all sediment sampling areas) in sediment fractions 1 to 4 also exceeded the lower, but not upper, BC WSQG.

The SQI were generally indicative of poor sediment quality relative to most lotic RAEMP sampling areas and natural or naturalized lentic areas in the Elk River watershed. Of the biological monitoring areas within the Greenhills Creek watershed, the Greenhills Creek Sedimentation Pond had the lowest SQI in 2021, followed by Lower Greenhills Creek.

Benthic invertebrate abundances, densities, LPL richness, %Ephemeroptera, and %Plecoptera in 2021 were generally similar among the biological monitoring areas on Greenhills Creek. The higher biomass on Lower Greenhills Creek suggests the availability of food for fish may have been better there, relative to Upper Greenhills Creek, in 2021. It is also possible that the benthic invertebrate community in Lower Greenhills Creek was showing signs of recovery in the post-treatment period. Proportions of Diptera (tolerant taxa) were generally lower on Lower Greenhills Creek versus untreated areas on Upper Greenhills Creek. Increases in proportions of sensitive EPT taxa at the treated versus untreated areas during 2018 to 2020 were also observed. However, one of the three timed kick samples from Lower Greenhills Creek exceeded the biological trigger for %EPT, based on its predicted ADIT score, whereas each of the three timed kick samples from Upper Greenhills Creek had %EPT consistent with expectations.

Benthic invertebrate densities on Gardine Creek were highest at the furthest downstream monitoring area; however, biomass was similar between areas. The higher %Diptera in the samples from lower Gardine Creek, downstream from the seeps, likely reflects this taxonomic group's ability to tolerate a wider range of environmental conditions.

In 2021, strong, positive relationships were observed between benthic invertebrate density and aqueous concentrations of TDS, nitrate, nitrite, sulphate, and total antimony, boron, molybdenum, nickel, selenium, uranium and zinc. Other strong significant positive (%Diptera) or negative (%EPT, %Ephemeroptera, and %Plecoptera) relationships with TDS, nitrate, sulphate, and total nickel, selenium, and uranium were also observed. Additionally, %EPT and %Trichoptera were strongly negatively correlated to CI, CI', and concretion whereas %Diptera tended be higher in areas with more calcite. Overall, the results observed for the benthic invertebrate communities in Upper and Lower Greenhills and Gardine creeks are likely associated with the combined influences of water quality and calcite.

The benthic invertebrate community in the Greenhills Creek Sedimentation Pond differed from the creek sampling areas in 2021, which is unsurprising given the lentic-like characteristics of the pond. Bivalves were the predominant taxonomic group in the samples and gastropods were also relatively abundant. Proportions of Diptera were much higher than %EPT.

The highest selenium concentrations in composite-taxa benthic invertebrate tissues collected from creek habitats in 2021 were observed for Lower Greenhills Creek. Mean concentrations in samples collected from RG_GHBP in 2021 (range = 21 to 34 µg/g dw) exceeded EVWQP Level

3 Benchmarks for effects to invertebrates and juvenile fish and birds. Additionally, selenium concentrations in each of the nine samples collected from Lower Greenhills Creek in 2021 exceeded the biological trigger (i.e., were higher than the reference area normal range and the 95% prediction interval from the lotic bioaccumulation model). Conversely, mean selenium concentrations in tissues from Upper Greenhills Creek varied from within the reference area normal range and less than benchmarks to above the normal range and the most conservative EVWQP Level 1 Benchmark in 2021. No exceedances of the biological trigger were identified for Upper Greenhills Creek. Additionally, each of the benthic invertebrate tissue samples collected from Gardine Creek in September 2021 had selenium concentrations that were within the reference area normal range and below applicable benchmarks. Selenium concentrations in benthic invertebrate tissues were higher than expected on Lower Greenhills Creek in 2021, and this was likely attributed, at least in part, to enhanced generation of organoselenium species in the Greenhills Creek Sedimentation Pond located immediately upstream. However, results of the B-tool analysis suggest that some factors other than selenium speciation could also be contributing to tissue selenium concentrations in Lower Greenhills Creek.

Composite-taxa benthic invertebrate tissue samples from Greenhills Creek Sedimentation Pond had selenium concentrations greater than the EVWQP Level 1 Benchmarks for effects benthic invertebrates and juvenile fish and birds, but lower than those predicted using the B-tool. Selenium concentrations in the bivalve-only samples from the pond were lower than benchmarks and within the reference area normal range.

In 2021, WCT were sampled from Upper Greenhills and Gardine creeks (GGCAMP) and Lower Greenhills Creek (Upper Fording River WCT Population Monitoring Program). Fish were successfully sampled from each targeted area, except at the furthest upstream biological monitoring area on Upper Greenhills Creek. The lack of fish observations or captures at this location is consistent with the results of an eDNA study completed in 2021.

In general, age-0 and age-1 WCT from Lower Greenhills Creek are expected to attain longer fork lengths than individuals from Upper Greenhills and Gardine creeks, as well as other creeks within the Upper Fording River population area. Growth rates of WCT in Greenhills and Gardine creeks were not calculated because no previously PIT-tagged fish were captured in 2021. Condition (weight-at-length) of fish captured from Upper Greenhills and Gardine creeks was lower in 2021 relative to previous years, whereas fish condition in the Upper Fording River WCT population, which can access Lower Greenhills Creek, was above average in 2021.

Fifteen percent of the 13 WCT captured from Upper Greenhills Creek, 8.2% of the 85 WCT captured from Gardine Creek, and none of the four WCT captured from Lower Greenhills Creek in 2021 had external anomalies (e.g., fin erosion, deformities, tumours). The anomaly rates for

Upper Greenhills and Gardine creeks were higher than those reported for WCT collected from other areas sampled as part of the RAEMP in 2021. Anomalies observed in Greenhills and Gardine creeks in 2021 were mostly minor and primarily classified as light active fin erosion or fin deformities. Overall, visual observations of fin erosion in 2021 were supported by measurements of relative caudal fin lengths and comparisons to mean relative caudal fin lengths reported for wild-caught cutthroat trout.

In 2021, estimates of fish abundance, density, and biomass, were highest at lower Gardine Creek. Additionally, there was no indication that WCT densities within Upper Greenhills Creek increased with increasing distance downstream and proximity to the Greenhills Creek Sedimentation Pond.

A single muscle tissue sample was collected opportunistically from one incidental WCT mortality observed in Lower Greenhills Creek in 2021. The selenium concentration in the muscle sample was greater than the estimated effects threshold, exceeded the biological trigger for WCT muscle, and was associated with an estimated ovary selenium concentration in excess of the site-specific Level 3 Benchmark for potential reproductive effects.

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 unexpected changes over time.

Concentrations of most mine-related constituents with EWTs have remained stable or have decreased over time at Teck's routine water quality monitoring stations on Greenhills and Gardine creeks. Additionally, concentrations generally showed similar seasonal patterns between 2017 and 2021. Total nickel concentrations were substantially lower in 2021 relative to 2016 to 2018; however, the decrease in concentrations is expected given the historical events (December 2014 spoil failure) and activities (pumping of water from Phase 3/4 to Greenhills Creek in 2018) in the watershed. Selenium concentrations were higher at GH_GH1, between the Greenhills Creek Sedimentation Pond outlet and the antiscalant addition facility, throughout 2017 to 2021 versus 2016. The increase in aqueous selenium concentrations at GH_GH1 could be attributed to 2016 being a low flow year; however, no other temporal increases in selenium concentrations were identified for the other stations.

High-magnitude changes in calcite characteristics over time were limited to Lower Greenhills Creek. An 89% decrease in C_c relative to the pre-treatment year (2017) was observed in 2021, and C_c was also lower relative to all other treatment years (2018 to 2020), consistent with expectations or desired outcomes of water treatment with antiscalant. The field crew also noted less concretion in 2021, but that there were more particles with calcite present relative to previous years. This observation was supported by higher C_p scores on Lower Greenhills Creek relative to previous years. However, it is uncertain whether the increase in C_p in 2021 is attributed to antiscalant addition (on its own or in combination with natural factors) or other potential influences on Lower Greenhills Creek.

In general, particle sizes, TOC content, and constituent concentrations within sediment samples from Lower Greenhills Creek, Gardine Creek, and the Greenhills Creek Sedimentation Pond have remained relatively constant. Exceptions include decreasing concentrations of arsenic and iron (creeks) and increasing concentrations of nickel and zinc (creeks) and dibenz(a,h)anthracene (pond). Additionally, concentrations of manganese, selenium, and 12 PAHs in "bulk" sediments from Lower Greenhills Creek were higher throughout the period of antiscalant addition (2018 to 2021) relative to before (2017). It is unclear whether observed increases are attributable to water treatment or some combination of factors.

Sediment sampling for SEA has been completed annually at Lower Greenhills Creek since 2018 and at Gardine Creek and the Greenhills Creek Sedimentation Pond since 2019 and the results have been consistent year after year (i.e., the 2021 results are as expected). For example, most sequentially-extracted selenium was in fraction 4 (organic fraction) from 2018 to 2021, regardless of where the sediment samples were collected. Overall, the consistency among areas and years emphasizes the need to revisit the requirement to complete annual sediment sampling for SEA.

Year after year, SQIs were lowest for Greenhills Creek Sedimentation Pond followed by Lower Greenhills Creek. Sediment quality as a whole was lower at Lower Greenhills Creek in 2020 and 2021 and at Gardine Creek in 2021 relative to previous years.

Few notable temporal changes in benthic invertebrate community endpoints were identified. Specific exceptions included lower %EPT at RG_GHFF in 2021 relative to 2017 to 2020 and concomitant decreases in %Plecoptera and increases in %Diptera at RG_GHUT (both on Upper Greenhills Creek) from 2019 to 2021. At the furthest upstream station on Gardine Creek, benthic invertebrate densities were lower in 2021 relative to 2020 and 2019; densities were unchanged over time (i.e., from 2019 to 2021) downstream from the seeps. Apparent increases in %EPT and %Ephemeroptera at lower Gardine Creek 2021 were likely explained by delayed emergence and higher numbers of *Baetis* in some of the samples.

No significant temporal changes in selenium concentrations in benthic invertebrate tissues over time were identified and concentrations in tissues from Lower Greenhills Creek were consistently and substantially higher relative to Upper Greenhills and Gardine creeks. Additionally, tissue selenium concentrations on Lower Greenhills Creek were higher than expected based on the lotic bioaccumulation model, throughout 2018 to 2021. Results of the B-tool analysis indicate this is likely attributed to selenium speciation, but other factors may also contribute to the selenium concentrations in benthic invertebrate tissues. Overall, the absence of changes over time is generally expected, based on patterns in water quality and selenium speciation.

The fork lengths of WCT captured in 2021 were consistent with previous years; however, condition (weight-at-length) of WCT captured from Upper Greenhills and Gardine creeks was lower than in 2017 to 2019 and 2019, respectively. The largest decrease was observed in Upper Greenhills Creek (26% decrease relative to 2017), followed by upper Gardine Creek (14% decrease relative to 2019). These results may be attributable to the population being isolated from the Upper Fording River population and potential environmental or regional factors (e.g., temperature) having a greater stress on fish condition. Additionally, higher fish densities in the isolated pools at upper Gardine Creek in 2021 versus 2019 may have also contributed to these results. Fish condition in the Upper Fording River WCT population, which has access to habitats in Lower Greenhills Creek, was above average in 2021.

Temporal comparisons of external anomalies on WCT were not completed due to a change in methods in 2021; however, relative caudal fin lengths measured in 2021 were comparable to those for 2019, but lower relative to 2017. Relative caudal fin lengths for WCT captured from Gardine Creek in 2021 were comparable to those for 2019. This suggests that there has been no change in fin health (erosion of the lower caudal fin lobes) of WCT over time since 2019.

Overall, estimates of fry and juvenile densities, abundance, and biomass for lower Gardine Creek were comparable in 2019 and 2021. However, densities and abundances in Greenhills Creek were generally lower in 2021 than in previous years. Estimated WCT biomass on Upper and Lower Greenhills Creek was also generally lower than previous years of monitoring.

The selenium concentration in a single muscle tissue sample collected opportunistically from one WCT mortality in Lower Greenhills Creek in 2021 was greater than muscle selenium concentrations reported for WCT sampled from the Greenhills Creek Sedimentation Pond in 2018. The WCT that was sampled in 2021 also had an estimated ovary selenium concentration that was higher than the WCT sampled from the pond in 2018. The 2021 results might be considered "unexpected" given that the WCT muscle concentration from 2021 exceeded the biological trigger.

Question 3 ("*Can observed changes be linked to antiscalant addition in Lower Greenhills Creek, specifically*?") was addressed by drawing comparisons among the treated area on Lower Greenhills Creek versus untreated areas before and after initiation of antiscalant addition in 2017.

Overall, antiscalant addition has had limited influence in water quality in Lower Greenhills Creek. Total and dissolved molybdenum were the only exceptions; however, molybdenum is a component of the antiscalant compound, so these results are not unexpected and observed concentrations were still well below guidelines. Additionally, concentrations of mine-related constituents upstream and downstream from the antiscalant addition facility generally did not differ significantly from concentrations just upstream from the pond. 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 89% decrease in calcite concretion in Lower Greenhills Creek from 2017 to 2021 is attributed to successful treatment with antiscalant. Also, prevention of additional calcite precipitation may allow natural processes (e.g., bed movement) to support recovery of the natural substrates. It is notable that although calcite was frequently encountered on Lower Greenhills Creek, assessed particles were not fully covered in calcite (unlike Upper Greenhills Creek). Overall, it appears water treatment is having the desired effect.

Antiscalant addition has not influenced sediment texture in Lower Greenhills Creek and multiple years of data suggest that water treatment has no impact on the distribution of metals among sediment fractions 1 to 5. However, it remains unclear if observed increases in some metal and PAH concentrations in Lower Greenhills Creek sediments after 2017 are attributable to water treatment or other factors. Despite this uncertainty, it is noted that sediments in erosional, lotic systems generally accumulate in small deposits near banks and pools, and as such, sediment quality is not anticipated to have the same biological impact as would be expected from changes in water quality.

Benthic invertebrate biomass and LPL and family richness have not changed significantly in treated versus untreated areas since the initiation of antiscalant addition in 2017. However, the increase in %Ephemeroptera in the treated relative to untreated areas was larger in 2018, 2019, and 2020 relative to 2016 and in 2019 and 2020 relative to 2017. Additionally, lower %Diptera in the treated area in 2021 resulted in differences between treated and untreated areas that were larger in 2021 relative to 2017. These difference among areas before and after treatment are likely attributed to antiscalant addition. Subtle shifts in community composition from tolerant to more sensitive species are consistent with expectations, given that lower concretion scores are considered indicative of improved substrates, and therefore improved benthic invertebrate habitat, in Lower Greenhills Creek.

The absence of change over time for selenium concentrations in benthic invertebrate tissues from Lower Greenhills Creek suggests that selenium concentrations at that location are likely unrelated to antiscalant addition. Rather, the observed concentrations are likely attributed to RG_GHBP being downstream from the Greenhills Creek Sedimentation Pond, as well as the greater prevalence of depositional habitat than at other creek sampling areas.

In 2021, WCT captured from Lower Greenhills Creek were in good condition and good external health. It is therefore considered unlikely that antiscalant addition was negatively impacting these endpoints in 2021. The lower fry and juvenile densities, as well as lower estimates of abundance and biomass, on Lower Greenhills Creek in 2021 is also not likely attributed to antiscalant addition. This is because conditions of water quality, calcite concretion, and food availability have remained unchanged or improved relative to pre-treatment. The selenium concentration in the single WCT muscle tissue sample collected from Lower Greenhills Creek in 2021 was greater than muscle selenium concentrations reported for WCT sampled from the Greenhills Creek Sedimentation Pond in 2018. These results for 2021 were higher than expected, based on model predictions, but are more likely attributed to factors related to selenium speciation than antiscalant addition.

The data collected and interpreted as part of the 2021 GGCAMP will ultimately support the advancement of the Greenhills Creek Watershed Rehabilitation Program. An updated summary for the Greenhills Creek Water Quality and Aquatic Health response framework is provided in the 2021 AMP Annual Report. The program characterizes existing conditions within Greenhills and Gardine creeks and evaluates changes over time to identify any patterns that may be indicative of unexpected changes. The 2022 study design for the GGCAMP is being prepared for submission and includes consideration of the current understanding of the proposed mitigation and rehabilitation projects within the watershed, advice and input received from the EMC, as well as integration of WCT monitoring within the regional framework for the Upper Fording River.

5 REFERENCES

ADEPT (ADEPT Environmental Sciences Ltd.). 2022. Elk Valley Selenium Speciation Monitoring Program – 2021 Annual Report. Prepared for Teck Coal Limited, Sparwood, BC.

Austin, J. (ed.). 2020. British Columbia Environmental Laboratory Manual. Analysis, Reporting, and Knowledge Services, Knowledge Management Branch, British Columbia Ministry of Environment and Climate Change Strategy, Victoria, BC.

Azimuth (Azimuth Consulting Group Partnership). 2018. Proposed Water Quality Triggers for the Elk Valley Adaptive Management Plan. Prepared for Teck Resources Limited, Vancouver, BC. June 2018.

Azimuth (Azimuth Consulting Group Inc). 2021. Development of biological triggers for the Elk Valley Adaptive Management Plan. Prepared for Teck Coal Limited, Sparwood, BC.

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish. Second Edition. EPA 841-B-99-002. United States Environmental Protection Agency, Office of Water, Washington, District of Columbia.

Bergman, E.A., and W.L. Hilsenhoff. 1978. *Baetis* (Ephemeroptera: *Baetidae*) of Wisconsin. The Great Lakes Entomologist 11(3): 125-135.

Bosakowski, T., and E.J. Wagner. 1994. Assessment of Fin Erosion by Comparison of Relative Fin Length in Hatchery and Wild Trout in Utah. Canadian Journal of Fisheries and Aquatic Sciences 51: 636-641.

BCMOE (British Columbia Ministry of Environment). 2014. Ambient Water Quality Guidelines for Selenium Technical Report (Update). Water Protection and Sustainability Branch. April 2014.

BCMOECCS (British Columbia Ministry of Environment and Climate Change Strategy). 2021a. British Columbia Working Water Quality Guidelines: Aquatic Life, Wildlife, and Agriculture (Feb 2021). Water Quality Guideline Series, WQG-08.

BCMOECCS. 2021b. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife, and Agriculture – Guideline Summary. Water Quality Guideline Series, WQG-20.

Carle, F.L., and M.R. Strub. 1978. A new method for estimating population size from removal data. Biometrics 34: 621-630.

CCME (Canadian Council of Ministers of the Environment). 2001. Canadian sediment quality guidelines [online]. Available from: http://ceqg-rcqe.ccme.ca/en/index.html#void [Accessed May 10, 2022].

CCME. 2002. Canadian sediment quality guidelines for the protection of aquatic life: Summary tables. Updated. In: Canadian Environmental Quality Guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg, MB.

CCME. 2014. Resources [online]. Available from: https://ccme.ca/en/resources [accessed May 10, 2022].

Christensen, J. 2021. Founder and Chief Executive Officer, TrichAnalytics Inc. Email correspondence with Amy Wiebe (Minnow). October 13, 2021.

Cope, S. 2020. Upper Fording River Westslope Cutthroat Trout Population Monitoring Project: 2019. Prepared for Teck Coal Limited, Sparwood, BC. Prepared by Westslope Fisheries Ltd., Cranbrook, BC. 48 p. + 2 app.

Cope, S., C.J. Schwarz, A. Prince, and J. Bisset. 2016. Upper Fording River Westslope Cutthroat Trout Population Assessment and Telemetry Project: Final Report. Report Prepared for Teck Coal Limited, Sparwood, BC. Report Prepared by Westslope Fisheries Ltd., Cranbrook, BC. 266 p.

de Bruyn, A., and S.N. Luoma. 2021. Selenium Species Bioaccumulation Tool Draft Version 2.0. Prepared for Teck Coal Limited, Sparwood, BC. Project 19133414/MQ2 Task 4.

DeForest, D.K., K.V. Brix, J.R. Elphick, C.J. Rickwood, A.M.H. de Bruyn, L.M. Tear, G. Gilron, S.A. Hughes, And W.J. Adams. 2017. Lentic, lotic, and sulphate-dependent waterborne selenium screening guidelines for freshwater systems. Environmental Toxicology and Chemistry 36(9): 2503-2513.

Ecofish (Ecofish Research Ltd.). 2022. Greenhills Creek Water Management Project: Environmental Flow Needs and Fish and Fish Habitat Existing Conditions Report. Draft Version 2. Prepared for Teck Coal Limited, Sparwood, BC.

Environment Canada. 2012a. Field Manual: Wadeable Streams. Canadian Aquatic Biomonitoring Network (CABIN).

Environment Canada. 2012b. Metal Mining Technical Guidance for Environmental Effects Monitoring.

Environment Canada. 2014. Laboratory Methods: Processing, Taxonomy, and Quality Control of Benthic Macroinvertebrate Samples. Canadian Aquatic Biomonitoring Network (CABIN). May 2014.

EPA (United States Environmental Protection Agency). 2016. Aquatic Life Ambient Water Quality Criterion for Selenium – Freshwater. EPA 822-R-16-006. June.

Ferguson, A. 2021. Regional Water Monitoring Lead, Teck Resources Limited. Phone conversation with Amy Wiebe (Minnow). June 29, 2021.

Golder (Golder Associates). 2014. Benchmark Derivation Report for Selenium. Annex E of the Elk Valley Water Quality Plan. Prepared for Teck Coal Limited, Sparwood, BC. July 2014.

Golder. 2020. Updates to the Lotic and Lentic Bioaccumulation Models for Selenium in the Elk Valley. Prepared for Teck Coal Limited, Sparwood, BC.

Golder. 2021a. Elk Valley Selenium Speciation Program 2021 Study Design. Prepared for Teck Coal Limited, Sparwood, BC.

Golder. 2021b. Preliminary Annelid Bioaccumulation Analysis. Prepared for Teck Coal Limited, Sparwood, BC.

Green, R. H. 1979. Sampling design and statistical methods for environmental biologists. Wiley Interscience, Chichester, England.

Harper, M.P., and B.L. Peckarsky. 2006. Emergence cues of a mayfly in a high-altitude stream ecosystem: Potential responses to climate change. Ecological Applications 16(2): 612-621.

He, J., G.L. Liu, D.W. Zhu, J.B. Cai, W.B. Zhou, and W.W. Guo. 2015. Sequential extraction of calcium in lake sediments for investigating the cycle of phosphorus in water environment. International Journal of Environmental Science and Technology 12: 1123-1136.

Hillman, E. 2021a. Calcite Program Lead, Teck Resources Limited. Email correspondence with Amy Wiebe (Minnow). June 9, 2021.

Hillman, E. 2021b. Calcite Program Lead, Teck Resources Limited. Email correspondence with Amy Wiebe (Minnow). November 4, 2021.

Jaeger, C. 2020. Regional Groundwater and Calcite Lead, Teck Resources Limited. Email correspondence with Heidi Currier (Minnow). April 22, 2020.

KNRC (Kootenay Natural Resource Consulting). 2007. Fish Stream Identification, Greenhills Creek. Prepared for Elk Valley Coal Corporation. July 30, 2007.

Lotic (Lotic Environmental Inc.). 2021. Teck Coal Ltd. Regional Calcite Monitoring Plan – Field Manual. Prepared for Teck Coal Limited, Sparwood, BC.

Luoma, S. 2021. Selenium Bioaccumulation in Annelids Collected from the Fording and Elk Rivers. Prepared for Teck Coal Limited, Sparwood, BC.

Massé, A.J., J.R. Muscatello, and D.M. Janz. 2015. Dose-dependent early life stage toxicities in *Xenopus laevis* exposed in ovo to selenium. Environmental Science and Technology 49(22): 13658-13666.

Minnow (Minnow Environmental Inc.). 2017. DRAFT Study Design for the Greenhills Creek Calcite Management Aquatic Biological Study. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 167202.0079.

Minnow. 2018a. Study Design for the Regional Aquatic Effects Monitoring Program, 2018 to 2020. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 177202.0053.

Minnow. 2018b. Upper Greenhills Creek Aquatic Baseline. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 177202.0032.

Minnow. 2018c. Elk River Watershed Regional Aquatic Effects Monitoring Program (RAEMP) Report, 2015-2016. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 2561.

Minnow. 2019a. Greenhills Creek and Gardine Creek Monitoring Program Study Design – 2019. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 197202.0005.

Minnow. 2019b. Upper Greenhills Creek Aquatic Baseline 2018. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 187202.0027.

Minnow. 2019c. Lower Greenhills Creek Aquatic Baseline 2018. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 187202.0028.

Minnow. 2020a. Greenhills Creek Aquatic Monitoring Program 2019 Report. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 197202.0005.

Minnow. 2020b. Greenhills Creek and Gardine Creek Monitoring Program Study Design – 2020. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 207202.0014.

Minnow. 2020c. Greenhills Selenium Speciation Monitoring and Stilling Basin Sampling. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 207202.0014.

Minnow. 2020d. Regional Aquatic Effects Monitoring Program (RAEMP) Report, 2017 to 2019. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 187202.0011.

Minnow. 2020e. Lentic Area Supporting Study Report, 2018 to 2020. Report prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 207202.0016.

Minnow. 2021a. Greenhills Creek and Gardine Creek Aquatic Monitoring Program Report – 2020. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 207202.0014.

Minnow. 2021b. Study Design for the 2021 Greenhills and Gardine Creeks Aquatic Monitoring Program. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 217202.0052.

Minnow. 2021c. Study Design for the Regional Aquatic Effects Monitoring Program, 2021 to 2023. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 207202.0006.

Minnow. 2021d. 2020 Greenhills Operation Local Aquatic Effects Monitoring Program (LAEMP) Report. Report prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 207202.0022.

Nautilus Environmental and Interior Reforestation. 2011. Evaluation of the Effects of Selenium on Early Life Stage Development of Westslope Cutthroat Trout from the Elk Valley, BC. Prepared for the Elk Valley Selenium Task Force. November 2011.

Ogle D.H., P. Wheeler, and A. Dinno. 2020. FSA: Fisheries Stock Analysis. R package version 0.8.27.9000 [online]. Available from: https://github.com/droglenc/FSA.

Orr, P.L., K.R. Guiguer, and C.K. Russell. 2006. Food chain transfer of selenium in lentic and lotic habitats of a western Canadian watershed. Ecotoxicology and Environmental Safety 63(2): 175-188.

Ptolemy, R.A., M. Ramsay, D. Peard, and D. Sollit. 2006. Results of steelhead stock monitoring (1988-2006) in the Bella Coola River and implications for population recovery. Prepared for Ministry of Environment and Habitat Conservation Trust Fund, Victoria, BC. 63 p. + 6 app.

R Core Team. 2021. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org.

Robinson, M.D., S. Gordon, and M. Otto. 2022. Teck Coal Ltd. 2021 Calcite Monitoring Program Annual Report. Prepared for Teck Coal Limited, Sparwood, BC. Prepared by Lotic Environmental Ltd. 45 pp + appendices.

Sanders, R.E., R.J. Miltner, C.O. Yoder, and E.T. Rankin. 1999. The Use of External Deformities, Erosion, Lesions, and Tumors (DELT anomalies) in Fish Assemblages for Characterizing Aquatic Resources: A case Study of Seven Ohio streams. In: T.P. Simon (Ed.), pp: 225-246, Assessing the Sustainability, and Biological Integrity of Water Resources Using Fish Communities. CRC Press, Boca Raton, FL.

Teck (Teck Resources Limited). 2014. Elk Valley Water Quality Plan. Submitted to the British Columbia Minister of Environment for approval on July 22, 2014.

Teck. 2016. Measurement of the Calcite Index. Standard Practices and Procedures – TC-CI-01.

Teck. 2017. DRAFT Passive Integrated Transponder (PIT) Tagging Guidance Document. July 10, 2017.

Teck. 2018. Water Quality Adaptive Management Plan for Teck Coal Operations in the Elk Valley. December 21, 2018.

Teck. 2019a. Calcite Management Plan – 2019 Update. July 30, 2019. 177 pp.

Teck. 2019b. Lower Greenhills Creek Calcite Management - 2018 Operations Report. March 14, 2019.

Teck. 2021a. Water Quality Adaptive Management Plan for Teck Coal Operations in the Elk Valley – 2021 Update. December 15, 2021.

Teck. 2021b. Water Quality Adaptive Management Plan for Teck Coal Operations in the Elk Valley – 2020 Annual Report. July 31, 2021.

Teck. 2021c. Permit 107517 Calcite Operations 2020 Annual Performance Report. March 31, 2021.

Tessier, A., P.G.C. Campbell, and M. Bisson. 1979. Sequential Extraction Procedure for the Speciation of Particulate Trace Metals. Analytical Chemistry 51(7): 844-846.

Thorley, J.L. 2022. Senior Computational Biologist, Poisson Consulting Ltd. Email correspondence with Amy Wiebe (Minnow). June 8, 2022.

Thorley, J.L., A.K. Kortello, J. Brooks, and M. Robinson. 2022. Upper Fording River Westslope Cutthroat Trout Population Monitoring 2021. Prepared for Teck Coal Limited, Sparwood, BC. Prepared by Poisson Consulting, Grylloblatta, and Lotic Environmental Inc.

Watson, R.J., E.C.V. Butler, L.A. Clementson, and K.M. Berry. 2005. Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in sea water. Journal of Environmental Monitoring 7(1): 37-42.

Zathey, N., S. Mitchell, and M.D. Robinson. 2021. Teck Coal Ltd. 2020 Calcite Monitoring Program Annual Report. Prepared for Teck Coal Limited, Sparwood, BC. Prepared by Lotic Environmental Ltd. 54 pp + appendices.

APPENDIX A
DATA QUALITY
REVIEW

APPENDIX A DATA QUALITY REVIEW

A1 INTRODUCTION

A1.1 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 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 A.1). Programs involving many samples and analytes 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 2021 Greenhills and Gardine Creeks Aquatic Monitoring Program. The objective of the DQR was to define the overall quality of the data presented in the annual report, and, by extension, the confidence

[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 A.1: Data Quality Objectives for the Greenhills and Gardine Creeks Aquatic Monitoring Program, 2021

Quality Control Measure	QC Sample Type/Check		Study Component: Water Chemistry	Study Component: Selenium Speciation	Study Component: Sediment Chemistry
			ALS	**Brooks**	**ALS**
Analytical LRL	Comparison actual LRL versus target LRL		LRL for each parameter should be at least as low as applicable guidelines, benchmarks, and/or screening values (ideally ≤1/10th of the value) [a]	LRL for each parameter should be at least as low as applicable guidelines, benchmarks, and screening values [a]	LRL for each parameter should be at least as low as applicable guidelines, benchmarks, and/or screening values (ideally ≤1/10th of the value) [a]
Blank Analysis	Field or Laboratory Blank		Concentrations measured in blank samples should be <LRL [b]	Concentrations measured in blank samples should be <LRL [b]	Concentrations measured in blank samples should be <LRL [b]
Laboratory Precision	Laboratory Duplicates	Concentrations <2-times the LRL:	No DQO set	≤20% RPD (total selenium) ≤25% RPD (selenium species)	0.2 (pH) ≤5% RPD (sand, silt, clay) ≤20% RPD (moisture, total and inorganic carbon) ≤25% RPD (gravel) ≤30% RPD (metals) ≤50% RPD (PAHs)
		Concentrations 2 to 4-times the LRL:	≤10% RPD (pH) ≤10% RPD (conductivity) ≤15% RPD (turbidity) ≤20% RPD (all remaining analytes)		
		Concentrations 4 to 10-times the LRL:			
		Concentrations 10 to 20-times the LRL:			
		Concentrations >20-times the LRL:			
	Repeatability of Reference Material Recoveries		-	-	-
	Taxonomic Precision		-	-	-
	Organism Sub-Sampling Precision		-	-	-
Accuracy	Recovery of Blank Spike		-	75 to 125% recovery (methylseleninic acid, selenate, selenite, selenocyanate, selenomethionine, total selenium)	6.8 to 7.2 (pH) 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)
	Recovery of Matrix Spike		70 to 130% (TKN, orthophosphate, phosphorus, DOC, TOC, total and dissolved metals) 75 to 125% (ammonia, Br, Cl, F, nitrate, nitrite, sulfate)	75 to 125% recovery (selenate, selenite, selenocyanate, selenomethionine, total selenium)	-
	Matrix Spike Duplicate		-	75 to 125% recovery (selenate, selenite, selenocyanate, selenomethionine, total selenium) ≤20% RPD (total selenium) ≤25% RPD (selenate, selenite, selenocyanate, selenomethionine)	-
	Recovery of Certified Reference Material, QC Standards		80 to 120% (orthophosphate, phosphorus) 85 to 115% (turbidity, alkalinity) 90 to 110% (conductivity) 6.9 to 7.1 (pH)	75 to 125% (total selenium)	7.7 to 8.3 (pH) 8.4 to 18.4% (sand [0.125 to 0.063 mm]) 8.5 to 18.5% (sand [0.063 to 0.0312 mm]) 11.7 to 21.7% (sand [0.25 to 0.125 mm]) 15.1 to 25.1% (silt [0.0312 to 0.004 mm) 16.5 to 26.5% (clay [<4µm]) 80 to 12% (total and inorganic carbon) 0.15 to 0.55 mg/kg (Se) 0.16 to 0.36 mg/kg (Ag) 0.2 to 4.2 mg/kg (Sn) 1 to 2 mg/kg (W) 70 to 130% (remaining metals metals) [c] 50 to 130% (naphthalene) 60 to 130% (remaining PAHs)
	Organism Recovery		-	-	-
	Organism Sub-Sampling Accuracy		-	-	-

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; > = greater than; % = percent; RPD = relative percent difference; PAHs = polycyclic aromatic hydrocarbons; DQO = data quality objective; TKN = total Kjeldahl nitrogen; DOC = dissolved organic carbon; TOC = total organic carbon; TSS = total suspended solids; TDS = total dissolved solids.

[a] If no guideline, benchmark, or screening value exists for a substance, the LRL should be less than predictions

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

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

[d] Only applies to QC samples at concentrations >20-times the LRL.

Table A.1: Data Quality Objectives for the Greenhills and Gardine Creeks Aquatic Monitoring Program, 2021

Quality Control Measure	QC Sample Type/Check		Study Component: Benthic Invertebrate Chemistry – Trich	Study Component: Benthic Invertebrate Community – Cordillera	Study Component: Benthic Invertebrate Community – ZEAS
Analytical LRL	Comparison actual LRL versus target LRL		LRL for each parameter should be at least as low as applicable guidelines, benchmarks, and screening values [a]	-	-
Blank Analysis	Field or Laboratory Blank		-	-	-
Laboratory Precision	Laboratory Duplicates	Concentrations <2-times the LRL:	No DQO set		
		Concentrations 2 to 4-times the LRL:	No DQO set		
		Concentrations 4 to 10-times the LRL:	No DQO set	-	-
		Concentrations 10 to 20-times the LRL:	≤60% RPD (Ca, Sr) ≤40% RPD (all other analytes)		
		Concentrations >20-times the LRL:	≤60% RPD (Ca, Sr) ≤40% RPD (all other analytes)		
	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		-		-
	Recovery of Matrix Spike		-	-	-
	Matrix Spike Duplicate		-	-	-
	Recovery of Certified Reference Material, QC Standards		60 to 140% (Sb, Ba, B, Ag, Sn, Ti) 90 to 110% (Se) 70 to 130% (all other analytes) [d]	-	-
	Organism Recovery		-	≥95% recovery (CABIN)	≥90% recovery
	Organism Sub-Sampling Accuracy		-	≤20% difference between density estimates from sub-samples and actual density 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; > = greater than; % = percent; RPD = relative percent difference; PAHs = polycyclic aromatic hydrocarbons; DQO = data quality objective; TKN = total Kjeldahl nitrogen; DOC = dissolved organic carbon; TOC = total organic carbon; TSS = total suspended solids; TDS = total dissolved solids.

[a] If no guideline, benchmark, or screening value exists for a substance, the LRL should be less than predictions

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

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

[d] Only applies to QC samples at concentrations >20-times the LRL.

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 effect, if any, were had on interpretation of results within the context of the monitoring program.

A1.2 Laboratory Reporting Limits

An LRL is the lowest concentration of an analyte 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 an analyte 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, some guidelines are so low 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 2021 Greenhills and Gardine Creeks Aquatic Monitoring Program Report, LRLs were screened against guidelines from the British Columbia Ministry of Environment and Climate Change Strategy (BCMOECCS), Elk Valley Water Quality Plan (EVWQP) benchmarks, and site-specific screening values, as appropriate.

A1.3 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 Greenhills and Gardine Creeks Aquatic Monitoring Program in 2021, 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 analytes should be less than the LRL or within a pre-determined range of values for parameters like pH, conductivity, and hardness.
- **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 analyte (or mixture of analytes) 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.

A1.4 Other Quality Control Checks

Three additional types of QC checks were completed for the benthic invertebrate community samples collected as part of the 2021 Greenhills and Gardine Creeks Aquatic Monitoring Program. These included:

- **Sub-sampling Error** is assessed for studies in which 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.

A2 WATER CHEMISTRY

A2.1 Laboratory Reporting Limits

The analytical reports from ALS Environmental (ALS) for 2021 were examined to provide an inventory of analytes for which the sample results were equal to or less than the target LRL (Appendix Table A.2; see Appendix B for laboratory reports). The LRLs for these analytes were also assessed relative to the working and approved British Columbia Water Quality Guidelines (BC WQG) for the protection of freshwater aquatic life (BCMOECCS 2021a,b), EVWQP Level 1 Benchmarks for water quality (Teck 2014), and relevant site-specific benchmarks (Appendix Table A.2).

The LRLs achieved for water chemistry samples were lower than applicable BC WQG, EVWQP Level 1 benchmarks, and relevant screening values for all analytes (Appendix Table A.2). Multiple analytes were consistently (i.e., in 100% of samples) reported at concentrations below the LRL in 2021, including:

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

Concentrations of sulphate and total selenium, which have long-term targets under the EVWQP (Teck 2014), were detectable in all samples (Appendix Table A.2). Concentrations of nitrate and dissolved cadmium, both of which also have long-term targets under the EVWQP, were not detected in one (13%) and two (25%) of the water chemistry samples, respectively, that were collected in September 2021. Total nickel was detectable in all samples from February and September 2021 (Appendix Table A.2). Overall, the achieved LRLs were appropriate for this study.

A2.2 Field and Laboratory Blanks

A total of two field blank samples and one trip blank sample were used to assess field sampling contamination in 2021 (Appendix Table A.3). The analytes measured in the blanks were not consistent among samples (e.g., in February 2021, only a subset of dissolved metals [calcium, magnesium, potassium, and sodium] were measured in the trip blank); these differences are reflected in Appendix Table A.3. The same DQOs that were used for laboratory blanks were used for field and trip blanks (Appendix Table A.1).

Table A.2: Laboratory Reporting Limit (LRL) Evaluation for Water Chemistry Analyses, 2021 [a]

Analyte	Units	BC WQG [b]		EVWQP Level 1 Benchmarks/ Relevant Screening Values [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	1	2 (67%)	0
Total Dissolved Solids	mg/L	1,000 to 3,000	-	1,000	20 to 40	20 to 40	0	0
Turbidity	NTU	-	-	-	0.10	0.10	0	0
Anions and Nutrients								
Alkalinity, Total (as $CaCO_3$)	mg/L	-	-	-	1.0	1.0	0	0
Ammonia, Total (as N) [f]	mg/L	0.10 to 2.0	0.68 to 26	-	0.0050	0.0050	1 (33%)	4 (50%)
Bromide	mg/L	-	-	-	0.25	0.050 to 0.25	3 (100%)	8 (100%)
Chloride	mg/L	150	600	-	0.50	0.10 to 0.50	0	0
Fluoride [g]	mg/L	-	1.73 to 1.88	-	0.10	0.020 to 0.10	1 (33%)	2 (25%)
Nitrate (as N)	mg/L	3	32.8	6.8 to 15	0.025	0.0050 to 0.025	0	1 (13%)
Nitrite (as N) [h]	mg/L	0.02 to 0.20	0.06 to 0.60	0.015 to 0.050	0.0050	0.0010 to 0.0050	1 (33%)	4 (50%)
Total Kjeldahl Nitrogen	mg/L	-	-	-	0.050 to 0.25	0.050	3 (100%)	0
Orthophosphate-Dissolved (as P)	mg/L	-	-	-	0.0010	0.0010	0	4 (50%)
Total Phosphorus	mg/L	-	-	-	0.0020	0.0020	0	0
Sulphate (SO_4) [g]	mg/L	429	-	429	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)	mg/L	-	-	-	0.0030 to 0.0060	0.0030 to 0.0060	2 (67%)	1 (13%)
Antimony (Sb)	mg/L	0.009	-	-	0.00010 to 0.00020	0.00010 to 0.00020	0	0
Arsenic (As)	mg/L	-	0.005	-	0.00010 to 0.00020	0.00010 to 0.00020	0	0
Barium (Ba)	mg/L	1	-	-	0.00010 to 0.00020	0.00010 to 0.00020	0	0
Beryllium (Be)	mg/L	0.00013	-	0.0053	0.000020 to 0.000040	0.000020 to 0.000040	3 (100%)	8 (100%)
Bismuth (Bi)	mg/L	-	-	-	0.000050 to 0.00010	0.000050 to 0.00010	3 (100%)	8 (100%)
Boron (B)	mg/L	1.2	-	-	0.010 to 0.020	0.010 to 0.020	1 (33%)	3 (38%)
Cadmium (Cd)	mg/L	-	-	-	0.0000050 to 0.000010	0.0000050 to 0.000010	0	1 (13%)
Calcium (Ca)	mg/L	-	-	-	0.050 to 0.10	0.050 to 0.10	0	0
Chromium (Cr) [i]	mg/L	0.001	-	0.005	0.00010 to 0.00020	0.00010 to 0.00020	1 (33%)	6 (75%)
Cobalt (Co)	mg/L	0.004	0.11	0.0038 to 0.0083	0.00010 to 0.00020	0.00010 to 0.00020	3 (100%)	8 (100%)
Copper (Cu)	mg/L	-	-	-	0.00050 to 0.0010	0.00050 to 0.0010	3 (100%)	7 (88%)
Iron (Fe)	mg/L	-	1	-	0.010 to 0.020	0.010 to 0.020	3 (100%)	4 (50%)
Lead (Pb) [g]	mg/L	0.012 to 0.020	0.23 to 0.42	-	0.000050 to 0.00010	0.000050 to 0.00010	3 (100%)	8 (100%)
Lithium (Li)	mg/L	-	-	-	0.0010 to 0.0020	0.0010 to 0.0020	0	0
Magnesium (Mg)	mg/L	-	-	-	0.10	0.0050 to 0.010	0	0
Manganese (Mn)	mg/L	1.6 to 2.6	3.0 to 3.4	-	0.00010 to 0.00020	0.00010 to 0.00020	0	0
Mercury (Hg)	mg/L	0.0000013	-	-	0.00000050	0.00000050	3 (100%)	5 (63%)
Molybdenum (Mo)	mg/L	7.6	46	-	0.000050 to 0.00010	0.000050 to 0.00010	0	0
Nickel (Ni) [g]	mg/L	-	-	0.0053	0.00050 to 0.0010	0.00050 to 0.0010	0	0
Potassium (K)	mg/L	-	-	-	0.050 to 0.10	0.050 to 0.10	0	0
Selenium (Se)	mg/L	0.002	-	0.070	0.000050 to 0.00010	0.000050 to 0.00010	0	0
Silicon (Si)	mg/L	-	-	-	0.10 to 0.20	0.10 to 0.20	0	0
Silver (Ag) [g]	mg/L	0.0015	0.0030	-	0.000010 to 0.000020	0.000010 to 0.000020	3 (100%)	8 (100%)
Sodium (Na)	mg/L	-	-	-	0.050 to 0.10	0.050 to 0.10	0	0
Strontium (Sr)	mg/L	-	-	-	0.00020 to 0.00040	0.00020 to 0.00040	0	0
Thallium (Tl)	mg/L	0.0008	-	-	0.000010 to 0.000020	0.000010 to 0.000020	2 (67%)	7 (88%)
Tin (Sn)	mg/L	-	-	-	0.00010 to 0.00020	0.00010 to 0.00020	3 (100%)	8 (100%)
Titanium (Ti)	mg/L	-	-	-	0.010	0.00030 to 0.00090	3 (100%)	8 (100%)
Uranium (U)	mg/L	0.0085	-	-	0.000010 to 0.000020	0.000010 to 0.000020	0	0
Vanadium (V)	mg/L	-	-	0.12	0.00050 to 0.0010	0.00050 to 0.0010	3 (100%)	8 (100%)
Zinc (Zn) [g]	mg/L	0.11 to 0.19	0.13 to 0.34	-	0.0030 to 0.0060	0.0030 to 0.0060	2 (67%)	5 (63%)

Shading indicates an LRL greater than the lowest EVWQP Level 1 Benchmark (Teck 2014) or relevant, site-specific screening value.

Shading indicates an LRL greater than the lowest BC WQG for the protection of freshwater aquatic life (BCMOECCS 2021a,b).

Notes: BC WQG = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan; LRL = Laboratory Reporting Limit; < = 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.

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

[b] Working (BCMOECCS 2021a) or approved (BCMOECCS 2021b) BC WQG for the protection of freshwater aquatic life.

[c] Where more than one EVWQP Level 1 Benchmark or screening value was applicable, the most conservative (lowest) value was used.

[d] The LRLs for all analytes were consistently less than the applicable EVWQP Level 1 Benchmarks (Teck 2014) or screening values (Golder 2017; Teck 2020).

[e] The total number of samples in February 2021 was n = 3 (n = 2 water samples and n = 1 duplicate sample); in September 2021, the total number of samples was n = 8 (n = 7 water samples and n = 1 duplicate sample). Data for field and trip blanks are summarized in Appendix Table A.3.

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

[j] Dissolved aluminum guidelines were calculated based on the pH of individual water samples.

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

Table A.2: Laboratory Reporting Limit (LRL) Evaluation for Water Chemistry Analyses, 2021 [a]

Analyte	Units	BC WQG [b]		EVWQP Level 1 Benchmarks/ Relevant Screening Values [c]	Range of LRLs [d]		No. Sample Results <LRL [e]	
		Long-term Average	Short-term Maximum		February	September	February	September
Dissolved Metals								
Aluminum (Al) [j]	mg/L	0.05	0.1	-	0.0030	0.0010 to 0.0020	3 (100%)	5 (63%)
Antimony (Sb)	mg/L	-	-	-	0.00010 to 0.00020	0.00010 to 0.00020	0	0
Arsenic (As)	mg/L	-	-	-	0.00010 to 0.00020	0.00010 to 0.00020	0	0
Barium (Ba)	mg/L	-	-	-	0.00010 to 0.00020	0.00010 to 0.00020	0	0
Beryllium (Be)	mg/L	-	-	-	0.000020 to 0.000040	0.000020 to 0.000040	3 (100%)	8 (100%)
Bismuth (Bi)	mg/L	-	-	-	0.000050 to 0.00010	0.000050 to 0.00010	3 (100%)	8 (100%)
Boron (B)	mg/L	-	-	-	0.010 to 0.020	0.010 to 0.020	1 (33%)	3 (38%)
Cadmium (Cd) [g]	mg/L	0.00038 to 0.00046	0.0014 to 0.0028	0.00026 to 0.0016	0.0000050 to 0.000010	0.0000050 to 0.000010	0	2 (25%)
Calcium (Ca)	mg/L	-	-	-	0.050 to 0.10	0.050 to 0.10	0	0
Chromium (Cr)	mg/L	-	-	-	0.00010 to 0.00020	0.00010 to 0.00020	2 (67%)	7 (88%)
Cobalt (Co)	mg/L	-	-	-	0.00010 to 0.00020	0.00010 to 0.00020	3 (100%)	8 (100%)
Copper (Cu) [k]	mg/L	0.00060 to 0.0047	0.0038 to 0.028	-	0.00020 to 0.00040	0.00020 to 0.00040	3 (100%)	0
Iron (Fe)	mg/L	-	0.35	1.1	0.010 to 0.020	0.010 to 0.020	3 (100%)	8 (100%)
Lead (Pb)	mg/L	-	-	-	0.000050 to 0.00010	0.000050 to 0.00010	3 (100%)	8 (100%)
Lithium (Li)	mg/L	-	-	-	0.0010 to 0.0020	0.0010 to 0.0020	0	0
Magnesium (Mg)	mg/L	-	-	-	0.10	0.0050 to 0.010	0	0
Manganese (Mn)	mg/L	-	-	-	0.00010 to 0.00020	0.00010 to 0.00020	0	0
Mercury (Hg)	mg/L	-	-	-	0.0000050	0.0000050	3 (100%)	8 (100%)
Molybdenum (Mo)	mg/L	-	-	-	0.000050 to 0.00010	0.000050 to 0.00010	0	0
Nickel (Ni)	mg/L	-	-	-	0.00050 to 0.0010	0.00050 to 0.0010	0	0
Potassium (K)	mg/L	-	-	-	0.050 to 0.10	0.050 to 0.10	0	0
Selenium (Se)	mg/L	-	-	-	0.000050 to 0.00010	0.000050 to 0.00010	0	0
Silicon (Si)	mg/L	-	-	-	0.050 to 0.10	0.050 to 0.10	0	0
Silver (Ag)	mg/L	-	-	-	0.000010 to 0.000020	0.000010 to 0.000020	3 (100%)	8 (100%)
Sodium (Na)	mg/L	-	-	-	0.050 to 0.10	0.050 to 0.10	0	0
Strontium (Sr)	mg/L	-	-	-	0.00020 to 0.00040	0.00020 to 0.00040	0	0
Thallium (Tl)	mg/L	-	-	-	0.000010 to 0.000020	0.000010 to 0.000020	3 (100%)	6 (75%)
Tin (Sn)	mg/L	-	-	-	0.00010 to 0.00020	0.00010 to 0.00020	3 (100%)	8 (100%)
Titanium (Ti)	mg/L	-	-	-	0.010	0.00030 to 0.00060	3 (100%)	8 (100%)
Uranium (U)	mg/L	-	-	-	0.000010 to 0.000020	0.000010 to 0.000020	0	0
Vanadium (V)	mg/L	-	-	-	0.00050 to 0.0010	0.00050 to 0.0010	3 (100%)	8 (100%)
Zinc (Zn)	mg/L	-	-	-	0.0010 to 0.0020	0.0010 to 0.0020	1 (33%)	3 (38%)

Shading indicates an LRL greater than the lowest EVWQP Level 1 Benchmark (Teck 2014) or relevant, site-specific screening value.

Shading indicates an LRL greater than the lowest BC WQG for the protection of freshwater aquatic life (BCMOECCS 2021a,b).

Notes: BC WQG = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan; LRL = Laboratory Reporting Limit; < = 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.

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

[b] Working (BCMOECCS 2021a) or approved (BCMOECCS 2021b) BC WQG for the protection of freshwater aquatic life.

[c] Where more than one EVWQP Level 1 Benchmark or screening value was applicable, the most conservative (lowest) value was used.

[d] The LRLs for all analytes were consistently less than the applicable EVWQP Level 1 Benchmarks (Teck 2014) or screening values (Golder 2017; Teck 2020).

[e] The total number of samples in February 2021 was n = 3 (n = 2 water samples and n = 1 duplicate sample); in September 2021, the total number of samples was n = 8 (n = 7 water samples and n = 1 duplicate sample). Data for field and trip blanks are summarized in Appendix Table A.3.

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

[j] Dissolved aluminum guidelines were calculated based on the pH of individual water samples.

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

Table A.3: Field Blank and Trip Blank Evaluation for Water Chemistry Analyses, 2021[a]

Analyte	Units	BC WQG [b]		EVWQP Level 1 Benchmarks/ Relevant Screening Values [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	2 (100%)	1 (100%)
Hardness (as $CaCO_3$)	mg/L	-	-	-	0.50	0.50	2 (100%)	1 (100%)
pH	pH	6.5 to 9.0		-	0.10	0.10	0	0
Total Suspended Solids	mg/L	-	-	-	1.0	1.0	2 (100%)	1 (100%)
Total Dissolved Solids	mg/L	-	-	1,000	10	10	2 (100%)	1 (100%)
Turbidity	NTU	-	-	-	0.10	0.10	2 (100%)	1 (100%)
Anions and Nutrients								
Alkalinity, Total (as $CaCO_3$)	mg/L	-	-	-	1.0	1.0	2 (100%)	1 (100%)
Ammonia, Total (as N) [f]	mg/L	0.10 to 2.0	0.68 to 26	-	0.0050	0.0050	1 (50%)	1 (100%)
Bromide	mg/L	-	-	-	0.050	0.050	2 (100%)	1 (100%)
Chloride	mg/L	150	600	-	0.10	0.10	2 (100%)	1 (100%)
Fluoride [g]	mg/L	-	1.73 to 1.88	-	0.020	0.020	2 (100%)	1 (100%)
Nitrate (as N)	mg/L	3	32.8	6.8 to 15	0.0050	0.0050	2 (100%)	1 (100%)
Nitrite (as N) [h]	mg/L	0.02 to 0.20	0.06 to 0.60	0.015 to 0.050	0.0010	0.0010	2 (100%)	1 (100%)
Total Kjeldahl Nitrogen	mg/L	-	-	-	0.050	0.050	2 (100%)	1 (100%)
Orthophosphate-Dissolved (as P)	mg/L	-	-	-	0.0010	0.0010	2 (100%)	1 (100%)
Total Phosphorus	mg/L	-	-	-	0.0020	0.0020	2 (100%)	1 (100%)
Sulphate (SO_4) [g]	mg/L	429	-	429	0.030	0.030	2 (100%)	1 (100%)
Organic/Inorganic Carbon								
Total Organic Carbon	mg/L	-	-	-	0.50	0.50	2 (100%)	1 (100%)
Dissolved Organic Carbon	mg/L	-	-	-	0.50	0.50	2 (100%)	1 (100%)
Total Metals								
Aluminum (Al)	mg/L	-	-	-	0.0030	0.0030	2 (100%)	1 (100%)
Antimony (Sb)	mg/L	0.009	-	-	0.00010	0.00010	2 (100%)	1 (100%)
Arsenic (As)	mg/L	-	0.005	-	0.00010	0.00010	2 (100%)	1 (100%)
Barium (Ba)	mg/L	1	-	-	0.00010	0.00010	2 (100%)	1 (100%)
Beryllium (Be)	mg/L	0.00013	-	0.0053	0.000020	0.000020	2 (100%)	1 (100%)
Bismuth (Bi)	mg/L	-	-	-	0.000050	0.000050	2 (100%)	1 (100%)
Boron (B)	mg/L	1.2	-	-	0.010	0.010	2 (100%)	1 (100%)
Cadmium (Cd)	mg/L	-	-	-	0.0000050	0.0000050	2 (100%)	1 (100%)
Calcium (Ca)	mg/L	-	-	-	0.050	0.050	2 (100%)	1 (100%)
Chromium (Cr) [i]	mg/L	0.001	-	0.005	0.00010	0.00010	2 (100%)	1 (100%)
Cobalt (Co)	mg/L	0.004	0.11	0.0038 to 0.0083	0.00010	0.00010	2 (100%)	1 (100%)
Copper (Cu)	mg/L	-	-	-	0.00050	0.00050	2 (100%)	1 (100%)
Iron (Fe)	mg/L	-	1	-	0.010	0.010	2 (100%)	1 (100%)
Lead (Pb) [g]	mg/L	0.012 to 0.020	0.23 to 0.42	-	0.000050	0.000050	2 (100%)	1 (100%)
Lithium (Li)	mg/L	-	-	-	0.0010	0.0010	2 (100%)	1 (100%)
Magnesium (Mg)	mg/L	-	-	-	0.10	0.0050	2 (100%)	0
Manganese (Mn)	mg/L	1.6 to 2.6	3.0 to 3.4	-	0.00010	0.00010	2 (100%)	1 (100%)
Mercury (Hg)	mg/L	0.0000013	-	-	0.00000050	0.00000050	2 (100%)	1 (100%)
Molybdenum (Mo)	mg/L	7.6	46	-	0.000050	0.000050	2 (100%)	1 (100%)
Nickel (Ni) [g]	mg/L	-	-	0.0053	0.00050	0.00050	2 (100%)	1 (100%)
Potassium (K)	mg/L	-	-	-	0.050	0.050	2 (100%)	1 (100%)
Selenium (Se)	mg/L	0.002	-	0.070	0.000050	0.000050	2 (100%)	1 (100%)
Silicon (Si)	mg/L	-	-	-	0.10	0.10	2 (100%)	1 (100%)
Silver (Ag) [g]	mg/L	0.0015	0.0030	-	0.000010	0.000010	2 (100%)	1 (100%)
Sodium (Na)	mg/L	-	-	-	0.050	0.050	2 (100%)	1 (100%)
Strontium (Sr)	mg/L	-	-	-	0.00020	0.00020	2 (100%)	1 (100%)
Thallium (Tl)	mg/L	0.0008	-	-	0.000010	0.000010	2 (100%)	1 (100%)
Tin (Sn)	mg/L	-	-	-	0.00010	0.00010	2 (100%)	1 (100%)
Titanium (Ti)	mg/L	-	-	-	0.010	0.00030	2 (100%)	1 (100%)
Uranium (U)	mg/L	0.0085	-	-	0.000010	0.000010	2 (100%)	1 (100%)
Vanadium (V)	mg/L	-	-	0.12	0.00050	0.00050	2 (100%)	1 (100%)
Zinc (Zn) [g]	mg/L	0.11 to 0.19	0.13 to 0.34	-	0.0030	0.0030	2 (100%)	1 (100%)

Shading indicates blank concentrations at or greater than the LRL.

Shading indicates an LRL greater than the lowest EVWQP Level 1 Benchmark (Teck 2014) or relevant, site-specific screening value.

Shading indicates an LRL greater than the lowest BC WQG for the protection of freshwater aquatic life (BCMOECCS 2021a,b).

Notes: BC WQG = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan; LRL = Laboratory Reporting Limit; < = 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.

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

[b] Working (BCMOECCS 2021a) or approved (BCMOECCS 2021b) BC WQG for the protection of freshwater aquatic life.

[c] Where more than one EVWQP Level 1 Benchmark or screening value was applicable, the most conservative (lowest) value was used.

[d] The LRLs for all analytes were consistently less than the applicable EVWQP Level 1 Benchmarks (Teck 2014) or screening values (Golder 2017; Teck 2020).

[e] The total number of samples in February 2021 was n = 2 (n = 1 trip blank and n = 1 field blank); in September 2021, the total number of samples was n = 1 field blank (i.e., no trip blanks were submitted for analysis in September 2021). 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] Guideline for chromium VI (0.001 mg/L) was selected because this is the principal species found in surface waters.

[j] Dissolved aluminum guidelines were calculated based on the pH of individual water samples.

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

Table A.3: Field Blank and Trip Blank Evaluation for Water Chemistry Analyses, 2021[a]

Analyte	Units	BC WQG [b]		EVWQP Level 1 Benchmarks/ Relevant Screening Values [c]	Range of LRLs [d]		No. Sample Results <LRL [e]	
		Long-term Average	Short-term Maximum		February	September	February	September
Dissolved Metals								
Aluminum (Al) [j]	mg/L	0.05	0.1	-	0.0030	0.0010	1 (100%)	1 (100%)
Antimony (Sb)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)
Arsenic (As)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)
Barium (Ba)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)
Beryllium (Be)	mg/L	-	-	-	0.000020	0.000020	1 (100%)	1 (100%)
Bismuth (Bi)	mg/L	-	-	-	0.000050	0.000050	1 (100%)	1 (100%)
Boron (B)	mg/L	-	-	-	0.010	0.010	1 (100%)	1 (100%)
Cadmium (Cd) [g]	mg/L	0.00038 to 0.00046	0.0014 to 0.0028	0.00026 to 0.0016	0.0000050	0.0000050	1 (100%)	1 (100%)
Calcium (Ca)	mg/L	-	-	-	0.050	0.050	2 (100%)	1 (100%)
Chromium (Cr)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)
Cobalt (Co)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)
Copper (Cu) [k]	mg/L	0.00060 to 0.0047	0.0038 to 0.028	-	0.00020	0.00020	1 (100%)	1 (100%)
Iron (Fe)	mg/L	-	0.35	1.1	0.010	0.010	1 (100%)	1 (100%)
Lead (Pb)	mg/L	-	-	-	0.000050	0.000050	1 (100%)	1 (100%)
Lithium (Li)	mg/L	-	-	-	0.0010	0.0010	1 (100%)	1 (100%)
Magnesium (Mg)	mg/L	-	-	-	0.0050 to 0.10	0.0050	2 (100%)	1 (100%)
Manganese (Mn)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)
Mercury (Hg)	mg/L	-	-	-	0.0000050	0.0000050	1 (100%)	1 (100%)
Molybdenum (Mo)	mg/L	-	-	-	0.000050	0.000050	1 (100%)	1 (100%)
Nickel (Ni)	mg/L	-	-	-	0.00050	0.00050	1 (100%)	1 (100%)
Potassium (K)	mg/L	-	-	-	0.050	0.050	2 (100%)	1 (100%)
Selenium (Se)	mg/L	-	-	-	0.000050	0.000050	1 (100%)	1 (100%)
Silicon (Si)	mg/L	-	-	-	0.050	0.050	1 (100%)	1 (100%)
Silver (Ag)	mg/L	-	-	-	0.000010	0.000010	1 (100%)	1 (100%)
Sodium (Na)	mg/L	-	-	-	0.050	0.050	2 (100%)	1 (100%)
Strontium (Sr)	mg/L	-	-	-	0.00020	0.00020	1 (100%)	1 (100%)
Thallium (Tl)	mg/L	-	-	-	0.000010	0.000010	1 (100%)	1 (100%)
Tin (Sn)	mg/L	-	-	-	0.00010	0.00010	1 (100%)	1 (100%)
Titanium (Ti)	mg/L	-	-	-	0.010	0.00030	1 (100%)	1 (100%)
Uranium (U)	mg/L	-	-	-	0.000010	0.000010	1 (100%)	1 (100%)
Vanadium (V)	mg/L	-	-	-	0.00050	0.00050	1 (100%)	1 (100%)
Zinc (Zn)	mg/L	-	-	-	0.0010	0.0010	1 (100%)	1 (100%)

Shading indicates blank concentrations at or greater than the LRL.

Shading indicates an LRL greater than the lowest EVWQP Level 1 Benchmark (Teck 2014) or relevant, site-specific screening value.

Shading indicates an LRL greater than the lowest BC WQG for the protection of freshwater aquatic life (BCMOECCS 2021a,b).

Notes: BC WQG = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan; LRL = Laboratory Reporting Limit; < = 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.

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

[b] Working (BCMOECCS 2021a) or approved (BCMOECCS 2021b) BC WQG for the protection of freshwater aquatic life.

[c] Where more than one EVWQP Level 1 Benchmark or screening value was applicable, the most conservative (lowest) value was used.

[d] The LRLs for all analytes were consistently less than the applicable EVWQP Level 1 Benchmarks (Teck 2014) or screening values (Golder 2017; Teck 2020).

[e] The total number of samples in February 2021 was n = 2 (n = 1 trip blank and n = 1 field blank); in September 2021, the total number of samples was n = 1 field blank (i.e., no trip blanks were submitted for analysis in September 2021). 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] Guideline for chromium VI (0.001 mg/L) was selected because this is the principal species found in surface waters.

[j] Dissolved aluminum guidelines were calculated based on the pH of individual water samples.

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

Of the results that were reported for field and trip blanks, only two were greater than the LRL: ammonia (as N) in one sample from February 2021 and total magnesium in one sample from September 2021 (Appendix Table A.3). However, detectable concentrations measured in blank samples are only considered reliable if they are greater than five-times the LRL (Appendix Table A.1), and this was not the case for the two instances of reported concentrations. The results for the field and trip blanks therefore indicate contamination of the samples in the field or during transport was unlikely.

A total of 576 method blank results were reported by ALS (see Appendix B for applicable laboratory reports) and all results were below the LRL. Therefore, the laboratory method blank results do not indicate any issues with the data that might affect data interpretability.

A2.3 Data Precision

A2.3.1 Field Duplicate Samples

Two field duplicate samples were collected to assess field sampling precision: one in February and one in September 2021 (Appendix Table A.4). 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).

The analytes with long-term targets under the EVWQP (i.e., selenium, nitrate, sulphate, and dissolved cadmium; Teck 2014), had excellent field sampling precision, except for dissolved cadmium (Appendix Table A.4). Relative percent difference (RPDs) between paired results for selenium were less than or equal to (≤) 7.3%; RPDs for nitrate and sulphate were ≤0.68% and ≤1.3%, respectively. For dissolved cadmium, RPDs between paired results were ≤38%. The high cadmium RPD is likely attributed to both reported concentrations being within five-times the LRL.[2] Field sampling precision was good to excellent for total dissolved solids (TDS) and nickel, both of which have site-specific screening values. For TDS, RPDs between paired results were ≤18. For total nickel, RPDs between paired concentrations were ≤4.8% (Appendix Table A.4).

Field precision and reproducibility are considered good to excellent for most of the analytes with long term targets under the EVQWP (total selenium and nickel, nitrate, sulphate, dissolved cadmium, and TDS). Overall, the field sampling precision is considered acceptable for the purpose of this study.

[2] Greater RPDs between paired results for water chemistry analyses are considered more acceptable when concentrations are close to the LRL (e.g., within five-times the LRL; Austin 2020).

Table A.4: Field Duplicate Results for Water Chemistry Analyses, 2021

Analyte	Units	RG_GHBP			RG_GHBP		
		February			September		
		18-Feb-21		RPD (%)	13-Sep-21		RPD (%)
		L2559277			CG2104105		
Physical Tests							
Specific Conductance	µS/cm	1,690	1,700	0.59	1,600	1,590	0.63
Hardness (as $CaCO_3$)	mg/L	1,180	1,170	0.85	989	993	0.40
pH	pH	8.22	8.21	0.12	8.44	8.43	0.12
Total Suspended Solids	mg/L	<1.0	<1.0	0	1,310	1,300	0.77
Total Dissolved Solids	mg/L	1,540	1,560	1.3	2.4	2.0	18
Turbidity	NTU	0.24	0.20	18	1.42	0.91	44
Anions and Nutrients							
Alkalinity, Total (as $CaCO_3$)	mg/L	294	293	0.34	230	256	11
Ammonia, Total (as N)	mg/L	0.0227	0.0268	17	0.0108	0.0091	17
Bromide	mg/L	<0.25	<0.25	0	<0.250	<0.250	0
Chloride	mg/L	1.88	2.6	32	1.50	1.56	3.9
Fluoride	mg/L	0.160	0.160	0	0.112	0.115	2.6
Nitrate (as N)	mg/L	5.87	5.83	0.68	4.74	4.71	0.63
Nitrite (as N)	mg/L	0.0064	0.0080	22	0.0064	0.0077	18
Total Kjeldahl Nitrogen	mg/L	<0.25	<0.050	0	0.678	0.563	19
Orthophosphate-Dissolved (as P)	mg/L	0.0037	0.0045	20	<0.0010	<0.0010	0
Total Phosphorus	mg/L	0.0034	0.0052	42	0.0065	0.0079	19
Sulphate (SO_4)	mg/L	910	898	1.3	787	783	0.51
Organic/Inorganic Carbon							
Total Organic Carbon	mg/L	1.51	1.58	4.5	2.24	2.18	2.7
Dissolved Organic Carbon	mg/L	1.43	1.58	10	2.35	2.05	14
Total Metals							
Aluminum (Al)	mg/L	<0.0030	<0.0030	0	0.0110	0.0072	42
Antimony (Sb)	mg/L	0.00047	0.00047	0	0.00053	0.00053	0
Arsenic (As)	mg/L	0.00028	0.00031	10	0.00020	0.00020	0
Barium (Ba)	mg/L	0.0525	0.0493	6.3	0.0363	0.0386	6.1
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	0.013	26	0.012	0.012	0
Cadmium (Cd)	mg/L	0.0000098	0.0000099	1.0	0.0000128	0.0000077	50
Calcium (Ca)	mg/L	224	231	3.1	176	184	4.4
Chromium (Cr)	mg/L	0.00010	0.00011	10	<0.00010	<0.00010	0
Cobalt (Co)	mg/L	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)	mg/L	<0.00050	<0.00050	0	0.00051	<0.00050	0
Iron (Fe)	mg/L	<0.010	<0.010	0	0.010	0.012	18
Lead (Pb)	mg/L	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)	mg/L	0.0166	0.0171	3.0	0.0186	0.0185	0.54
Magnesium (Mg)	mg/L	175	176	0.57	139	152	8.9
Manganese (Mn)	mg/L	0.00172	0.00180	4.5	0.00183	0.00206	12
Mercury (Hg)	mg/L	<0.00000050	<0.00000050	0	0.00000051	<0.00000050	2.0
Molybdenum (Mo)	mg/L	0.00403	0.00399	1.0	0.00394	0.00441	11
Nickel (Ni)	mg/L	0.0106	0.0106	0	0.00747	0.00784	4.8
Potassium (K)	mg/L	2.45	2.50	2.0	2.42	2.54	4.8
Selenium (Se)	mg/L	0.177	0.180	1.7	0.145	0.156	7.3
Silicon (Si)	mg/L	4.14	4.27	3.1	3.78	4.06	7.1
Silver (Ag)	mg/L	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	3.02	2.94	2.7	2.54	2.71	6.5
Strontium (Sr)	mg/L	0.230	0.236	2.6	0.188	0.195	3.7
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	<0.010	<0.010	0	<0.00030	<0.00030	0
Uranium (U)	mg/L	0.0092	0.0091	1.2	0.00890	0.00891	0.11
Vanadium (V)	mg/L	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Zinc (Zn)	mg/L	<0.0030	<0.0030	0	0.0045	<0.0030	40

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 A.4: Field Duplicate Results for Water Chemistry Analyses, 2021

Analyte	Units	RG_GHFF			RG_GHBP		
		February			September		
		18-Feb-21		RPD (%)	13-Sep-21		RPD (%)
		L2503266			CG2104105		
Dissolved Metals							
Aluminum (Al)	mg/L	<0.0030	<0.0030	0	<0.0010	<0.0010	0
Antimony (Sb)	mg/L	0.00043	0.00045	4.5	0.00050	0.00048	4.1
Arsenic (As)	mg/L	0.00019	0.00019	0	0.00019	0.00021	10
Barium (Ba)	mg/L	0.0471	0.0477	1.3	0.0390	0.0377	3.4
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	0.0000089	0.0000089	0	0.0000076	0.0000052	38
Calcium (Ca)	mg/L	202	203	0.49	170	170	0
Chromium (Cr)	mg/L	0.00010	<0.00010	0	<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	0.00045	0.00027	50
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	0.017	0.017	2.9	0.0179	0.0178	0.56
Magnesium (Mg)	mg/L	164	161	1.8	137	138	0.73
Manganese (Mn)	mg/L	0.00081	0.00084	3.6	0.00065	0.00047	32
Mercury (Hg)	mg/L	<0.0000050	<0.0000050	0	<0.0000050	<0.0000050	0
Molybdenum (Mo)	mg/L	0.00386	0.00392	1.5	0.00380	0.00431	13
Nickel (Ni)	mg/L	0.0099	0.0099	0.30	0.00724	0.00744	2.7
Potassium (K)	mg/L	2.53	2.49	1.6	2.60	2.57	1.2
Selenium (Se)	mg/L	0.167	0.180	7.5	0.145	0.142	2.1
Silicon (Si)	mg/L	3.99	4.04	1.2	3.85	3.90	1.3
Silver (Ag)	mg/L	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)	mg/L	3.08	3.03	1.6	2.66	2.56	3.8
Strontium (Sr)	mg/L	0.223	0.228	2.2	0.178	0.174	2.3
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	<0.010	<0.010	0	<0.00030	<0.00030	0
Uranium (U)	mg/L	0.0079	0.0080	2.1	0.00831	0.00864	3.9
Vanadium (V)	mg/L	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Zinc (Zn)	mg/L	<0.0010	0.0012	18	0.0053	<0.0010	137

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.

A2.3.2 Laboratory Duplicate Samples

A total of 490 duplicate results were used to evaluate analytical precision (see Appendix B for relevant laboratory reports). For all paired samples, comparisons were within the DQO set by the analytical laboratory (i.e., RPDs for pH and conductivity were ≤10%, RPDs for turbidity were ≤15%, and RPDs for all other analytes were ≤20%; Appendix Table A.1).[3] The laboratory analytical precision can therefore be considered excellent.

A2.4 Data Accuracy

Data accuracy was evaluated based on results for CRM, Laboratory Control Samples (LCS), and MS samples. Specifically, 1 CRM result, 572 LCS results, and 435 MS results were reported by ALS in 2021 (see Appendix B for respective laboratory reports). Only two LCS results failed to meet the laboratory DQO (Appendix Table A.1). The recovery target (80 to 120%) for total antimony in one LCS sample from September 2021 was marginally exceeded (i.e., the recovery was 122%). Similarly, the recovery of total strontium (122%) marginally exceeded the target recovery range (i.e., 80 to 120%) in a single sample from September 2021. Eight of the 45 MS recoveries from February 2021 could not be accurately calculated due to high background concentrations of the spiked analytes in the parent field sample that was used as the basis for the MS sample. A single MS result for total Kjeldahl nitrogen failed to meet the laboratory's DQO due to interference from a high nitrate concentration in the sample, which biased the total Kjeldahl nitrogen results low. Overall, the CRM, LCS and MS results are considered indicative of excellent analytical precision.

A2.5 Data Quality Statement

Water quality data collected for this study are of acceptable quality as characterized by good to excellent detectability, negligible analyte 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.

[3] The DQO only apply to analyte concentrations greater than two-times the LRL.

A3 SELENIUM SPECIATION

A3.1 Laboratory Reporting Limits

The analytical reports from Brooks Applied Labs for aqueous selenium speciation analyses were examined to provide an inventory of analytes for which the sample results were less than or equal to the target LRL (Appendix Table A.5; see Appendix B for laboratory reports). The LRLs for these analytes were also assessed relative to the approved BCMOECCS selenium BC WQG for the protection of freshwater aquatic life (i.e., 2 micrograms per litre [µg/L; BCMOECCS 2021b) and the relevant EVWQP Level 1 Benchmark for water quality (i.e., 70 µg/L; Teck 2014; Appendix Table A.5).

Concentrations of dissolved selenium, selenate, and selenite were consistently (i.e., in 100% of samples) greater than their applicable LRLs in 2021 (Appendix Table A.5). Each of the three samples collected in February 2021 and seven of the eight samples collected in September 2021 had total selenium concentrations that were also greater than their applicable LRLs. The LRLs for all analytes were consistently lower than applicable BC WQG and EVWQP Level 1 Benchmarks for water quality (Teck 2014). Therefore, the achieved LRLs were appropriate for this study.

A3.2 Laboratory Blanks

In 2021, a total of 19 laboratory blank samples were analyzed for total selenium and 16 laboratory blank samples were analyzed for selenium species to produce a total of 123 individual analyte results. Laboratory blank results met the laboratory's DQO (Appendix Table A.1). Therefore, laboratory blanks indicated no inadvertent sample contamination during analyses.

A3.3 Data Precision

A3.3.1 Field Duplicate Samples

Two field duplicate samples were collected to assess field sampling precision: one in February and one in September 2021 (Appendix Table A.6). The RPDs between paired results were ≤13%. Given that the field duplicates met the DQO for laboratory duplicate samples (i.e., ≤20% for total selenium and ≤20% for selenium species; Appendix Table A.1), field sampling precision and reproducibility are considered excellent.

Table A.5: Laboratory Reporting Limit (LRL) Evaluation for Selenium Speciation Analyses, 2021

Analyte	Units	February 2021		September 2021	
		LRLs [a]	No. Sample Results <LRL	LRLs [a]	No. Sample Results <LRL
Selenium (Se)-Total	µg/L	0.132	0	0.165 and 0.825	1 (13%) [b]
Selenium (Se)-Dissolved	µg/L	0.132	0	0.165	0
Dimethylselenoxide-Dissolved	µg/L	0.010	1 (33%)	0.010	5 (63%)
MeSe(IV) - Methylseleninic Acid (CH_3SeO_2H)-Dissolved	µg/L	0.010	0	0.010	3 (38%)
MeSe(VI) - Methaneselenonic Acid (CH_4O_3Se)-Dissolved	µg/L	0.010	3 (100%)	0.010	8 (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	0.010	0
SeCN - Selenocyanate ($SeCN^{1-}$)- Dissolved	µg/L	0.010	3 (100%)	0.010	8 (100%)
SeMe - Selenomethionine ($CH_3SeCH_2CH_2CH[NH_2]CO_2H$)-Dissolved	µg/L	0.010	3 (100%)	0.010	8 (100%)
Selenosulfate-Dissolved	µg/L	0.010	3 (100%)	0.010	8 (100%)
Unknown Selenium Species-Dissolved	µg/L	0.010	3 (100%)	0.010	8 (100%)

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

[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 2019) or the EVWQP Level 1 Benchmark for aqueous selenium concentrations (70 µg/L; Teck 2014).

[b] The LRL was raised for one of the samples collected in September 2021 due to insufficient sample volume.

Table A.6: Field Duplicate Results for Selenium Speciation Analyses, 2021

Analyte	Units	RG_GHBP			RG_GHBP		
		February 2021			September 2021		
		18-Feb-21		RPD (%)	13-Sep-21		RPD (%)
		2103140			2109237		
Selenium (Se)-Total	µg/L	142	146	2.8	128.000	121	5.6
Selenium (Se)-Dissolved	µg/L	148	149	0.67	122.000	129	5.6
Dimethylselenoxide-Dissolved	µg/L	0.066	0.068	3.0	0.250	0.255	2.0
MeSe(IV) - Methylseleninic Acid (CH_3SeO_2H)-Dissolved	µg/L	0.032	0.034	6.1	0.099	0.113	13
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	120	131	8.8	132	131	0.76
Se(IV) - Selenite (SeO_3^{2-})-Dissolved	µg/L	1.46	1.64	12	4.23	4.06	4.1
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.

A3.3.2 Laboratory Duplicate Samples

Analytical precision was evaluated by examining eight laboratory duplicate samples for a total of 40 reported duplicate pairs (Appendix B). All comparisons of paired duplicate concentrations were within the DQO set by the analytical laboratory. Therefore, laboratory analytical precision can be considered excellent.

The analytical laboratory also reported an estimate of precision for recoveries within six matrix spike duplicate (MSD) samples (Appendix B). 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 A.1).

A3.4 Laboratory Accuracy

Laboratory accuracy for selenium speciation analyses was evaluated based on 17 blank spike (BS) samples, 16 CRM samples, six MS samples, and six MSD samples. Recoveries of all BS, CRM, MS, and MSD samples met the laboratory DQO (Appendix Table A.1). Therefore, the overall accuracy achieved by the laboratory was considered excellent.

A3.5 General Laboratory and Data Quality Flags

The analytical laboratory included general laboratory data quality flags related to digests completed for two of the three batches of samples collected in September 2021. In the first batch, one of the BS samples (B212656-SRM1; Appendix B) was mis-prepped by the analytical laboratory during the digest. The laboratory did not report results for this sample and assessed digest performance based on the other BS samples and CRM included in the sample batch. In the second batch, eight of the laboratory QC samples failed to achieve the target sample volume following the heating step of the trace metal digestion (Appendix B). Field-collected and BS samples achieved target sample volumes and recoveries of BS and CRM samples were within acceptable ranges. Therefore, digest performance was considered acceptable and no further corrective actions were taken.

The dissolved selenium result was greater than the total selenium result for each of the three samples collected in February and in one sample from September 2021 (Appendix B). Because there was no indication of mislabeled samples, the original results were reported as representative of the submitted sample containers. The analytical laboratory indicated that the results were likely due to routine laboratory error (e.g., random errors in preparation and dilution steps, matrix effects on analyses, small changes in instrument responses; Maute 2021, pers. comm.). Additionally, paired total and dissolved selenium concentrations that differ by less than approximately 5% are considered statistically equivalent

(Maute 2021, pers. comm.) and reported results for these four samples from 2021 were within ≤6.4% of each other.

Sample 2109307-05 (RG_GAUT_WS_GGCAMP_2021-09-16) had a limited sample volume upon receipt by the laboratory. The LRL was adjusted upward to account for the limited volume used in the analysis.

A3.6 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.

A4 SEDIMENT CHEMISTRY

A4.1 Laboratory Reporting Limits

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

Sediment chemistry samples collected in September 2021 were analyzed using Sequential Extraction Analysis (SEA). Results were reported for bulk sediment samples as well as leachable metal fractions, specifically exchangeable and adsorbed metals, carbonate metals, easily-reducible metals and iron oxides, organic-bound metals, and residual metals. Concentrations of metals reported for bulk sediment chemistry samples were typically greater than the LRL (Appendix Table A.7). Exceptions included bismuth, boron, sulphur, tin, tungsten, and zirconium. For the leachable metal fractions, only barium, calcium, and manganese were consistently reported at detectable concentrations. Overall, none of the reported concentrations for bulk or extractable metals exceeded BC WSQG (Appendix Table A.7).

Unlike the case for metals, LRLs for polycyclic aromatic hydrocarbons (PAHs) occasionally exceeded BC WSQG (Appendix Table A.7). Analytes 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, benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, 2-methylnaphphalene, and naphthalene. The LRLs for acenaphthene (55% of samples), benz(a)anthracene (23% of samples), and chrysene (23% of samples) also exceeded the upper BC WSQG (i.e., the concentrations above which effects to aquatic biota may be more frequently observed). Typically, elevated (relative to BC WSQG) LRLs for these analytes are attributed to high moisture content and matrix interferences that necessitated raising the detection limits (Schvets 2020, pers. comm.).

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

Table A.7: Laboratory Reporting Limit (LRL) Evaluation for Sediment Chemistry Analyses, September 2021[a]

Analyte	Units	BC WSQGs [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	-	-	13 (59%)
% Sand (2.00mm - 1.00mm)	%	-	-	1.0	-	-	8 (36%)
% Sand (1.00mm - 0.50mm)	%	-	-	1.0	-	-	8 (36%)
% Sand (0.50mm - 0.25mm)	%	-	-	1.0	-	-	7 (32%)
% Sand (0.25mm - 0.125mm)	%	-	-	1.0	-	-	6 (27%)
% Sand (0.125mm - 0.063mm)	%	-	-	1.0	-	-	3 (14%)
% 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	%	-	-	0.050	-	-	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	-	-	21 (95%)
Boron (B)	mg/kg	-	-	5.0	-	-	8 (36%)
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	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	-	-	5 (23%)
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	-	-	13 (59%)
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	13 (59%)
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	7 (32%)
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	-	-	4 (18%)
Copper (Cu)	mg/kg	35.7	197	0.50	0	0	22 (100%)
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	3 (14%)
Phosphorus (P)	mg/kg	-	-	50	-	-	22 (100%)
Potassium (K)	mg/kg	-	-	100	-	-	7 (32%)
Selenium (Se)	mg/kg	[d]	[d]	0.20	0	0	14 (64%)
Silver (Ag)	mg/kg	0.5	-	0.10	0	-	22 (100%)
Sodium (Na)	mg/kg	-	-	100	-	-	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	-	-	22 (100%)
Uranium (U)	mg/kg	-	-	0.050	-	-	13 (59%)
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 2019) and laboratory reports.

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

[c] The total number of samples in September 2021 was n = 22 (n = 20 sediment samples and n = 2 duplicate samples).

[d] The 2 mg/kg alert concentration from BCMOECCS (2019) was applied; there is currently no BC WSQG for selenium.

Table A.7: Laboratory Reporting Limit (LRL) Evaluation for Sediment Chemistry Analyses, September 2021[a]

Analyte	Units	BC WSQGs [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	8 (36%)
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	22 (100%)
Lead (Pb)	mg/kg	35	91.3	0.50	0	0	18 (82%)
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	0
Phosphorus (P)	mg/kg	-	-	50	-	-	22 (100%)
Selenium (Se)	mg/kg	[d]	[d]	0.20	0	0	20 (91%)
Silver (Ag)	mg/kg	0.5	-	0.10	0	-	22 (100%)
Strontium (Sr)	mg/kg	-	-	5.0	-	-	1 (4.5%)
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	-	-	2 (9.1%)
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	-	-	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			5 (23%)
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	15 (68%)
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	0	3 (14%)
Silver (Ag)	mg/kg	0.5	-	0.10	0	-	17 (77%)
Strontium (Sr)	mg/kg	-	-	0.50	-	-	0
Thallium (Tl)	mg/kg	-	-	0.050	-	-	21 (95%)
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	-	-	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	-	-	22 (100%)
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	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	6 (27%)
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	21 (95%)
Nickel (Ni)	mg/kg	16	75	0.50	0	0	0
Selenium (Se)	mg/kg	[d]	[d]	0.20	0	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 2019) and laboratory reports.

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

[c] The total number of samples in September 2021 was n = 22 (n = 20 sediment samples and n = 2 duplicate samples).

[d] The 2 mg/kg alert concentration from BCMOECCS (2019) was applied; there is currently no BC WSQG for selenium.

Table A.7: Laboratory Reporting Limit (LRL) Evaluation for Sediment Chemistry Analyses, September 2021[a]

Analyte	Units	BC WSQGs [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	0.50	0	0	0
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	0
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	-	-	5 (23%)
Manganese (Mn)	mg/kg	460	1,100	5.0	0	0	0
Molybdenum (Mo)	mg/kg	25	23,000	0.50	0	0	0
Nickel (Ni)	mg/kg	16	75	2.0	0	0	0
Selenium (Se)	mg/kg	[d]	[d]	0.20	0	0	0
Silver (Ag)	mg/kg	0.5	-	0.10	0	-	5 (23%)
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	0.0050 to 0.665	14 (64%)	12 (55%)	12 (55%)
Acenaphthylene	mg/kg	0.00587	0.128	0.0050 to 0.055	10 (45%)	0	6 (27%)
Acridine	mg/kg	-	-	0.010 to 1.22	-	-	11 (50%)
Anthracene	mg/kg	0.0469	0.245	0.0040 to 0.035	0	0	15 (68%)
Benz(a)anthracene	mg/kg	0.0317	0.385	0.010 to 0.76	11 (50%)	5 (23%)	11 (50%)
Benzo(a)pyrene	mg/kg	0.0319	0.782	0.010 to 0.18	2 (9.1%)	0	1 (4.5%)
Benzo(b&j)fluoranthene	mg/kg	-	-	0.010 to 0.035	-	-	0
Benzo(b+j+k)fluoranthene	mg/kg	-	-	0.015 to 0.049	-	-	0
Benzo(e)pyrene	mg/kg	-	-	0.010 to 0.035	-	-	0
Benzo(g,h,i)perylene	mg/kg	0.17	3.2	0.010 to 0.13	0	0	1 (4.5%)
Benzo(k)fluoranthene	mg/kg	0.24	13.4	0.010 to 0.035	0	0	3 (14%)
Chrysene	mg/kg	0.0571	0.862	0.010 to 1.45	10 (45%)	5 (23%)	10 (45%)
Dibenz(a,h)anthracene	mg/kg	0.00622	0.135	0.0050 to 0.105	10 (45%)	0	5 (23%)
Fluoranthene	mg/kg	0.111	2.355	0.010 to 0.18	1 (4.5%)	0	1 (4.5%)
Fluorene	mg/kg	0.0212	0.144	0.010 to 0.035	4 (18%)	0	0
Indeno(1,2,3-c,d)pyrene	mg/kg	0.2	3.2	0.010 to 0.035	0	0	2 (9.1%)
1-Methylnaphthalene	mg/kg	-	-	0.020 to 0.050	-	-	0
2-Methylnaphthalene	mg/kg	0.0202	0.201	0.010 to 0.035	4 (18%)	0	0
Naphthalene	mg/kg	0.0346	0.391	0.010 to 0.035	2 (9.1%)	0	0
Perylene	mg/kg	-	-	0.010 to 0.035	-	-	12 (55%)
Phenanthrene	mg/kg	0.0419	0.515	0.010 to 0.035	0	0	0
Pyrene	mg/kg	0.053	0.875	0.010 to 0.035	0	0	1 (4.5%)
Quinoline	mg/kg	-	-	0.020 to 0.050	-	-	20 (91%)

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 2019) and laboratory reports.

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

[c] The total number of samples in September 2021 was n = 22 (n = 20 sediment samples and n = 2 duplicate samples).

[d] The 2 mg/kg alert concentration from BCMOECCS (2019) was applied; there is currently no BC WSQG for selenium.

A4.2 Laboratory Blanks

A total of 38 laboratory method blank samples were analyzed by ALS (see Appendix B for applicable laboratory reports). Each of the 916 reported method blank results met the laboratory DQO. Therefore, the results for this study indicated no inadvertent contamination of samples within the laboratory during analysis.

A4.3 Data Precision

A4.3.1 Field Duplicate Samples

Two pairs of field duplicate samples were collected to assess the precision of field sampling (Appendix Table A.8). Samples 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. For selenium, RPDs between paired results for bulk sediment samples were 3.3 and 11%. In general, RPDs for most (i.e., 94%) paired concentrations, including all metals fractions and PAHs, were ≤20% (Appendix Table A.8). Overall, reported results appear to be accurate; however, there is some variability even at a sub-sampling scale that should be considered when interpreting the sediment chemistry results. For example, concentrations of acenaphthylene, exchangeable and adsorbed manganese, and organic-bound thallium in one set of duplicate samples differed by an order of magnitude. The same was also true for organic-bound zinc in the second set of field duplicates (Appendix Table A.8).[4] However, the collection of replicate samples from each area is expected to reduce this type of variability and support the overall results and comparisons.

A4.3.2 Laboratory Duplicate Samples

A total of nine laboratory duplicate samples were used to evaluate laboratory precision (see Appendix B for the relevant laboratory reports). For almost all of the 442 comparisons that were reported, RPDs were within laboratory DQO (Appendix Table A.1). The exception was a single paired result for manganese in the exchangeable and adsorbed metals fraction; the RPD between paired results was 2.1% and the DQO was 2%. Therefore, laboratory analytical precision was excellent overall for the sediment chemistry samples collected in September 2021.

A4.4 Data Accuracy

[4] The order-of-magnitude (i.e., approximately 10-times) difference between results for these parameters in paired samples was investigated by the analytical laboratory and the original results were confirmed (Shvets 2022, pers. comm.).

Table A.8: Field Duplicate Results for Sediment Chemistry Analyses, September 2021

Analyte	Units	RG_GHP			RG_GHP		
		21-Sep-21		RPD (%)	22-Sep-21		RPD (%)
		L2644215			L2644215		
Physical Tests							
Moisture	%	57.8	57.3	0.87	59.6	60.4	1.3
pH (1:2)	pH units	8.21	8.01	2.5	8.13	8.19	0.74
Particle Size							
% Gravel (>2mm)	%	<1.0	<1.0	0	<1.0	<1.0	0
% Sand (2.00mm - 1.00mm)	%	<1.0	<1.0	0	<1.0	<1.0	0
% Sand (1.00mm - 0.50mm)	%	<1.0	<1.0	0	<1.0	<1.0	0
% Sand (0.50mm - 0.25mm)	%	<1.0	<1.0	0	<1.0	<1.0	0
% Sand (0.25mm - 0.125mm)	%	<1.0	<1.0	0	<1.0	<1.0	0
% Sand (0.125mm - 0.063mm)	%	<1.0	<1.0	0	1.1	1.3	0
% Silt (0.063mm - 0.0312mm)	%	14.7	14.7	0	15.5	9.6	47
% Silt (0.0312mm - 0.004mm)	%	56.0	55.8	0.36	49.1	48.3	1.6
% Clay (<4μm)	%	28.1	28.0	0.36	33.6	40.0	17
Organic/Inorganic Carbon							
Total Organic Carbon	%	17.1	17.8	4.0	22.3	21.2	5.1
Bulk Metals							
Aluminum (Al)	mg/kg	8,210	10,200	22	8,520	9,200	7.7
Antimony (Sb)	mg/kg	1.01	1.08	6.7	1.03	1.05	1.9
Arsenic (As)	mg/kg	5.93	6.22	4.8	5.77	5.84	1.2
Barium (Ba)	mg/kg	310	343	10	310	316	1.9
Beryllium (Be)	mg/kg	0.74	0.88	17	0.78	0.71	9.4
Bismuth (Bi)	mg/kg	<0.20	<0.20	0	<0.20	<0.20	0
Boron	mg/kg	<5.0	7.2	36	<5.0	5.7	13
Cadmium (Cd)	mg/kg	1.39	1.45	4.2	1.44	1.35	6.5
Calcium (Ca)	mg/kg	43,200	44,800	3.6	60,900	62,700	2.9
Chromium (Cr)	mg/kg	12.8	15.4	18	13.1	13.9	5.9
Cobalt (Co)	mg/kg	11.10	11.70	5.3	9.97	10.1	1.3
Copper (Cu)	mg/kg	25.6	27.2	6.1	26.1	26.6	1.9
Iron (Fe)	mg/kg	14,500	15,500	6.7	13,200	13,600	3.0
Lead (Pb)	mg/kg	12.2	12.8	4.8	12.3	12.5	1.6
Lithium (Li)	mg/kg	8.9	10.4	16	8.0	8.7	8.4
Magnesium (Mg)	mg/kg	5,020	5,240	4.3	4,630	4,750	2.6
Manganese (Mn)	mg/kg	673	701	4.1	567	595	4.8
Mercury (Hg)	mg/kg	0.13	0.12	8.0	0.108	0.118	8.8
Molybdenum (Mo)	mg/kg	1.63	1.67	2.4	1.66	1.72	3.6
Nickel (Ni)	mg/kg	64.5	67.9	5.1	64.5	67.8	5.0
Phosphorus (P)	mg/kg	967	1,030	6.3	923	924	0.11
Potassium (K)	mg/kg	1,870	2,440	26	2,070	2,260	8.8
Selenium (Se)	mg/kg	8.38	9.40	11	8.7	9.0	3.3
Silver (Ag)	mg/kg	0.38	0.40	5.1	0.36	0.38	5.4
Sodium (Na)	mg/kg	77	79	2.6	71	78	9.4
Strontium (Sr)	mg/kg	54.3	57.6	5.9	62.3	67.4	7.9
Sulphur (S)	mg/kg	1,600	1,700	6.1	1,800	1,900	5.4
Thallium (Tl)	mg/kg	0.125	0.145	15	0.092	0.095	3.2
Tin (Sn)	mg/kg	<2.0	<2.0	0	<2.0	<2.0	0
Titanium (Ti)	mg/kg	6.8	10.3	41	7.3	8.4	14
Tungsten (W)	mg/kg	<0.50	<0.50	0	<0.50	<0.50	0
Uranium (U)	mg/kg	1.13	1.20	6.0	1.09	1.11	1.8
Vanadium (V)	mg/kg	31.1	38.0	20	33.4	35.6	6.4
Zinc (Zn)	mg/kg	137	139	1.4	135	137	1.5
Zirconium (Zr)	mg/kg	<1.0	<1.0	0	<1.0	<1.0	0
Exchangeable and Adsorbed Metals							
Aluminum (Al)	mg/kg	<50	<50	0	<50	<50	0
Antimony (Sb)	mg/kg	<0.10	<0.10	0	<0.10	<0.10	0
Arsenic (As)	mg/kg	<0.050	<0.050	0	<0.050	<0.050	0
Barium (Ba)	mg/kg	17.3	17.8	2.8	16.5	16.1	2.5
Beryllium (Be)	mg/kg	<0.20	<0.20	0	<0.20	<0.20	0
Bismuth (Bi)	mg/kg	<0.20	<0.20	0	<0.20	<0.20	0
Cadmium (Cd)	mg/kg	0.266	0.258	3.1	0.161	0.166	3.1
Calcium (Ca)	mg/kg	3,420	3,780	10	2,990	3,140	4.9
Chromium (Cr)	mg/kg	<0.50	<0.50	0	<0.50	<0.50	0
Cobalt (Co)	mg/kg	0.11	<0.10	0	0.12	<0.10	18
Copper (Cu)	mg/kg	<0.50	<0.50	0	<0.50	<0.50	0
Iron (Fe)	mg/kg	<50	<50	0	<50	<50	0
Lead (Pb)	mg/kg	<0.50	<0.50	0	<0.50	<0.50	0
Lithium (Li)	mg/kg	<5.0	<5.0	0	<5.0	<5.0	0
Manganese (Mn)	mg/kg	69.8	7.3	162	60.2	50.4	18
Molybdenum (Mo)	mg/kg	<0.50	<0.50	0	<0.50	<0.50	0
Nickel (Ni)	mg/kg	1.88	1.40	29	1.98	2.22	11
Phosphorus (P)	mg/kg	<50	<50	0	<50	<50	0
Potassium (K)	mg/kg	<100	<100	0	<100	100	0
Selenium (Se)	mg/kg	0.30	0.41	31	0.52	0.47	10
Silver (Ag)	mg/kg	<0.10	<0.10	0	<0.10	<0.10	0
Sodium (Na)	mg/kg	<100	<100	0	<100	<100	0
Strontium (Sr)	mg/kg	4.79	5.09	6.1	4.24	4.39	3.5
Thallium (Tl)	mg/kg	<0.050	<0.050	0	<0.050	<0.050	0
Tin (Sn)	mg/kg	<2.0	<2.0	0	<2.0	<2.0	0
Titanium (Ti)	mg/kg	<1.0	<1.0	0	<1.0	<1.0	0
Uranium (U)	mg/kg	0.074	0.086	15	0.087	0.090	3.4
Vanadium (V)	mg/kg	<0.20	<0.20	0	<0.20	<0.20	0
Zinc (Zn)	mg/kg	<1.0	<1.0	0	<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 A.8: **Field Duplicate Results for Sediment Chemistry Analyses, September 2021**

Analyte	Units	RG_GHP			RG_GHP		
		21-Sep-21		RPD (%)	22-Sep-21		RPD (%)
		L2644215			L2644215		
Carbonate Metals							
Aluminum (Al)	mg/kg	<50	<50	0	<50	<50	0
Antimony (Sb)	mg/kg	<0.10	<0.10	0	<0.10	<0.10	0
Arsenic (As)	mg/kg	0.056	<0.050	11	<0.050	<0.050	0
Barium (Ba)	mg/kg	47.9	47.9	0	52.9	46.4	13
Beryllium (Be)	mg/kg	<0.20	<0.20	0	<0.20	<0.20	0
Bismuth (Bi)	mg/kg	<0.20	<0.20	0	<0.20	<0.20	0
Cadmium (Cd)	mg/kg	0.501	0.543	8.0	0.537	0.507	5.7
Calcium (Ca)	mg/kg	32,000	32,800	2.5	49,400	45,000	9.3
Chromium (Cr)	mg/kg	<5.0	<5.0	0	<5.0	<5.0	0
Cobalt (Co)	mg/kg	0.36	0.13	94	0.40	0.31	25
Copper (Cu)	mg/kg	<0.50	<0.50	0	<0.50	<0.50	0
Iron (Fe)	mg/kg	<50	<50	0	<50	<50	0
Lead (Pb)	mg/kg	<0.50	<0.50	0	<0.50	<0.50	0
Lithium (Li)	mg/kg	<5.0	<5.0	0	<5.0	<5.0	0
Manganese (Mn)	mg/kg	126	90.4	33	109	91	18
Molybdenum (Mo)	mg/kg	<0.50	<0.50	0	<0.50	<0.50	0
Nickel (Ni)	mg/kg	9.4	8.0	16	11.2	9.7	14
Phosphorus (P)	mg/kg	<50	<50	0	<50	<50	0
Selenium (Se)	mg/kg	<0.20	<0.20	0	0.21	<0.20	4.9
Silver (Ag)	mg/kg	<0.10	<0.10	0	<0.10	<0.10	0
Strontium (Sr)	mg/kg	14.4	15.2	5.4	20.2	18.3	9.9
Thallium (Tl)	mg/kg	<0.050	<0.050	0	<0.050	<0.050	0
Tin (Sn)	mg/kg	<2.0	<2.0	0	<2.0	<2.0	0
Titanium (Ti)	mg/kg	<5.0	<5.0	0	<5.0	<5.0	0
Uranium (U)	mg/kg	0.203	0.204	0.49	0.261	0.238	9.2
Vanadium (V)	mg/kg	<0.20	<0.20	0	<0.20	<0.20	0
Zinc (Zn)	mg/kg	16.2	16.4	1.2	15.6	13.4	15
Easily-reducible Metals and Iron Oxides							
Aluminum (Al)	mg/kg	638	621	2.7	665	607	9.1
Antimony (Sb)	mg/kg	<0.10	<0.10	0	<0.10	<0.10	0
Arsenic (As)	mg/kg	0.487	0.486	0.21	0.47	0.40	16
Barium (Ba)	mg/kg	47.7	48.2	1.0	45.2	39.6	13
Beryllium (Be)	mg/kg	0.35	0.36	2.8	0.37	0.35	5.6
Bismuth (Bi)	mg/kg	<0.20	<0.20	0	<0.20	<0.20	0
Cadmium (Cd)	mg/kg	0.441	0.474	7.2	0.435	0.452	3.8
Calcium (Ca)	mg/kg	6,440	6,520	1.2	6,290	7,740	21
Chromium (Cr)	mg/kg	0.98	0.95	3.1	1.08	1.00	7.7
Cobalt (Co)	mg/kg	6.55	6.72	2.6	5.34	5.52	3.3
Copper (Cu)	mg/kg	0.57	0.55	3.6	0.60	0.63	4.9
Iron (Fe)	mg/kg	3,400	3,370	0.89	3,560	3,390	4.9
Lead (Pb)	mg/kg	3.47	3.65	5.1	3.97	4.12	3.7
Lithium (Li)	mg/kg	<5.0	<5.0	0	<5.0	<5.0	0
Manganese (Mn)	mg/kg	410	515	23	319	349	9.0
Molybdenum (Mo)	mg/kg	<0.50	<0.50	0	<0.50	<0.50	0
Nickel (Ni)	mg/kg	31.1	33.4	7.1	31.2	31.9	2.2
Phosphorus (P)	mg/kg	159	135	16	125	103	19
Selenium (Se)	mg/kg	0.83	0.81	2.4	0.86	0.77	11
Silver (Ag)	mg/kg	0.15	0.14	6.9	0.12	0.11	8.7
Strontium (Sr)	mg/kg	6.78	7.06	4.0	7.29	7.05	3.3
Thallium (Tl)	mg/kg	<0.050	<0.050	0	<0.050	<0.050	0
Tin (Sn)	mg/kg	<2.0	<2.0	0	<2.0	<2.0	0
Titanium (Ti)	mg/kg	<1.0	<1.0	0	<1.0	<1.0	0
Uranium (U)	mg/kg	0.228	0.239	4.7	0.179	0.172	4.0
Vanadium (V)	mg/kg	3.27	3.24	0.92	3.84	3.65	5.1
Zinc (Zn)	mg/kg	48.6	48.5	0.21	49.3	50.3	2.0
Organic-bound Metals							
Aluminum (Al)	mg/kg	1,750	1,790	2.3	1,430	1,430	0
Antimony (Sb)	mg/kg	<0.10	<0.10	0	<0.10	<0.10	0
Arsenic (As)	mg/kg	0.453	0.456	0.66	0.382	0.388	1.6
Barium (Ba)	mg/kg	25.1	26.9	6.9	32.2	31.3	2.8
Beryllium (Be)	mg/kg	<0.20	<0.20	0	<0.20	<0.20	0
Bismuth (Bi)	mg/kg	<0.20	<0.20	0	<0.20	<0.20	0
Cadmium (Cd)	mg/kg	0.100	0.099	1.0	0.088	0.091	3.4
Calcium (Ca)	mg/kg	1,400	1,430	2.1	1,040	1,290	21
Chromium (Cr)	mg/kg	4.07	4.20	3.1	3.15	3.48	10
Cobalt (Co)	mg/kg	1.2	1.3	8.0	0.81	0.83	2.4
Copper (Cu)	mg/kg	9.76	9.75	0.10	7.78	7.84	0.77
Iron (Fe)	mg/kg	1,660	1,710	3.0	1,210	1,320	8.7
Lead (Pb)	mg/kg	1.59	1.55	2.5	1.52	1.42	6.8
Lithium (Li)	mg/kg	<5.0	<5.0	0	<5.0	<5.0	0
Manganese (Mn)	mg/kg	26.6	32.0	18	18.2	20.3	11
Molybdenum (Mo)	mg/kg	<0.50	<0.50	0	<0.50	<0.50	0
Nickel (Ni)	mg/kg	11.9	12.5	4.9	8.45	9.00	6.3
Selenium (Se)	mg/kg	7.1	7.34	2.8	6.91	6.89	0.29
Silver (Ag)	mg/kg	<0.10	<0.10	0	<0.10	<0.10	0
Strontium (Sr)	mg/kg	4.86	4.91	1.0	3.64	4.15	13
Thallium (Tl)	mg/kg	<0.050	<0.050	0	<0.050	<0.050	0
Tin (Sn)	mg/kg	<2.0	<2.0	0	<2.0	<2.0	0
Titanium (Ti)	mg/kg	10.9	1.1	163	8.7	4.8	58
Uranium (U)	mg/kg	0.379	0.386	1.8	0.27	0.28	2.6
Vanadium (V)	mg/kg	5.68	5.65	0.53	5.13	5.34	4.0
Zinc (Zn)	mg/kg	10.6	11.3	6.4	8.6	81.9	162

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 A.8: Field Duplicate Results for Sediment Chemistry Analyses, September 2021

Analyte	Units	RG_GHP			RG_GHP		
		21-Sep-21		RPD (%)	22-Sep-21		RPD (%)
		L2644215			L2644215		
Residual Metals							
Aluminum (Al)	mg/kg	7,020	6,450	8.5	5,810	6,120	5.2
Antimony (Sb)	mg/kg	1.04	1.05	0.96	0.92	1.00	8.3
Arsenic (As)	mg/kg	5.28	5.02	5.0	4.53	4.68	3.3
Barium (Ba)	mg/kg	163	151	7.6	119	128	7.3
Beryllium (Be)	mg/kg	0.38	0.38	0	0.36	0.33	8.7
Bismuth (Bi)	mg/kg	<0.20	<0.20	0	<0.20	<0.20	0
Cadmium (Cd)	mg/kg	0.109	0.108	0.92	0.09	0.08	12
Calcium (Ca)	mg/kg	109	103	5.7	80	80	0
Chromium (Cr)	mg/kg	11.2	10.4	7.4	9.4	9.6	2.1
Cobalt (Co)	mg/kg	3.5	3.37	3.5	3.19	3.18	0.31
Copper (Cu)	mg/kg	19.2	18.3	4.8	19.6	19.4	1.0
Iron (Fe)	mg/kg	11,600	11,300	2.6	9,580	9,800	2.3
Lead (Pb)	mg/kg	9.30	9.13	1.8	7.96	7.96	0
Lithium (Li)	mg/kg	5.3	5.0	5.8	<5.0	<5.0	0
Manganese (Mn)	mg/kg	48	45	6.5	43.5	43	1.4
Molybdenum (Mo)	mg/kg	1.29	1.33	3.1	1.11	1.18	6.1
Nickel (Ni)	mg/kg	14.6	14.2	2.8	13.0	12.6	3.1
Selenium (Se)	mg/kg	2.05	2.15	4.8	1.84	1.76	4.4
Silver (Ag)	mg/kg	0.24	0.25	4.1	0.23	0.23	0
Strontium (Sr)	mg/kg	21.3	20.1	5.8	20.7	21.3	2.9
Thallium (Tl)	mg/kg	0.166	0.155	6.9	0.099	0.128	26
Tin (Sn)	mg/kg	<2.0	<2.0	0	<2.0	<2.0	0
Titanium (Ti)	mg/kg	17.0	13.5	23	8.7	13.2	41
Uranium (U)	mg/kg	0.366	0.350	4.5	0.325	0.322	0.93
Vanadium (V)	mg/kg	29.6	27.5	7.4	25.3	26.3	3.9
Zinc (Zn)	mg/kg	81	77.2	4.4	71.0	72.5	2.1
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	<0.44	<0.39	0	<0.67	<0.59	0
Acenaphthylene	mg/kg	0.0166	0.0084	66	0.0347	0.0429	21
Acridine	mg/kg	<0.80	<0.72	0	<1.1	<1.1	0
Anthracene	mg/kg	<0.0040	0.0059	38	0.0064	0.0041	44
Benz(a)anthracene	mg/kg	<0.22	<0.70	0	<0.76	<0.29	0
Benzo(a)pyrene	mg/kg	0.097	0.086	12	0.133	0.118	12
Benzo(b&j)fluoranthene	mg/kg	0.478	0.462	3.4	0.514	0.502	2.4
Benzo(b+j+k)fluoranthene	mg/kg	0.515	0.488	5.4	0.540	0.536	0.74
Benzo(e)pyrene	mg/kg	0.458	0.432	5.8	0.511	0.518	1.4
Benzo(g,h,i)perylene	mg/kg	0.12	0.115	4.3	0.142	0.133	6.5
Benzo(k)fluoranthene	mg/kg	0.037	0.026	35	0.026	0.034	27
Chrysene	mg/kg	<0.72	<0.68	0	<0.87	<0.92	0
Dibenz(a,h)anthracene	mg/kg	<0.080	0.0743	7.4	<0.080	0.0901	12
Fluoranthene	mg/kg	0.193	0.205	6.0	0.215	0.248	14
Fluorene	mg/kg	0.851	0.976	14	1.39	1.58	13
Indeno(1,2,3-c,d)pyrene	mg/kg	0.044	0.04	9.5	0.052	0.056	7.4
1-Methylnaphthalene	mg/kg	5.14	4.76	7.7	7.39	7.23	2.2
2-Methylnaphthalene	mg/kg	9.5	8.78	7.4	13.90	13.60	2.2
Naphthalene	mg/kg	2.92	2.72	7.1	4.68	4.64	0.86
Perylene	mg/kg	<0.010	<0.010	0	<0.010	<0.010	0
Phenanthrene	mg/kg	4.04	3.73	8.0	5.34	5.13	4.0
Pyrene	mg/kg	0.432	0.402	7.2	0.493	0.474	3.9
Quinoline	mg/kg	<0.050	<0.050	0	<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.

Data accuracy was evaluated based on the analysis of CRM, LCS, and internal reference material (IRM). Specifically, three CRM samples, 40 LCS samples, and 34 IRM samples were analyzed to produce 99, 815, and 366 individual results, respectively (see Appendix B). All CRM, LCS, and IRM samples met the laboratory DQO. Overall, the accuracy achieved by the laboratory for this study can be considered excellent.

A4.5 Data Quality Statement

Sediment quality data collected for this study are of acceptable quality as characterized by good detectability, negligible analyte concentrations in method blanks, good 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.

A5 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. for area-based sampling and Cordillera Consulting for timed kicks) provided laboratory data files and original QC reports for benthic invertebrate sample processing (see Appendix B).

Analysis of benthic invertebrate community sub-samples consistently met the DQO of ≤20% for sub-sampling precision (i.e., estimated precision was within 18%; Appendix Table A.9). Organism densities were estimated for sub-sample fractions and compared to total densities to estimate sub-sampling accuracy. Results for the sub-samples were within 11% of actual densities; 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 A.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 99% was achieved for the five 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 A.11). All samples achieved the DQO for sorting efficiency (i.e., ≥90% recovery for area-based samples and ≥95%[5] 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 A.1 and A.12).

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

Table A.9: Calculation of Benthic Invertebrate Community Sub-sampling Error, September 2021 [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_GANF-2	-	188	200	-	-	-	388	6.0	-	3.1	-
RG_GANF-2	-	91	97	99	101	-	388	2.0	9.9	0	6.2
RG_GANF-1	2	192	208	-	-	-	400	7.7	-	-	-
RG_GHBP-1	-	210	249	-	-	-	459	15.7	-	-	-
RG_GHP-6	-	315	324	353	383	-	1,375	2.8	18	2.7	11
RG_GHP-6	-	677	698	-	-	-	1,375	3.0	-	1.5	-
Timed Kick Samples (Cordillera Consulting)											
RG_GHNF-3	-	497	490	477	470	482	2,416	1.04	5.43	0.25	2.86

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 A.10: Benthic Invertebrate Community Sample Fractions Sorted, September 2021

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

Notes: 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] Two quarters sorted for subsampling error calculations.

[c] Four quarters sorted for subsampling error calculations.

[d] Two halves sorted for subsampling error calculations.

[e] Two eighths sorted for subsampling error calculations.

Table A.11: Percent Recovery of Benthic Invertebrates, September 2021

Station	Number of Organisms Recovered (initial sort)	Number of Organisms in Re-sort	Percent Recovery
Area-based Samples (ZEAS Inc.)			
RG_GANF-1	398	402	99%
RG_GAUT-3	193	196	98%
RG_GHBP-4	469	482	97%
RG_GHP-3	719	724	99%
RG_GHUT-6	280	284	99%
		Average % Recovery	99%
Timed Kick Samples (Cordillera Consulting)			
QC Sample 1	392	403	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 A.12: Calculation of Benthic Invertebrate Community Taxonomic Error, September 2021 [a]

Station	Taxa Identified	Error Rate (%)	Percent Difference in Enumeration (%)	Percent Taxonomic Disagreement (%)	Bray-Curtis Dissimilarity Index
Timed Kick Samples (Cordillera Consulting)					
RG_GHNF-2	403	0	0	0.49627792	0.00496278

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.

A6 BENTHIC INVERTEBRATE TISSUE CHEMISTRY

A6.1 Laboratory Reporting Limits

Benthic invertebrate tissue chemistry samples collected in February and September 2021 were analyzed by TrichAnalytics Inc. (Trich) in Saanichton, British Columbia. The analytical reports (Appendix B) were examined to provide an inventory of analytes for which the sample results were less than the LRL. Additionally, LRLs for selenium were assessed relative to the 4 microgram per gram dry weight (μg/g dw) guideline for British Columbia (BCMOECCS 2021b) 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).

Except for arsenic and mercury, all analytes (including selenium) were detected in all samples collected in February and September 2021 (Appendix Table A.13). Arsenic and mercury were not detected in one (i.e., 17%) of the six samples from February 2021 and four (17%) of the 24 benthic invertebrate tissue chemistry samples from September 2021 did not have a detectable concentration of arsenic. Additionally, LRLs for selenium were less than the BCMOECCS guideline and the lowest EVWQP Level 1 Benchmark (Appendix Table A.13). Therefore, the achieved LRLs were considered appropriate for the study.

A6.2 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 A.1; Appendix B). Two and three laboratory duplicate samples were prepared and analyzed with the benthic invertebrate tissue chemistry samples collected in February and September 2021, respectively. All laboratory duplicate results met the DQO set by the analytical laboratory (Appendix Table A.1). The DQO for estimating precision of recoveries of CRM was set at a relative standard deviation (RSD) of ≤20%. Results, including those for selenium, were within the DQO (Appendix Table A.1). Therefore, laboratory precision for the benthic invertebrate tissue chemistry analyses completed by Trich are considered excellent and are of acceptable quality for this study.

A6.3 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 2021; Appendix B). Each of the reported results for the four CRM samples met the DQO (Appendix Table A.1). Therefore, the accuracy achieved by analytical laboratory was considered excellent.

Table A.13: Laboratory Reporting Limit (LRL) Evaluation for Benthic Invertebrate Tissue Chemistry Analyses, 2021

Analyte	Units	LRLs [a,b]		No. Sample Results <LRL [c]	
		February	September	February	September
Aluminum (Al)	µg/g dw	0.031	0.058	0	0
Antimony (Sb)	µg/g dw	0.004	0.004	0	0
Arsenic (As)	µg/g dw	0.431	0.423	1 (17%)	4 (17%)
Barium (Ba)	µg/g dw	0.001	0.001	0	0
Boron (B)	µg/g dw	0.095	0.102	0	0
Cadmium (Cd)	µg/g dw	0.041	0.044	0	0
Calcium (Ca)	µg/g dw	5.4	17	0	0
Chromium (Cr)	µg/g dw	0.140	0.184	0	0
Cobalt (Co)	µg/g dw	0.002	0.010	0	0
Copper (Cu)	µg/g dw	0.004	0.010	0	0
Iron (Fe)	µg/g dw	0.575	0.906	0	0
Lead (Pb)	µg/g dw	0.004	0.001	0	0
Lithium (Li)	µg/g dw	0.004	0.009	0	0
Magnesium (Mg)	µg/g dw	0.019	0.024	0	0
Manganese (Mn)	µg/g dw	0.008	0.007	0	0
Mercury (Hg)	µg/g dw	0.032	0.026	1 (17%)	0
Molybdenum (Mo)	µg/g dw	0.001	0.001	0	0
Nickel (Ni)	µg/g dw	0.001	0.047	0	0
Phosphorus (P)	µg/g dw	51	32	0	0
Potassium (K)	µg/g dw	0.638	2.0	0	0
Selenium (Se)	µg/g dw	0.356	0.387	0	0
Silver (Ag)	µg/g dw	0.001	0.001	0	0
Sodium (Na)	µg/g dw	0.504	1.4	0	0
Strontium (Sr)	µg/g dw	0.001	0.001	0	0
Thallium (Tl)	µg/g dw	0.001	0.001	0	0
Tin (Sn)	µg/g dw	0.021	0.027	0	0
Titanium (Ti)	µg/g dw	0.138	0.116	0	0
Uranium (U)	µg/g dw	0.001	0.001	0	0
Vanadium (V)	µg/g dw	0.042	0.072	0	0
Zinc (Zn)	µg/g dw	0.461	0.227	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 2019).

Notes: LRL = Laboratory Reporting Limit; < = less than; µg/g dw = microgram per gram 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 analytes had guidelines or EVWQP benchmarks for concentrations in benthic invertebrate tissues.

[c] Total n = 6 samples in February 2021 and total n = 24 samples in September 2021.

A7 DATA QUALITY STATEMENT

Overall, the quality of the data collected for this study was considered acceptable for derivation of conclusions associated with the objectives of the 2021 Greenhills and Gardine Creeks Aquatic Monitoring Program.

A8 REFERENCES

Austin, J. (ed.). 2020. British Columbia Environmental Laboratory Manual. Analysis, Reporting, and Knowledge Services, Knowledge Management Branch, British Columbia Ministry of Environment and Climate Change Strategy, Victoria, BC.

BCMOECCS (British Columbia Ministry of Environment and Climate Change Strategy). 2021a. British Columbia Working Water Quality Guidelines: Aquatic Life, Wildlife, and Agriculture (Feb 2021). Water Protection and Sustainability Branch, Ministry of Environment and Climate Change Strategy. February 2021.

BCMOECCS. 2021b. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife, and Agriculture – Guideline Summary. Water Quality Guideline Series, WQG-20.

Environment Canada. 2012. Canadian Aquatic Biomonitoring Network (CABIN) Laboratory Methods: Processing, Taxonomy, and Quality Control of Benthic Macroinvertebrate Samples. April 2012.

Golder (Golder Associates). 2014. Benchmark Derivation Report for Selenium. Annex E of the Elk Valley Water Quality Plan. Prepared for Teck Coal Limited, Sparwood, BC.

Golder. 2017. Coal Mountain Operations: Aquatic Health Assessment. Prepared for Teck Coal Limited, Sparwood, BC.

Maute, J. 2021. Senior Project Manager, Brooks Applied Labs. Email correspondence with Amy Wiebe (Minnow). November 29, 2021.

Schvets, L. 2020. Senior Accounts Manager, Environmental, ALS Environmental. Email correspondence with Amy Wiebe (Minnow). October 14, 2020.

Schvets, L. 2022. Senior Accounts Manager, Environmental, ALS Environmental. Email correspondence with Amy Wiebe (Minnow). March 9, 2022.

Teck (Teck Resources Limited). 2014. Elk Valley Water Quality Plan. Submitted to the British Columbia Minister of Environment for approval on July 22, 2014.

Teck. 2020. Elkview Operations Saturated Rock Fill Phase 2 Project Operations: Application for a Mines Act Permit and Environmental Management Act Amendment to Authorize the Commissioning and Operation Phase Activities. MMO ID: EVO-015-3. Rev 2 May 5, 2020. 349 pp + Appendices.

APPENDIX B
RAW LABORATORY
REPORTS

ALS - SEDIMENT

Teck Coal Ltd.
ATTN: Allie Ferguson
421 Pine Avenue
Sparwood BC V0B 2G0

Date Received: 16-SEP-21
Report Date: 25-OCT-21 13:28 (MT)
Version: FINAL

Client Phone: 250-425-8202

Certificate of Analysis

Lab Work Order #: L2641287
Project P.O. #: VPO00750546
Job Reference: REGIONAL EFFECTS PROGRAM
C of C Numbers: September GGCAMP
Legal Site Desc:

Lyudmyla Shvets, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2641287-1	L2641287-2	L2641287-3	L2641287-4	L2641287-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	13-SEP-21	14-SEP-21	14-SEP-21	14-SEP-21	14-SEP-21
	Sampled Time	16:00	10:15	12:00	13:30	14:30
	Client ID	RG_GHBP_SE-1_2021-09-13_1600	RG_GHBP_SE-2_2021-09-14_1015	RG_GHBP_SE-3_2021-09-14_1200	RG_GHBP_SE-4_2021-09-14_1330	RG_GHBP_SE-5_2021-09-14_1430
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	85.8	87.6	64.0	85.8	84.0
	pH (1:2 soil:water) (pH)	7.99	8.06	8.17	8.12	8.10
Particle Size	% Gravel (>2mm) (%)	<1.0	4.7	9.3	<1.0 PSAL	<1.0 PSAL
	% Sand (2.00mm - 1.00mm) (%)	2.5	19.9	12.0	<1.0 PSAL	5.2 PSAL
	% Sand (1.00mm - 0.50mm) (%)	3.0	10.2	11.3	<1.0 PSAL	8.3 PSAL
	% Sand (0.50mm - 0.25mm) (%)	3.3	6.7	10.3	2.1 PSAL	6.4 PSAL
	% Sand (0.25mm - 0.125mm) (%)	5.7	5.4	8.5	3.3 PSAL	4.7 PSAL
	% Sand (0.125mm - 0.063mm) (%)	8.1	3.9	6.7	4.5 PSAL	3.7 PSAL
	% Silt (0.063mm - 0.0312mm) (%)	26.8	17.2	14.8	28.8 PSAL	22.5 PSAL
	% Silt (0.0312mm - 0.004mm) (%)	37.4	23.7	19.8	43.1 PSAL	36.7 PSAL
	% Clay (<4um) (%)	12.3	8.3	7.3	17.4 PSAL	12.5 PSAL
	Texture	Silt loam	Sandy loam	Sandy loam	Silt loam	Silt loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	17.9	10.9	5.87	22.3	20.3
Metals	Aluminum (Al) (mg/kg)	4590	4870	8200	4800	3900
	Antimony (Sb) (mg/kg)	0.63	0.64	0.76	0.69	0.59
	Arsenic (As) (mg/kg)	3.06	2.74	5.87	2.88	2.64
	Barium (Ba) (mg/kg)	176	176	267	180	177
	Beryllium (Be) (mg/kg)	0.44	0.41	0.67	0.42	0.36
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	<5.0	5.4	6.7	6.2	<5.0
	Cadmium (Cd) (mg/kg)	1.47	1.41	1.06	1.20	1.30
	Calcium (Ca) (mg/kg)	68500	82000	32200	64100	109000
	Chromium (Cr) (mg/kg)	7.51	7.60	15.2	8.10	6.36
	Cobalt (Co) (mg/kg)	6.56	7.27	7.63	6.51	6.13
	Copper (Cu) (mg/kg)	18.1	17.0	20.5	17.9	14.5
	Iron (Fe) (mg/kg)	9150	8200	17800	8900	7820
	Lead (Pb) (mg/kg)	8.22	7.43	11.5	7.74	6.63
	Lithium (Li) (mg/kg)	6.0	5.5	11.5	6.2	5.1
	Magnesium (Mg) (mg/kg)	5020	4920	6960	4750	4970
	Manganese (Mn) (mg/kg)	377	304	542	466	458
	Mercury (Hg) (mg/kg)	0.0717	0.0829	0.0760	0.0651	0.0632
	Molybdenum (Mo) (mg/kg)	1.05	0.93	1.38	0.95	0.94
	Nickel (Ni) (mg/kg)	118	116	68.1	117	99.9
	Phosphorus (P) (mg/kg)	778	727	1150	763	715
	Potassium (K) (mg/kg)	1060	1230	2030	1240	1100
	Selenium (Se) (mg/kg)	29.5	32.6	11.9	20.7	19.2
	Silver (Ag) (mg/kg)	0.24	0.22	0.28	0.22	0.18

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2641287-1	L2641287-2	L2641287-3	L2641287-4	L2641287-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	13-SEP-21	14-SEP-21	14-SEP-21	14-SEP-21	14-SEP-21
	Sampled Time	16:00	10:15	12:00	13:30	14:30
	Client ID	RG_GHBP_SE-1_2021-09-13_1600	RG_GHBP_SE-2_2021-09-14_1015	RG_GHBP_SE-3_2021-09-14_1200	RG_GHBP_SE-4_2021-09-14_1330	RG_GHBP_SE-5_2021-09-14_1430
Grouping	**Analyte**					
SOIL						
Metals	Sodium (Na) (mg/kg)	64	69	72	69	70
	Strontium (Sr) (mg/kg)	51.2	53.9	44.1	50.9	65.9
	Sulfur (S) (mg/kg)	1900	2100	<1000	1900	2100
	Thallium (Tl) (mg/kg)	0.124	0.121	0.208	0.107	0.106
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	7.3	7.6	5.7	7.5	5.0
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	1.89	2.09	1.28	1.67	2.01
	Vanadium (V) (mg/kg)	16.0	16.5	30.0	17.2	14.6
	Zinc (Zn) (mg/kg)	147	150	137	141	129
	Zirconium (Zr) (mg/kg)	1.1	1.1	<1.0	<1.0	<1.0
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.43 DLCI	<0.24 DLCI	<0.19 DLCI	<0.64 DLCI	<0.60 DLCI
	Acenaphthylene (mg/kg)	<0.055 DLCI	<0.030 DLCI	<0.025 DLCI	0.086 DLHM	0.030 DLHM
	Acridine (mg/kg)	<0.85 DLCI	<0.54 DLCI	0.379	<1.2 DLCI	<1.2 DLCI
	Anthracene (mg/kg)	0.017 DLHM	<0.035 DLHM	<0.0040	0.020 DLHM	<0.010 DLHM
	Benz(a)anthracene (mg/kg)	<0.28 DLCI	<0.52 DLCI	<0.11 DLCI	<0.39 DLCI	<0.35 DLCI
	Benzo(a)pyrene (mg/kg)	0.175 DLHM	<0.18 DLCI	0.083	0.194 DLHM	0.222 DLHM
	Benzo(b&j)fluoranthene (mg/kg)	0.511 DLHM	0.434 DLHM	0.207	0.601 DLHM	0.626 DLHM
	Benzo(b+j+k)fluoranthene (mg/kg)	0.551	0.471	0.207	0.658	0.626
	Benzo(e)pyrene (mg/kg)	0.564 DLHM	0.462 DLHM	0.221	0.711 DLHM	0.699 DLHM
	Benzo(g,h,i)perylene (mg/kg)	0.255 DLHM	0.191 DLHM	0.093	0.328 DLHM	0.308 DLHM
	Benzo(k)fluoranthene (mg/kg)	0.040 DLHM	0.037 DLHM	<0.010	0.057 DLHM	<0.025 DLHM
	Chrysene (mg/kg)	0.682 DLHM	0.451 DLHM	<0.49 DLCI	<0.89 DLCI	<1.5 DLCI
	Dibenz(a,h)anthracene (mg/kg)	<0.11 DLCI	<0.075 DLCI	<0.045 DLCI	0.128 DLHM	0.142 DLHM
	Fluoranthene (mg/kg)	0.214 DLHM	0.143 DLHM	0.078	0.229 DLHM	0.268 DLHM
	Fluorene (mg/kg)	1.06 DLHM	0.761 DLHM	0.457	1.61 DLHM	1.53 DLHM
	Indeno(1,2,3-c,d)pyrene (mg/kg)	0.064 DLHM	<0.035 DLHM	<0.010	0.048 DLHM	0.054 DLHM
	1-Methylnaphthalene (mg/kg)	5.22 DLHM	4.01 DLHM	2.16	7.85 DLHM	7.36 DLHM
	2-Methylnaphthalene (mg/kg)	9.74 DLHM	6.69 DLHM	4.06	14.8 DLHM	13.7 DLHM
	Naphthalene (mg/kg)	3.02 DLHM	2.15 DLHM	1.26	4.79 DLHM	4.50 DLHM
	Perylene (mg/kg)	<0.035 DLHM	<0.035 DLHM	<0.010	<0.025 DLHM	<0.025 DLHM
	Phenanthrene (mg/kg)	4.00 DLHM	3.30 DLHM	1.65	5.69 DLHM	5.36 DLHM
	Pyrene (mg/kg)	0.364 DLHM	0.273 DLHM	0.143	0.477 DLHM	0.450 DLHM
	Quinoline (mg/kg)	<0.035 DLHM	0.036 DLHM	<0.050	<0.025 DLHM	<0.025 DLHM
	Surrogate: d10-Acenaphthene (%)	114.3	112.2	109.0	101.3	109.3
	Surrogate: d12-Chrysene (%)	116.2	118.3	113.8	100.6	107.2

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L2641287-1	L2641287-2	L2641287-3	L2641287-4	L2641287-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	13-SEP-21	14-SEP-21	14-SEP-21	14-SEP-21	14-SEP-21
	Sampled Time	16:00	10:15	12:00	13:30	14:30
	Client ID	RG_GHBP_SE-1_2021-09-13_1600	RG_GHBP_SE-2_2021-09-14_1015	RG_GHBP_SE-3_2021-09-14_1200	RG_GHBP_SE-4_2021-09-14_1330	RG_GHBP_SE-5_2021-09-14_1430
SOIL						
Polycyclic Aromatic Hydrocarbons	Surrogate: d8-Naphthalene (%)	103.0	101.2	102.1	91.1	95.6
	Surrogate: d10-Phenanthrene (%)	109.8	110.8	108.2	97.6	102.5
	IACR:Coarse	0.163	0.145	0.057	0.203	0.177
	IACR:Fine	0.313	0.277	0.109	0.391	0.341
	B(a)P Total Potency Equivalent (mg/kg)	0.312	0.21	0.136	0.419	0.461
	IACR (CCME)	4.96	4.4	1.95	6.1	6.1
Exchangeable & Adsorbed Metals	Aluminum (Al)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	0.074	0.072	0.085	0.077	0.059
	Barium (Ba)-Leachable (mg/kg)	19.6	29.2	22.4	21.4	21.8
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Calcium (Ca)-Leachable (mg/kg)	3130	4030	3840	3120	2210
	Chromium (Cr)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Cobalt (Co)-Leachable (mg/kg)	0.18	0.24	0.18	0.20	0.20
	Copper (Cu)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Iron (Fe)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Lead (Pb)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	82.3	99.3	121	83.7	86.8
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	1.37	1.09	1.32	1.32	0.81
	Phosphorus (P)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Potassium (K)-Leachable (mg/kg)	120	<100	110	<100	<100
	Selenium (Se)-Leachable (mg/kg)	<0.20	0.28	<0.20	<0.20	<0.20
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Sodium (Na)-Leachable (mg/kg)	<100	<100	<100	<100	<100
	Strontium (Sr)-Leachable (mg/kg)	5.46	7.55	7.77	6.12	6.78
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Uranium (U)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Vanadium (V)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Zinc (Zn)-Leachable (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
Carbonate Metals	Aluminum (Al)-Leachable (mg/kg)	<50	<50	<50	<50	<50

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2641287-1	L2641287-2	L2641287-3	L2641287-4	L2641287-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	13-SEP-21	14-SEP-21	14-SEP-21	14-SEP-21	14-SEP-21
	Sampled Time	16:00	10:15	12:00	13:30	14:30
	Client ID	RG_GHBP_SE-1_2021-09-13_1600	RG_GHBP_SE-2_2021-09-14_1015	RG_GHBP_SE-3_2021-09-14_1200	RG_GHBP_SE-4_2021-09-14_1330	RG_GHBP_SE-5_2021-09-14_1430
Grouping	**Analyte**					
SOIL						
Carbonate Metals	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	0.071	0.094	0.051	<0.050	0.094
	Barium (Ba)-Leachable (mg/kg)	47.7	48.1	46.6	47.2	33.3
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.382	0.161	0.229	0.593	0.482
	Calcium (Ca)-Leachable (mg/kg)	48100	44500	45200	48700	44500
	Chromium (Cr)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Cobalt (Co)-Leachable (mg/kg)	0.74	0.89	0.83	0.78	0.98
	Copper (Cu)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Iron (Fe)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Lead (Pb)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	0.51
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	120	117	148	139	168
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	4.8	6.3	6.3	5.6	5.1
	Phosphorus (P)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Selenium (Se)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Strontium (Sr)-Leachable (mg/kg)	22.3	23.2	22.5	19.8	34.4
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Uranium (U)-Leachable (mg/kg)	0.154	0.257	0.195	0.155	0.200
	Vanadium (V)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Zinc (Zn)-Leachable (mg/kg)	27.4	28.0	33.0	28.0	24.7
Easily Reducible Metals and Iron Oxides	Aluminum (Al)-Leachable (mg/kg)	265	278	274	260	270
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	0.394	0.521	0.491	0.420	0.459
	Barium (Ba)-Leachable (mg/kg)	39.6	29.5	38.8	57.2	23.2
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	1.68	3.56	3.46	1.59	1.28
	Calcium (Ca)-Leachable (mg/kg)	64700	42100	50100	88700	32200
	Chromium (Cr)-Leachable (mg/kg)	1.16	1.04	1.01	0.99	1.25
	Cobalt (Co)-Leachable (mg/kg)	1.25	1.22	1.38	1.19	1.33

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2641287-1	L2641287-2	L2641287-3	L2641287-4	L2641287-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	13-SEP-21	14-SEP-21	14-SEP-21	14-SEP-21	14-SEP-21
	Sampled Time	16:00	10:15	12:00	13:30	14:30
	Client ID	RG_GHBP_SE-1_2021-09-13_1600	RG_GHBP_SE-2_2021-09-14_1015	RG_GHBP_SE-3_2021-09-14_1200	RG_GHBP_SE-4_2021-09-14_1330	RG_GHBP_SE-5_2021-09-14_1430
Grouping	**Analyte**					
SOIL						
Easily Reducible Metals and Iron Oxides	Copper (Cu)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Iron (Fe)-Leachable (mg/kg)	2700	2830	2690	2470	2770
	Lead (Pb)-Leachable (mg/kg)	3.22	3.08	3.11	3.05	2.97
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	221	207	237	213	222
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	8.85	11.2	12.8	10.3	7.31
	Phosphorus (P)-Leachable (mg/kg)	73	93	90	80	74
	Selenium (Se)-Leachable (mg/kg)	0.64	1.33	0.96	0.74	0.45
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Strontium (Sr)-Leachable (mg/kg)	39.6	27.3	33.3	49.2	22.5
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	0.088
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Uranium (U)-Leachable (mg/kg)	0.216	0.288	0.291	0.259	0.214
	Vanadium (V)-Leachable (mg/kg)	2.98	2.90	2.79	2.73	3.04
	Zinc (Zn)-Leachable (mg/kg)	68.7	107	104	74.3	47.2
Organic Bound Metals	Aluminum (Al)-Leachable (mg/kg)	506	856	807	320	591
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	0.333	0.513	0.540	0.254	0.248
	Barium (Ba)-Leachable (mg/kg)	12.0	9.45	14.5	13.4	6.50
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.091	0.245	0.257	0.091	0.091
	Calcium (Ca)-Leachable (mg/kg)	2140	2000	2290	3140	1470
	Chromium (Cr)-Leachable (mg/kg)	1.91	2.92	3.07	1.84	2.04
	Cobalt (Co)-Leachable (mg/kg)	0.66	0.98	1.15	0.75	0.65
	Copper (Cu)-Leachable (mg/kg)	4.01	5.70	6.01	5.70	4.83
	Iron (Fe)-Leachable (mg/kg)	1160	1950	2020	957	1070
	Lead (Pb)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	9.7	10.8	12.9	11.9	10.3
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	0.60
	Nickel (Ni)-Leachable (mg/kg)	4.63	8.20	9.74	6.01	4.53
	Selenium (Se)-Leachable (mg/kg)	2.71	4.74	4.06	2.95	1.82
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2641287-1	L2641287-2	L2641287-3	L2641287-4	L2641287-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	13-SEP-21	14-SEP-21	14-SEP-21	14-SEP-21	14-SEP-21
	Sampled Time	16:00	10:15	12:00	13:30	14:30
	Client ID	RG_GHBP_SE-1_2021-09-13_1600	RG_GHBP_SE-2_2021-09-14_1015	RG_GHBP_SE-3_2021-09-14_1200	RG_GHBP_SE-4_2021-09-14_1330	RG_GHBP_SE-5_2021-09-14_1430
Grouping	**Analyte**					
SOIL						
Organic Bound Metals	Strontium (Sr)-Leachable (mg/kg)	3.41	4.16	4.22	3.00	3.47
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	8.8	13.3	13.1	6.9	6.0
	Uranium (U)-Leachable (mg/kg)	0.113	0.211	0.195	0.089	0.147
	Vanadium (V)-Leachable (mg/kg)	2.21	3.23	3.27	2.08	2.84
	Zinc (Zn)-Leachable (mg/kg)	6.1	11.7	12.0	6.0	6.9
Residual Metals	Aluminum (Al)-Leachable (mg/kg)	5620	5560	5670	5000	5790
	Antimony (Sb)-Leachable (mg/kg)	0.37	0.42	0.43	0.34	0.52
	Arsenic (As)-Leachable (mg/kg)	3.14	2.92	2.98	2.86	5.07
	Barium (Ba)-Leachable (mg/kg)	103	96.9	100	84.1	82.7
	Beryllium (Be)-Leachable (mg/kg)	0.22	0.24	0.23	0.23	0.26
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.058	0.067	0.066	0.071	0.096
	Calcium (Ca)-Leachable (mg/kg)	1310	1040	964	1210	1550
	Chromium (Cr)-Leachable (mg/kg)	8.9	9.0	9.4	7.8	8.7
	Cobalt (Co)-Leachable (mg/kg)	1.46	1.46	1.50	1.42	1.60
	Copper (Cu)-Leachable (mg/kg)	5.82	6.48	6.37	5.47	10.4
	Iron (Fe)-Leachable (mg/kg)	7040	6560	6730	6600	9480
	Lead (Pb)-Leachable (mg/kg)	2.71	3.26	3.29	2.42	3.56
	Lithium (Li)-Leachable (mg/kg)	7.1	6.9	6.8	6.5	7.9
	Manganese (Mn)-Leachable (mg/kg)	33.0	31.0	33.6	30.1	37.9
	Molybdenum (Mo)-Leachable (mg/kg)	0.80	0.83	0.78	0.67	2.94
	Nickel (Ni)-Leachable (mg/kg)	7.1	6.9	7.1	6.3	8.8
	Selenium (Se)-Leachable (mg/kg)	0.41	0.66	0.48	0.49	0.54
	Silver (Ag)-Leachable (mg/kg)	<0.10	0.10	<0.10	0.10	<0.10
	Strontium (Sr)-Leachable (mg/kg)	17.9	17.8	17.9	16.2	17.6
	Thallium (Tl)-Leachable (mg/kg)	0.138	0.153	0.148	0.129	0.286
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	32.0	23.7	24.5	26.5	25.9
	Uranium (U)-Leachable (mg/kg)	0.401	0.349	0.355	0.369	0.452
	Vanadium (V)-Leachable (mg/kg)	17.0	17.7	17.9	15.1	19.3
	Zinc (Zn)-Leachable (mg/kg)	37.3	38.6	38.2	33.5	53.7

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLCI	Detection Limit Raised: Chromatographic Interference due to co-elution.
DLHM	Detection Limit Adjusted: Sample has High Moisture Content
PSAL	Limited sample was available for Particle Size Analysis (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
C-TIC-PCT-SK	Soil	Total Inorganic Carbon in Soil	CSSS (2008) P216-217

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.

C-TOC-CALC-SK	Soil	Total Organic Carbon Calculation	CSSS (2008) 21.2

Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon. (TIC)

C-TOT-LECO-SK	Soil	Total Carbon by combustion method	CSSS (2008) 21.2

The sample is ignited in a combustion analyzer where carbon in the reduced CO2 gas is determined using a thermal conductivity detector.

HG-200.2-CVAA-CL	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

IC-CACO3-CALC-SK	Soil	Inorganic Carbon as CaCO3 Equivalent	Calculation
MET-200.2-CCMS-CL	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

MET-TESS-CM-CCMS-VA	Soil	METALS BY CCMS (TESSIER EXTRACTION #2)	Tessier Extraction 1979/EPA 6020A

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 inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Note: For Extraction #2, the extraction solution is 1M Sodium Acetate adjusted to pH 5 and is intended to extract the "Carbonate" metals.

MET-TESS-EA-CCMS-VA	Soil	METALS BY CCMS (TESSIER EXTRACTION #1)	Tessier Extraction 1979/EPA 6020A

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 inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Note: For Extraction #1, the extraction solution is 1M Magnesium Chloride and is intended to extract the "Exchangeable and Adsorbed" metals.

MET-TESS-FEO-CCMS-VA	Soil	METALS BY CCMS (TESSIER EXTRACTION #3)	Tessier Extraction 1979/EPA 6020A

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 inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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 .

MET-TESS-OB-CCMS-VA	Soil	METALS BY CCMS (TESSIER EXTRACTION #4)	Tessier Extraction 1979/EPA 6020A

"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

Reference Information

of the digested extract is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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.

MET-TESS-RM-CCMS-VA	Soil	METALS BY CCMS (TESSIER RM EXTRACTION)	Tessier Extraction 1979/EPA 6020A

"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 collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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.

MOISTURE-CL	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)

This analysis is carried out gravimetrically by drying the sample at 105 C

PAH-TMB-H/A-MS-CL	Soil	PAH Tumbler Extraction (Hexane/Acetone)	EPA 3570/8270-GC/MS

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Methods 3545 & 8270, published by the United States Environmental Protection Agency (EPA). The procedure uses a mechanical shaking technique to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone. The extract is then solvent exchanged to toluene. The final extract is analysed by capillary column gas chromatography with mass spectrometric detection (GC/MS). Surrogate recoveries may not be reported in cases where interferences from the sample matrix prevent accurate quantitation. Because the two isomers cannot be readily chromatographically separated, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.

PH-1:2-CL	Soil	pH in soil (1:2 Soil:Water Extraction)	CSSS Ch. 16

Soil and de-ionized water (by volume) are mixed in a defined ratio. The slurry is allowed to stand, shaken, and then allowed to stand again prior to taking measurements. After equilibration, the pH of the liquid portion of the extract is measured by a pH meter. Field Measurement is recommended where accurate pH measurements are required, due to the 15 minute recommended hold time.

PSA-PIPET-DETAIL-SK	Soil	Particle size - Sieve and Pipette	SSIR-51 METHOD 3.2.1

Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

September GGCAMP

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour 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.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: Teck Coal Ltd.
421 Pine Avenue
Sparwood BC V0B 2G0
Contact: Allie Ferguson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-TIC-PCT-SK	**Soil**							
Batch R5602036								
WG3622541-4 IRM		**08-109_SOIL**						
Inorganic Carbon			104.2		%		80-120	27-SEP-21
WG3622541-2 LCS		**0.5**						
Inorganic Carbon			94.1		%		90-110	27-SEP-21
WG3622541-3 MB								
Inorganic Carbon			<0.050		%		0.05	27-SEP-21
Batch R5602037								
WG3622547-4 IRM		**08-109_SOIL**						
Inorganic Carbon			107.9		%		80-120	27-SEP-21
WG3622547-2 LCS		**0.5**						
Inorganic Carbon			94.7		%		90-110	27-SEP-21
WG3622547-3 MB								
Inorganic Carbon			<0.050		%		0.05	27-SEP-21
Batch R5626364								
WG3641172-4 IRM		**08-109_SOIL**						
Inorganic Carbon			98.3		%		80-120	21-OCT-21
WG3641172-2 LCS		**0.5**						
Inorganic Carbon			96.3		%		90-110	21-OCT-21
WG3641172-3 MB								
Inorganic Carbon			<0.050		%		0.05	21-OCT-21
C-TOT-LECO-SK	**Soil**							
Batch R5599818								
WG3622204-2 IRM		**08-109_SOIL**						
Total Carbon by Combustion			99.3		%		80-120	22-SEP-21
WG3622204-4 LCS		**SULFADIAZINE**						
Total Carbon by Combustion			106.0		%		90-110	22-SEP-21
WG3622204-3 MB								
Total Carbon by Combustion			<0.05		%		0.05	22-SEP-21
Batch R5605746								
WG3622203-2 IRM		**08-109_SOIL**						
Total Carbon by Combustion			101.0		%		80-120	24-SEP-21
WG3622203-4 LCS		**SULFADIAZINE**						
Total Carbon by Combustion			102.9		%		90-110	24-SEP-21
WG3622203-3 MB								
Total Carbon by Combustion			<0.05		%		0.05	24-SEP-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-TOT-LECO-SK	**Soil**							
Batch R5615198								
WG3633519-3 IRM		**08-109_SOIL**						
Total Carbon by Combustion			106.7		%		80-120	09-OCT-21
WG3633519-6 LCS		**SULFADIAZINE**						
Total Carbon by Combustion			101.7		%		90-110	09-OCT-21
WG3633519-5 MB								
Total Carbon by Combustion			<0.05		%		0.05	09-OCT-21
HG-200.2-CVAA-CL	**Soil**							
Batch R5605501								
WG3627462-9 CRM		**TILL-2**						
Mercury (Hg)			101.0		%		70-130	30-SEP-21
WG3627462-8 LCS								
Mercury (Hg)			98.4		%		80-120	30-SEP-21
WG3627462-6 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	30-SEP-21
MET-200.2-CCMS-CL	**Soil**							
Batch R5605699								
WG3627462-9 CRM		**TILL-2**						
Aluminum (Al)			77.6		%		70-130	01-OCT-21
Antimony (Sb)			96.9		%		70-130	01-OCT-21
Arsenic (As)			92.2		%		70-130	01-OCT-21
Barium (Ba)			87.5		%		70-130	01-OCT-21
Beryllium (Be)			86.6		%		70-130	01-OCT-21
Bismuth (Bi)			94.4		%		70-130	01-OCT-21
Cadmium (Cd)			95.8		%		70-130	01-OCT-21
Calcium (Ca)			84.0		%		70-130	01-OCT-21
Chromium (Cr)			90.0		%		70-130	01-OCT-21
Cobalt (Co)			92.5		%		70-130	01-OCT-21
Copper (Cu)			93.5		%		70-130	01-OCT-21
Iron (Fe)			92.3		%		70-130	01-OCT-21
Lead (Pb)			93.3		%		70-130	01-OCT-21
Lithium (Li)			90.7		%		70-130	01-OCT-21
Magnesium (Mg)			85.8		%		70-130	01-OCT-21
Manganese (Mn)			87.8		%		70-130	01-OCT-21
Molybdenum (Mo)			86.4		%		70-130	01-OCT-21
Nickel (Ni)			95.0		%		70-130	01-OCT-21
Phosphorus (P)			93.0		%		70-130	01-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-CL	**Soil**							
Batch R5605699								
WG3627462-9 CRM		**TILL-2**						
Potassium (K)			83.1		%		70-130	01-OCT-21
Selenium (Se)			0.36		mg/kg		0.15-0.55	01-OCT-21
Silver (Ag)			0.24		mg/kg		0.16-0.36	01-OCT-21
Sodium (Na)			79.9		%		70-130	01-OCT-21
Strontium (Sr)			87.6		%		70-130	01-OCT-21
Thallium (Tl)			92.0		%		70-130	01-OCT-21
Tin (Sn)			2.1		mg/kg		0.2-4.2	01-OCT-21
Titanium (Ti)			76.9		%		70-130	01-OCT-21
Tungsten (W)			1.30		mg/kg		1-2	01-OCT-21
Uranium (U)			91.1		%		70-130	01-OCT-21
Vanadium (V)			87.6		%		70-130	01-OCT-21
Zinc (Zn)			93.9		%		70-130	01-OCT-21
Zirconium (Zr)			90.3		%		70-130	01-OCT-21
WG3627462-8 LCS								
Aluminum (Al)			89.4		%		80-120	01-OCT-21
Antimony (Sb)			96.2		%		80-120	01-OCT-21
Arsenic (As)			94.9		%		80-120	01-OCT-21
Barium (Ba)			93.9		%		80-120	01-OCT-21
Beryllium (Be)			94.8		%		80-120	01-OCT-21
Bismuth (Bi)			90.8		%		80-120	01-OCT-21
Boron (B)			87.7		%		80-120	01-OCT-21
Cadmium (Cd)			94.7		%		80-120	01-OCT-21
Calcium (Ca)			88.4		%		80-120	01-OCT-21
Chromium (Cr)			95.5		%		80-120	01-OCT-21
Cobalt (Co)			97.4		%		80-120	01-OCT-21
Copper (Cu)			93.6		%		80-120	01-OCT-21
Iron (Fe)			99.8		%		80-120	01-OCT-21
Lead (Pb)			91.7		%		80-120	01-OCT-21
Lithium (Li)			97.2		%		80-120	01-OCT-21
Magnesium (Mg)			94.1		%		80-120	01-OCT-21
Manganese (Mn)			96.7		%		80-120	01-OCT-21
Molybdenum (Mo)			91.6		%		80-120	01-OCT-21
Nickel (Ni)			98.5		%		80-120	01-OCT-21
Phosphorus (P)			97.4		%		80-120	01-OCT-21

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-CL	**Soil**							
Batch R5605699								
WG3627462-8 LCS								
Potassium (K)			96.6		%		80-120	01-OCT-21
Selenium (Se)			95.3		%		80-120	01-OCT-21
Silver (Ag)			92.7		%		80-120	01-OCT-21
Sodium (Na)			95.8		%		80-120	01-OCT-21
Strontium (Sr)			92.9		%		80-120	01-OCT-21
Sulfur (S)			82.2		%		80-120	01-OCT-21
Thallium (Tl)			88.9		%		80-120	01-OCT-21
Tin (Sn)			92.9		%		80-120	01-OCT-21
Titanium (Ti)			84.6		%		80-120	01-OCT-21
Tungsten (W)			94.9		%		80-120	01-OCT-21
Uranium (U)			93.9		%		80-120	01-OCT-21
Vanadium (V)			95.7		%		80-120	01-OCT-21
Zinc (Zn)			92.0		%		80-120	01-OCT-21
Zirconium (Zr)			92.5		%		80-120	01-OCT-21
WG3627462-6 MB								
Aluminum (Al)			<50		mg/kg		50	01-OCT-21
Antimony (Sb)			<0.10		mg/kg		0.1	01-OCT-21
Arsenic (As)			<0.10		mg/kg		0.1	01-OCT-21
Barium (Ba)			<0.50		mg/kg		0.5	01-OCT-21
Beryllium (Be)			<0.10		mg/kg		0.1	01-OCT-21
Bismuth (Bi)			<0.20		mg/kg		0.2	01-OCT-21
Boron (B)			<5.0		mg/kg		5	01-OCT-21
Cadmium (Cd)			<0.020		mg/kg		0.02	01-OCT-21
Calcium (Ca)			<50		mg/kg		50	01-OCT-21
Chromium (Cr)			<0.50		mg/kg		0.5	01-OCT-21
Cobalt (Co)			<0.10		mg/kg		0.1	01-OCT-21
Copper (Cu)			<0.50		mg/kg		0.5	01-OCT-21
Iron (Fe)			<50		mg/kg		50	01-OCT-21
Lead (Pb)			<0.50		mg/kg		0.5	01-OCT-21
Lithium (Li)			<2.0		mg/kg		2	01-OCT-21
Magnesium (Mg)			<20		mg/kg		20	01-OCT-21
Manganese (Mn)			<1.0		mg/kg		1	01-OCT-21
Molybdenum (Mo)			<0.10		mg/kg		0.1	01-OCT-21
Nickel (Ni)			<0.50		mg/kg		0.5	01-OCT-21

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-CL	**Soil**							
Batch R5605699								
WG3627462-6 MB								
Phosphorus (P)			<50		mg/kg		50	01-OCT-21
Potassium (K)			<100		mg/kg		100	01-OCT-21
Selenium (Se)			<0.20		mg/kg		0.2	01-OCT-21
Silver (Ag)			<0.10		mg/kg		0.1	01-OCT-21
Sodium (Na)			<50		mg/kg		50	01-OCT-21
Strontium (Sr)			<0.50		mg/kg		0.5	01-OCT-21
Sulfur (S)			<1000		mg/kg		1000	01-OCT-21
Thallium (Tl)			<0.050		mg/kg		0.05	01-OCT-21
Tin (Sn)			<2.0		mg/kg		2	01-OCT-21
Titanium (Ti)			<1.0		mg/kg		1	01-OCT-21
Tungsten (W)			<0.50		mg/kg		0.5	01-OCT-21
Uranium (U)			<0.050		mg/kg		0.05	01-OCT-21
Vanadium (V)			<0.20		mg/kg		0.2	01-OCT-21
Zinc (Zn)			<2.0		mg/kg		2	01-OCT-21
Zirconium (Zr)			<1.0		mg/kg		1	01-OCT-21
MET-TESS-CM-CCMS-VA	**Soil**							
Batch R5607116								
WG3627150-3 DUP		**L2641287-2**						
Aluminum (Al)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Antimony (Sb)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	04-OCT-21
Arsenic (As)-Leachable		0.094	0.116		mg/kg	22	30	04-OCT-21
Barium (Ba)-Leachable		48.1	50.5		mg/kg	4.8	30	04-OCT-21
Beryllium (Be)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	04-OCT-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	04-OCT-21
Cadmium (Cd)-Leachable		0.161	0.177		mg/kg	10	30	04-OCT-21
Calcium (Ca)-Leachable		44500	46800		mg/kg	5.1	30	04-OCT-21
Chromium (Cr)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	04-OCT-21
Cobalt (Co)-Leachable		0.89	0.92		mg/kg	4.2	30	04-OCT-21
Copper (Cu)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Iron (Fe)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Lead (Pb)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Lithium (Li)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	04-OCT-21
Manganese (Mn)-Leachable		117	122		mg/kg	4.5	30	04-OCT-21
Molybdenum (Mo)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	04-OCT-21

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-CM-CCMS-VA	**Soil**							
Batch R5607116								
WG3627150-3 DUP		**L2641287-2**						
Nickel (Ni)-Leachable		6.3	6.8		mg/kg	8.4	30	04-OCT-21
Phosphorus (P)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Selenium (Se)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	04-OCT-21
Silver (Ag)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	04-OCT-21
Strontium (Sr)-Leachable		23.2	24.7		mg/kg	6.1	30	04-OCT-21
Thallium (Tl)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	04-OCT-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	04-OCT-21
Titanium (Ti)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	04-OCT-21
Uranium (U)-Leachable		0.257	0.256		mg/kg	0.4	30	04-OCT-21
Vanadium (V)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	04-OCT-21
Zinc (Zn)-Leachable		28.0	28.6		mg/kg	2.0	30	04-OCT-21
WG3627150-2 LCS								
Aluminum (Al)-Leachable			115.8		%		70-130	04-OCT-21
Antimony (Sb)-Leachable			108.3		%		70-130	04-OCT-21
Arsenic (As)-Leachable			104.9		%		70-130	04-OCT-21
Barium (Ba)-Leachable			107.9		%		70-130	04-OCT-21
Beryllium (Be)-Leachable			108.4		%		70-130	04-OCT-21
Bismuth (Bi)-Leachable			97.0		%		70-130	04-OCT-21
Cadmium (Cd)-Leachable			102.6		%		70-130	04-OCT-21
Calcium (Ca)-Leachable			103.6		%		70-130	04-OCT-21
Chromium (Cr)-Leachable			102.7		%		70-130	04-OCT-21
Cobalt (Co)-Leachable			102.5		%		70-130	04-OCT-21
Copper (Cu)-Leachable			101.9		%		70-130	04-OCT-21
Iron (Fe)-Leachable			103.2		%		70-130	04-OCT-21
Lead (Pb)-Leachable			98.9		%		70-130	04-OCT-21
Lithium (Li)-Leachable			107.3		%		70-130	04-OCT-21
Manganese (Mn)-Leachable			107.3		%		70-130	04-OCT-21
Molybdenum (Mo)-Leachable			107.2		%		70-130	04-OCT-21
Nickel (Ni)-Leachable			101.2		%		70-130	04-OCT-21
Phosphorus (P)-Leachable			105.2		%		70-130	04-OCT-21
Selenium (Se)-Leachable			109.3		%		70-130	04-OCT-21
Silver (Ag)-Leachable			103.3		%		70-130	04-OCT-21
Strontium (Sr)-Leachable			105.2		%		70-130	04-OCT-21
Thallium (Tl)-Leachable			98.5		%		70-130	04-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-CM-CCMS-VA	**Soil**							
Batch R5607116								
WG3627150-2 LCS								
Tin (Sn)-Leachable			105.0		%		70-130	04-OCT-21
Titanium (Ti)-Leachable			100.1		%		70-130	04-OCT-21
Uranium (U)-Leachable			99.4		%		70-130	04-OCT-21
Vanadium (V)-Leachable			106.0		%		70-130	04-OCT-21
Zinc (Zn)-Leachable			104.0		%		70-130	04-OCT-21
WG3627150-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	04-OCT-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	04-OCT-21
Arsenic (As)-Leachable			<0.050		mg/kg		0.05	04-OCT-21
Barium (Ba)-Leachable			<2.0		mg/kg		2	04-OCT-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	04-OCT-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	04-OCT-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	04-OCT-21
Calcium (Ca)-Leachable			<50		mg/kg		50	04-OCT-21
Chromium (Cr)-Leachable			<5.0		mg/kg		5	04-OCT-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	04-OCT-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Iron (Fe)-Leachable			<50		mg/kg		50	04-OCT-21
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	04-OCT-21
Manganese (Mn)-Leachable			<5.0		mg/kg		5	04-OCT-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Nickel (Ni)-Leachable			<2.0		mg/kg		2	04-OCT-21
Phosphorus (P)-Leachable			<50		mg/kg		50	04-OCT-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	04-OCT-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	04-OCT-21
Strontium (Sr)-Leachable			<5.0		mg/kg		5	04-OCT-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	04-OCT-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	04-OCT-21
Titanium (Ti)-Leachable			<5.0		mg/kg		5	04-OCT-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	04-OCT-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	04-OCT-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	04-OCT-21
MET-TESS-EA-CCMS-VA	**Soil**							

Quality Control Report

Workorder: L2641287 Report Date: 25-OCT-21

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-EA-CCMS-VA	**Soil**							
Batch R5607116								
WG3627150-3 DUP		**L2641287-2**						
Aluminum (Al)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Antimony (Sb)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	04-OCT-21
Arsenic (As)-Leachable		0.072	0.067		mg/kg	7.1	30	04-OCT-21
Barium (Ba)-Leachable		29.2	28.9		mg/kg	1.3	30	04-OCT-21
Beryllium (Be)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	04-OCT-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	04-OCT-21
Cadmium (Cd)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	04-OCT-21
Calcium (Ca)-Leachable		4030	3820		mg/kg	5.2	30	04-OCT-21
Chromium (Cr)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Cobalt (Co)-Leachable		0.24	0.23		mg/kg	5.0	30	04-OCT-21
Copper (Cu)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Iron (Fe)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Lead (Pb)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Lithium (Li)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	04-OCT-21
Manganese (Mn)-Leachable		99.3	98.0		mg/kg	1.3	30	04-OCT-21
Molybdenum (Mo)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Nickel (Ni)-Leachable		1.09	1.08		mg/kg	0.9	30	04-OCT-21
Phosphorus (P)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Potassium (K)-Leachable		<100	<100	RPD-NA	mg/kg	N/A	30	04-OCT-21
Selenium (Se)-Leachable		0.28	0.21		mg/kg	27	30	04-OCT-21
Silver (Ag)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	04-OCT-21
Sodium (Na)-Leachable		<100	<100	RPD-NA	mg/kg	N/A	30	04-OCT-21
Strontium (Sr)-Leachable		7.55	7.34		mg/kg	2.9	30	04-OCT-21
Thallium (Tl)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	04-OCT-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	04-OCT-21
Titanium (Ti)-Leachable		<1.0	<1.0	RPD-NA	mg/kg	N/A	30	04-OCT-21
Uranium (U)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	04-OCT-21
Vanadium (V)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	04-OCT-21
Zinc (Zn)-Leachable		<1.0	<1.0	RPD-NA	mg/kg	N/A	30	04-OCT-21
WG3627150-2 LCS								
Aluminum (Al)-Leachable			105.1		%		70-130	04-OCT-21
Antimony (Sb)-Leachable			105.6		%		70-130	04-OCT-21
Arsenic (As)-Leachable			96.4		%		70-130	04-OCT-21
Barium (Ba)-Leachable			100.2		%		70-130	04-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-EA-CCMS-VA	**Soil**							
Batch R5607116								
WG3627150-2 LCS								
Beryllium (Be)-Leachable			106.9		%		70-130	04-OCT-21
Bismuth (Bi)-Leachable			95.3		%		70-130	04-OCT-21
Cadmium (Cd)-Leachable			94.9		%		70-130	04-OCT-21
Calcium (Ca)-Leachable			101.6		%		70-130	04-OCT-21
Chromium (Cr)-Leachable			96.7		%		70-130	04-OCT-21
Cobalt (Co)-Leachable			93.8		%		70-130	04-OCT-21
Copper (Cu)-Leachable			93.0		%		70-130	04-OCT-21
Iron (Fe)-Leachable			96.1		%		70-130	04-OCT-21
Lead (Pb)-Leachable			96.5		%		70-130	04-OCT-21
Lithium (Li)-Leachable			107.5		%		70-130	04-OCT-21
Manganese (Mn)-Leachable			97.4		%		70-130	04-OCT-21
Molybdenum (Mo)-Leachable			103.4		%		70-130	04-OCT-21
Nickel (Ni)-Leachable			93.5		%		70-130	04-OCT-21
Phosphorus (P)-Leachable			97.6		%		70-130	04-OCT-21
Potassium (K)-Leachable			98.6		%		70-130	04-OCT-21
Selenium (Se)-Leachable			100.4		%		70-130	04-OCT-21
Silver (Ag)-Leachable			102.4		%		70-130	04-OCT-21
Sodium (Na)-Leachable			99.1		%		70-130	04-OCT-21
Strontium (Sr)-Leachable			103.2		%		70-130	04-OCT-21
Thallium (Tl)-Leachable			97.3		%		70-130	04-OCT-21
Tin (Sn)-Leachable			100.3		%		70-130	04-OCT-21
Titanium (Ti)-Leachable			92.8		%		70-130	04-OCT-21
Uranium (U)-Leachable			95.5		%		70-130	04-OCT-21
Vanadium (V)-Leachable			98.9		%		70-130	04-OCT-21
Zinc (Zn)-Leachable			94.1		%		70-130	04-OCT-21
WG3627150-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	04-OCT-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	04-OCT-21
Arsenic (As)-Leachable			<0.050		mg/kg		0.05	04-OCT-21
Barium (Ba)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	04-OCT-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	04-OCT-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	04-OCT-21
Calcium (Ca)-Leachable			<50		mg/kg		50	04-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-EA-CCMS-VA	**Soil**							
Batch R5607116								
WG3627150-1 MB								
Chromium (Cr)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	04-OCT-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Iron (Fe)-Leachable			<50		mg/kg		50	04-OCT-21
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	04-OCT-21
Manganese (Mn)-Leachable			<1.0		mg/kg		1	04-OCT-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Nickel (Ni)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Phosphorus (P)-Leachable			<50		mg/kg		50	04-OCT-21
Potassium (K)-Leachable			<100		mg/kg		100	04-OCT-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	04-OCT-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	04-OCT-21
Sodium (Na)-Leachable			<100		mg/kg		100	04-OCT-21
Strontium (Sr)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	04-OCT-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	04-OCT-21
Titanium (Ti)-Leachable			<1.0		mg/kg		1	04-OCT-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	04-OCT-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	04-OCT-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	04-OCT-21
MET-TESS-FEO-CCMS-VA	**Soil**							
Batch R5607116								
WG3627150-3 DUP		**L2641287-2**						
Aluminum (Al)-Leachable		278	285		mg/kg	2.6	30	04-OCT-21
Antimony (Sb)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	04-OCT-21
Arsenic (As)-Leachable		0.521	0.554		mg/kg	6.3	30	04-OCT-21
Barium (Ba)-Leachable		29.5	28.8		mg/kg	2.5	30	04-OCT-21
Beryllium (Be)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	04-OCT-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	04-OCT-21
Cadmium (Cd)-Leachable		3.56	3.50		mg/kg	1.7	30	04-OCT-21
Calcium (Ca)-Leachable		42100	39100		mg/kg	7.3	30	04-OCT-21
Chromium (Cr)-Leachable		1.04	1.00		mg/kg	3.9	30	04-OCT-21
Cobalt (Co)-Leachable		1.22	1.16		mg/kg	5.3	30	04-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-FEO-CCMS-VA	**Soil**							
Batch **R5607116**								
WG3627150-3 DUP		**L2641287-2**						
Copper (Cu)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Iron (Fe)-Leachable		2830	2900		mg/kg	2.4	30	04-OCT-21
Lead (Pb)-Leachable		3.08	2.97		mg/kg	3.8	30	04-OCT-21
Lithium (Li)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	04-OCT-21
Manganese (Mn)-Leachable		207	208		mg/kg	0.0	30	04-OCT-21
Molybdenum (Mo)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	04-OCT-21
Nickel (Ni)-Leachable		11.2	11.2		mg/kg	0.2	30	04-OCT-21
Phosphorus (P)-Leachable		93	100		mg/kg	7.7	30	04-OCT-21
Selenium (Se)-Leachable		1.33	1.35		mg/kg	1.7	30	04-OCT-21
Silver (Ag)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	04-OCT-21
Strontium (Sr)-Leachable		27.3	25.7		mg/kg	5.8	30	04-OCT-21
Thallium (Tl)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	04-OCT-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	04-OCT-21
Titanium (Ti)-Leachable		<1.0	<1.0	RPD-NA	mg/kg	N/A	30	04-OCT-21
Uranium (U)-Leachable		0.288	0.285		mg/kg	1.0	30	04-OCT-21
Vanadium (V)-Leachable		2.90	2.90		mg/kg	0.1	30	04-OCT-21
Zinc (Zn)-Leachable		107	106		mg/kg	0.2	30	04-OCT-21
WG3627150-2 LCS								
Aluminum (Al)-Leachable			104.0		%		70-130	04-OCT-21
Antimony (Sb)-Leachable			102.5		%		70-130	04-OCT-21
Arsenic (As)-Leachable			103.8		%		70-130	04-OCT-21
Barium (Ba)-Leachable			100.9		%		70-130	04-OCT-21
Beryllium (Be)-Leachable			101.4		%		70-130	04-OCT-21
Bismuth (Bi)-Leachable			99.7		%		70-130	04-OCT-21
Cadmium (Cd)-Leachable			97.3		%		70-130	04-OCT-21
Calcium (Ca)-Leachable			100.6		%		70-130	04-OCT-21
Chromium (Cr)-Leachable			99.0		%		70-130	04-OCT-21
Cobalt (Co)-Leachable			101.2		%		70-130	04-OCT-21
Copper (Cu)-Leachable			99.1		%		70-130	04-OCT-21
Iron (Fe)-Leachable			99.98		%		70-130	04-OCT-21
Lead (Pb)-Leachable			98.7		%		70-130	04-OCT-21
Lithium (Li)-Leachable			102.0		%		70-130	04-OCT-21
Manganese (Mn)-Leachable			100.5		%		70-130	04-OCT-21
Molybdenum (Mo)-Leachable			99.6		%		70-130	04-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-FEO-CCMS-VA	**Soil**							
Batch R5607116								
WG3627150-2 LCS								
Nickel (Ni)-Leachable			100.3		%		70-130	04-OCT-21
Phosphorus (P)-Leachable			98.1		%		70-130	04-OCT-21
Selenium (Se)-Leachable			111.9		%		70-130	04-OCT-21
Silver (Ag)-Leachable			100.6		%		70-130	04-OCT-21
Strontium (Sr)-Leachable			99.3		%		70-130	04-OCT-21
Thallium (Tl)-Leachable			99.5		%		70-130	04-OCT-21
Tin (Sn)-Leachable			98.5		%		70-130	04-OCT-21
Titanium (Ti)-Leachable			95.9		%		70-130	04-OCT-21
Uranium (U)-Leachable			96.5		%		70-130	04-OCT-21
Vanadium (V)-Leachable			99.2		%		70-130	04-OCT-21
Zinc (Zn)-Leachable			101.6		%		70-130	04-OCT-21
WG3627150-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	04-OCT-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	04-OCT-21
Arsenic (As)-Leachable			<0.050		mg/kg		0.05	04-OCT-21
Barium (Ba)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	04-OCT-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	04-OCT-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	04-OCT-21
Calcium (Ca)-Leachable			<50		mg/kg		50	04-OCT-21
Chromium (Cr)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	04-OCT-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Iron (Fe)-Leachable			<50		mg/kg		50	04-OCT-21
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	04-OCT-21
Manganese (Mn)-Leachable			<1.0		mg/kg		1	04-OCT-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Nickel (Ni)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Phosphorus (P)-Leachable			<50		mg/kg		50	04-OCT-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	04-OCT-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	04-OCT-21
Strontium (Sr)-Leachable			<0.50		mg/kg		0.5	04-OCT-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	04-OCT-21

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-FEO-CCMS-VA	**Soil**							
Batch R5607116								
WG3627150-1 MB								
Tin (Sn)-Leachable			<2.0		mg/kg		2	04-OCT-21
Titanium (Ti)-Leachable			<1.0		mg/kg		1	04-OCT-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	04-OCT-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	04-OCT-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	04-OCT-21
MET-TESS-OB-CCMS-VA	**Soil**							
Batch R5614045								
WG3627150-3 DUP		**L2641287-2**						
Aluminum (Al)-Leachable		856	922		mg/kg	7.5	30	07-OCT-21
Antimony (Sb)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	07-OCT-21
Arsenic (As)-Leachable		0.513	0.565		mg/kg	9.6	30	07-OCT-21
Barium (Ba)-Leachable		9.45	9.41		mg/kg	0.4	30	07-OCT-21
Beryllium (Be)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	07-OCT-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	07-OCT-21
Cadmium (Cd)-Leachable		0.245	0.259		mg/kg	5.4	30	07-OCT-21
Calcium (Ca)-Leachable		2000	1990		mg/kg	0.5	30	07-OCT-21
Chromium (Cr)-Leachable		2.92	3.04		mg/kg	4.2	30	07-OCT-21
Cobalt (Co)-Leachable		0.98	1.06		mg/kg	7.9	30	07-OCT-21
Copper (Cu)-Leachable		5.70	5.71		mg/kg	0.2	30	07-OCT-21
Iron (Fe)-Leachable		1950	2060		mg/kg	5.5	30	07-OCT-21
Lead (Pb)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	07-OCT-21
Lithium (Li)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	07-OCT-21
Manganese (Mn)-Leachable		10.8	11.1		mg/kg	2.7	30	07-OCT-21
Molybdenum (Mo)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	07-OCT-21
Nickel (Ni)-Leachable		8.20	8.50		mg/kg	3.6	30	07-OCT-21
Selenium (Se)-Leachable		4.74	5.25		mg/kg	10	30	07-OCT-21
Silver (Ag)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	07-OCT-21
Strontium (Sr)-Leachable		4.16	4.39		mg/kg	5.5	30	07-OCT-21
Thallium (Tl)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	07-OCT-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	07-OCT-21
Titanium (Ti)-Leachable		13.3	14.2		mg/kg	6.8	30	07-OCT-21
Uranium (U)-Leachable		0.211	0.221		mg/kg	4.6	30	07-OCT-21
Vanadium (V)-Leachable		3.23	3.37		mg/kg	4.3	30	07-OCT-21
Zinc (Zn)-Leachable		11.7	11.9		mg/kg	2.2	30	07-OCT-21

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-OB-CCMS-VA	**Soil**							
Batch R5614045								
WG3627150-2 LCS								
Aluminum (Al)-Leachable			98.9		%		70-130	07-OCT-21
Antimony (Sb)-Leachable			99.9		%		70-130	07-OCT-21
Arsenic (As)-Leachable			100.5		%		70-130	07-OCT-21
Barium (Ba)-Leachable			94.2		%		70-130	07-OCT-21
Beryllium (Be)-Leachable			97.2		%		70-130	07-OCT-21
Bismuth (Bi)-Leachable			96.5		%		70-130	07-OCT-21
Cadmium (Cd)-Leachable			99.95		%		70-130	07-OCT-21
Calcium (Ca)-Leachable			95.9		%		70-130	07-OCT-21
Chromium (Cr)-Leachable			98.0		%		70-130	07-OCT-21
Cobalt (Co)-Leachable			99.0		%		70-130	07-OCT-21
Copper (Cu)-Leachable			99.0		%		70-130	07-OCT-21
Iron (Fe)-Leachable			97.6		%		70-130	07-OCT-21
Lead (Pb)-Leachable			96.1		%		70-130	07-OCT-21
Lithium (Li)-Leachable			98.3		%		70-130	07-OCT-21
Manganese (Mn)-Leachable			99.6		%		70-130	07-OCT-21
Molybdenum (Mo)-Leachable			96.1		%		70-130	07-OCT-21
Nickel (Ni)-Leachable			97.6		%		70-130	07-OCT-21
Selenium (Se)-Leachable			102.9		%		70-130	07-OCT-21
Silver (Ag)-Leachable			98.2		%		70-130	07-OCT-21
Strontium (Sr)-Leachable			99.1		%		70-130	07-OCT-21
Thallium (Tl)-Leachable			95.2		%		70-130	07-OCT-21
Tin (Sn)-Leachable			96.9		%		70-130	07-OCT-21
Titanium (Ti)-Leachable			89.0		%		70-130	07-OCT-21
Uranium (U)-Leachable			93.5		%		70-130	07-OCT-21
Vanadium (V)-Leachable			97.9		%		70-130	07-OCT-21
Zinc (Zn)-Leachable			105.5		%		70-130	07-OCT-21
WG3627150-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	07-OCT-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	07-OCT-21
Arsenic (As)-Leachable			<0.050		mg/kg		0.05	07-OCT-21
Barium (Ba)-Leachable			<0.50		mg/kg		0.5	07-OCT-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	07-OCT-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	07-OCT-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	07-OCT-21

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-OB-CCMS-VA	**Soil**							
Batch R5614045								
WG3627150-1 MB								
Calcium (Ca)-Leachable			<50		mg/kg		50	07-OCT-21
Chromium (Cr)-Leachable			<0.50		mg/kg		0.5	07-OCT-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	07-OCT-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	07-OCT-21
Iron (Fe)-Leachable			<50		mg/kg		50	07-OCT-21
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	07-OCT-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	07-OCT-21
Manganese (Mn)-Leachable			<1.0		mg/kg		1	07-OCT-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	07-OCT-21
Nickel (Ni)-Leachable			<0.50		mg/kg		0.5	07-OCT-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	07-OCT-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	07-OCT-21
Strontium (Sr)-Leachable			<0.50		mg/kg		0.5	07-OCT-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	07-OCT-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	07-OCT-21
Titanium (Ti)-Leachable			<1.0		mg/kg		1	07-OCT-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	07-OCT-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	07-OCT-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	07-OCT-21
MET-TESS-RM-CCMS-VA	**Soil**							
Batch R5614010								
WG3627150-3 DUP		**L2641287-2**						
Aluminum (Al)-Leachable		5560	5360		mg/kg	3.7	30	08-OCT-21
Antimony (Sb)-Leachable		0.42	0.40		mg/kg	5.4	30	08-OCT-21
Arsenic (As)-Leachable		2.92	2.73		mg/kg	6.8	30	08-OCT-21
Barium (Ba)-Leachable		96.9	95.4		mg/kg	1.5	30	08-OCT-21
Beryllium (Be)-Leachable		0.24	0.23		mg/kg	2.8	30	08-OCT-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	08-OCT-21
Cadmium (Cd)-Leachable		0.067	0.052		mg/kg	25	30	08-OCT-21
Calcium (Ca)-Leachable		1040	792		mg/kg	27	30	08-OCT-21
Chromium (Cr)-Leachable		9.0	8.8		mg/kg	1.7	30	08-OCT-21
Cobalt (Co)-Leachable		1.46	1.50		mg/kg	2.5	30	08-OCT-21
Copper (Cu)-Leachable		6.48	6.54		mg/kg	0.8	30	08-OCT-21
Iron (Fe)-Leachable		6560	6460		mg/kg	1.6	30	08-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-RM-CCMS-VA	**Soil**							
Batch R5614010								
WG3627150-3 DUP		**L2641287-2**						
Lead (Pb)-Leachable		3.26	3.15		mg/kg	3.3	30	08-OCT-21
Lithium (Li)-Leachable		6.9	6.6		mg/kg	3.7	30	08-OCT-21
Manganese (Mn)-Leachable		31.0	30.2		mg/kg	2.5	30	08-OCT-21
Molybdenum (Mo)-Leachable		0.83	0.76		mg/kg	9.1	30	08-OCT-21
Nickel (Ni)-Leachable		6.9	6.7		mg/kg	2.3	30	08-OCT-21
Selenium (Se)-Leachable		0.66	0.64		mg/kg	2.4	30	08-OCT-21
Silver (Ag)-Leachable		0.10	0.11		mg/kg	7.1	30	08-OCT-21
Strontium (Sr)-Leachable		17.8	16.6		mg/kg	7.2	30	08-OCT-21
Thallium (Tl)-Leachable		0.153	0.146		mg/kg	4.4	30	08-OCT-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	08-OCT-21
Titanium (Ti)-Leachable		23.7	23.5		mg/kg	0.8	30	08-OCT-21
Uranium (U)-Leachable		0.349	0.313		mg/kg	11	30	08-OCT-21
Vanadium (V)-Leachable		17.7	17.2		mg/kg	2.5	30	08-OCT-21
Zinc (Zn)-Leachable		38.6	37.6		mg/kg	2.7	30	08-OCT-21
WG3627150-2 LCS								
Aluminum (Al)-Leachable			99.7		%		70-130	08-OCT-21
Antimony (Sb)-Leachable			101.9		%		70-130	08-OCT-21
Arsenic (As)-Leachable			102.8		%		70-130	08-OCT-21
Barium (Ba)-Leachable			101.7		%		70-130	08-OCT-21
Beryllium (Be)-Leachable			100.7		%		70-130	08-OCT-21
Bismuth (Bi)-Leachable			97.7		%		70-130	08-OCT-21
Cadmium (Cd)-Leachable			103.4		%		70-130	08-OCT-21
Calcium (Ca)-Leachable			98.0		%		70-130	08-OCT-21
Chromium (Cr)-Leachable			99.95		%		70-130	08-OCT-21
Cobalt (Co)-Leachable			101.9		%		70-130	08-OCT-21
Copper (Cu)-Leachable			102.0		%		70-130	08-OCT-21
Iron (Fe)-Leachable			99.8		%		70-130	08-OCT-21
Lead (Pb)-Leachable			98.7		%		70-130	08-OCT-21
Lithium (Li)-Leachable			103.0		%		70-130	08-OCT-21
Manganese (Mn)-Leachable			102.1		%		70-130	08-OCT-21
Molybdenum (Mo)-Leachable			96.3		%		70-130	08-OCT-21
Nickel (Ni)-Leachable			103.4		%		70-130	08-OCT-21
Selenium (Se)-Leachable			99.7		%		70-130	08-OCT-21
Silver (Ag)-Leachable			98.7		%		70-130	08-OCT-21

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-RM-CCMS-VA	**Soil**							
Batch R5614010								
WG3627150-2 LCS								
Strontium (Sr)-Leachable			96.9		%		70-130	08-OCT-21
Thallium (Tl)-Leachable			97.2		%		70-130	08-OCT-21
Tin (Sn)-Leachable			99.0		%		70-130	08-OCT-21
Titanium (Ti)-Leachable			102.4		%		70-130	08-OCT-21
Uranium (U)-Leachable			98.3		%		70-130	08-OCT-21
Vanadium (V)-Leachable			102.6		%		70-130	08-OCT-21
Zinc (Zn)-Leachable			104.0		%		70-130	08-OCT-21
WG3627150-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	08-OCT-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	08-OCT-21
Arsenic (As)-Leachable			<0.50		mg/kg		0.5	08-OCT-21
Barium (Ba)-Leachable			<2.0		mg/kg		2	08-OCT-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	08-OCT-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	08-OCT-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	08-OCT-21
Calcium (Ca)-Leachable			<50		mg/kg		50	08-OCT-21
Chromium (Cr)-Leachable			<5.0		mg/kg		5	08-OCT-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	08-OCT-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	08-OCT-21
Iron (Fe)-Leachable			<50		mg/kg		50	08-OCT-21
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	08-OCT-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	08-OCT-21
Manganese (Mn)-Leachable			<5.0		mg/kg		5	08-OCT-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	08-OCT-21
Nickel (Ni)-Leachable			<2.0		mg/kg		2	08-OCT-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	08-OCT-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	08-OCT-21
Strontium (Sr)-Leachable			<5.0		mg/kg		5	08-OCT-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	08-OCT-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	08-OCT-21
Titanium (Ti)-Leachable			<5.0		mg/kg		5	08-OCT-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	08-OCT-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	08-OCT-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	08-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-CL	**Soil**							
Batch R5600298								
WG3625228-2 LCS								
Moisture			100.8		%		90-110	27-SEP-21
WG3625228-1 MB								
Moisture			<0.25		%		0.25	27-SEP-21
Batch R5600336								
WG3625226-2 LCS								
Moisture			99.4		%		90-110	27-SEP-21
WG3625226-1 MB								
Moisture			<0.25		%		0.25	27-SEP-21
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5603578								
WG3626733-4 IRM		**ALS PAH RM2**						
Acenaphthene			84.8		%		60-130	27-SEP-21
Acenaphthylene			101.9		%		60-130	27-SEP-21
Anthracene			107.6		%		60-130	27-SEP-21
Acridine			116.5		%		60-130	27-SEP-21
Benz(a)anthracene			103.0		%		60-130	27-SEP-21
Benzo(a)pyrene			103.6		%		60-130	27-SEP-21
Benzo(b&j)fluoranthene			98.0		%		60-130	27-SEP-21
Benzo(e)pyrene			104.0		%		60-130	27-SEP-21
Benzo(g,h,i)perylene			91.4		%		60-130	27-SEP-21
Benzo(k)fluoranthene			80.6		%		60-130	27-SEP-21
Chrysene			99.7		%		60-130	27-SEP-21
Dibenz(a,h)anthracene			91.3		%		60-130	27-SEP-21
Fluoranthene			87.0		%		60-130	27-SEP-21
Fluorene			88.5		%		60-130	27-SEP-21
Indeno(1,2,3-c,d)pyrene			116.1		%		60-130	27-SEP-21
2-Methylnaphthalene			83.4		%		60-130	27-SEP-21
Naphthalene			78.6		%		50-130	27-SEP-21
Perylene			103.9		%		60-130	27-SEP-21
Phenanthrene			89.7		%		60-130	27-SEP-21
Pyrene			90.3		%		60-130	27-SEP-21
1-Methylnaphthalene			82.5		%		60-130	27-SEP-21
WG3626733-6 IRM		**ALS PAH RM2**						
Acenaphthene			93.6		%		60-130	27-SEP-21
Acenaphthylene			107.4		%		60-130	27-SEP-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5603578								
WG3626733-6 IRM		**ALS PAH RM2**						
Anthracene			116.1		%		60-130	27-SEP-21
Acridine			111.2		%		60-130	27-SEP-21
Benz(a)anthracene			106.0		%		60-130	27-SEP-21
Benzo(a)pyrene			102.6		%		60-130	27-SEP-21
Benzo(b&j)fluoranthene			101.7		%		60-130	27-SEP-21
Benzo(e)pyrene			96.6		%		60-130	27-SEP-21
Benzo(g,h,i)perylene			95.0		%		60-130	27-SEP-21
Benzo(k)fluoranthene			87.8		%		60-130	27-SEP-21
Chrysene			102.8		%		60-130	27-SEP-21
Dibenz(a,h)anthracene			96.7		%		60-130	27-SEP-21
Fluoranthene			92.5		%		60-130	27-SEP-21
Fluorene			98.4		%		60-130	27-SEP-21
Indeno(1,2,3-c,d)pyrene			69.6		%		60-130	27-SEP-21
2-Methylnaphthalene			92.5		%		60-130	27-SEP-21
Naphthalene			86.2		%		50-130	27-SEP-21
Perylene			84.2		%		60-130	27-SEP-21
Phenanthrene			97.9		%		60-130	27-SEP-21
Pyrene			95.5		%		60-130	27-SEP-21
1-Methylnaphthalene			91.3		%		60-130	27-SEP-21
WG3626733-9 IRM		**ALS PAH RM2**						
Acenaphthene			87.0		%		60-130	28-SEP-21
Acenaphthylene			98.8		%		60-130	28-SEP-21
Anthracene			108.2		%		60-130	28-SEP-21
Acridine			106.5		%		60-130	28-SEP-21
Benz(a)anthracene			97.5		%		60-130	28-SEP-21
Benzo(a)pyrene			94.3		%		60-130	28-SEP-21
Benzo(b&j)fluoranthene			93.3		%		60-130	28-SEP-21
Benzo(e)pyrene			97.8		%		60-130	28-SEP-21
Benzo(g,h,i)perylene			87.6		%		60-130	28-SEP-21
Benzo(k)fluoranthene			89.4		%		60-130	28-SEP-21
Chrysene			93.8		%		60-130	28-SEP-21
Dibenz(a,h)anthracene			83.5		%		60-130	28-SEP-21
Fluoranthene			83.6		%		60-130	28-SEP-21
Fluorene			86.4		%		60-130	28-SEP-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5603578								
WG3626733-9 IRM		**ALS PAH RM2**						
Indeno(1,2,3-c,d)pyrene			109.6		%		60-130	28-SEP-21
2-Methylnaphthalene			84.8		%		60-130	28-SEP-21
Naphthalene			82.3		%		50-130	28-SEP-21
Perylene			98.3		%		60-130	28-SEP-21
Phenanthrene			87.9		%		60-130	28-SEP-21
Pyrene			86.9		%		60-130	28-SEP-21
1-Methylnaphthalene			83.4		%		60-130	28-SEP-21
WG3626733-3 LCS								
Acenaphthene			104.8		%		60-130	27-SEP-21
Acenaphthylene			101.8		%		60-130	27-SEP-21
Anthracene			110.1		%		60-130	27-SEP-21
Acridine			91.6		%		60-130	27-SEP-21
Benz(a)anthracene			115.1		%		60-130	27-SEP-21
Benzo(a)pyrene			105.5		%		60-130	27-SEP-21
Benzo(b&j)fluoranthene			109.0		%		60-130	27-SEP-21
Benzo(e)pyrene			112.1		%		60-130	27-SEP-21
Benzo(g,h,i)perylene			98.5		%		60-130	27-SEP-21
Benzo(k)fluoranthene			103.7		%		60-130	27-SEP-21
Chrysene			106.2		%		60-130	27-SEP-21
Dibenz(a,h)anthracene			95.6		%		60-130	27-SEP-21
Fluoranthene			104.3		%		60-130	27-SEP-21
Fluorene			105.0		%		60-130	27-SEP-21
Indeno(1,2,3-c,d)pyrene			100.6		%		60-130	27-SEP-21
2-Methylnaphthalene			107.0		%		60-130	27-SEP-21
Naphthalene			101.6		%		50-130	27-SEP-21
Perylene			99.6		%		60-130	27-SEP-21
Phenanthrene			110.2		%		60-130	27-SEP-21
Pyrene			105.5		%		60-130	27-SEP-21
1-Methylnaphthalene			107.9		%		60-130	27-SEP-21
Quinoline			86.7		%		60-130	27-SEP-21
WG3626733-5 LCS								
Acenaphthene			107.5		%		60-130	27-SEP-21
Acenaphthylene			104.6		%		60-130	27-SEP-21
Anthracene			114.7		%		60-130	27-SEP-21
Acridine			112.8		%		60-130	27-SEP-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5603578								
WG3626733-5 LCS								
Benz(a)anthracene			119.5		%		60-130	27-SEP-21
Benzo(a)pyrene			110.0		%		60-130	27-SEP-21
Benzo(b&j)fluoranthene			111.3		%		60-130	27-SEP-21
Benzo(e)pyrene			118.1		%		60-130	27-SEP-21
Benzo(g,h,i)perylene			103.3		%		60-130	27-SEP-21
Benzo(k)fluoranthene			110.3		%		60-130	27-SEP-21
Chrysene			112.7		%		60-130	27-SEP-21
Dibenz(a,h)anthracene			100.2		%		60-130	27-SEP-21
Fluoranthene			108.9		%		60-130	27-SEP-21
Fluorene			112.1		%		60-130	27-SEP-21
Indeno(1,2,3-c,d)pyrene			80.6		%		60-130	27-SEP-21
2-Methylnaphthalene			113.5		%		60-130	27-SEP-21
Naphthalene			106.5		%		50-130	27-SEP-21
Perylene			108.2		%		60-130	27-SEP-21
Phenanthrene			115.4		%		60-130	27-SEP-21
Pyrene			110.2		%		60-130	27-SEP-21
1-Methylnaphthalene			110.8		%		60-130	27-SEP-21
Quinoline			103.2		%		60-130	27-SEP-21
WG3626733-1 MB								
Acenaphthene			<0.0050		mg/kg		0.005	27-SEP-21
Acenaphthylene			<0.0050		mg/kg		0.005	27-SEP-21
Anthracene			<0.0040		mg/kg		0.004	27-SEP-21
Acridine			<0.010		mg/kg		0.01	27-SEP-21
Benz(a)anthracene			<0.010		mg/kg		0.01	27-SEP-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	27-SEP-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	27-SEP-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	27-SEP-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	27-SEP-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	27-SEP-21
Chrysene			<0.010		mg/kg		0.01	27-SEP-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	27-SEP-21
Fluoranthene			<0.010		mg/kg		0.01	27-SEP-21
Fluorene			<0.010		mg/kg		0.01	27-SEP-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	27-SEP-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5603578								
WG3626733-1 MB								
2-Methylnaphthalene			<0.010		mg/kg		0.01	27-SEP-21
Naphthalene			<0.010		mg/kg		0.01	27-SEP-21
Perylene			<0.010		mg/kg		0.01	27-SEP-21
Phenanthrene			<0.010		mg/kg		0.01	27-SEP-21
Pyrene			<0.010		mg/kg		0.01	27-SEP-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	27-SEP-21
Quinoline			<0.050		mg/kg		0.05	27-SEP-21
Surrogate: d8-Naphthalene			84.6		%		50-130	27-SEP-21
Surrogate: d10-Acenaphthene			89.8		%		60-130	27-SEP-21
Surrogate: d10-Phenanthrene			91.4		%		60-130	27-SEP-21
Surrogate: d12-Chrysene			93.8		%		60-130	27-SEP-21
WG3626733-10 MB								
Acenaphthene			<0.0050		mg/kg		0.005	28-SEP-21
Acenaphthylene			<0.0050		mg/kg		0.005	28-SEP-21
Anthracene			<0.0040		mg/kg		0.004	28-SEP-21
Acridine			<0.010		mg/kg		0.01	28-SEP-21
Benz(a)anthracene			<0.010		mg/kg		0.01	28-SEP-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	28-SEP-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	28-SEP-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	28-SEP-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	28-SEP-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	28-SEP-21
Chrysene			<0.010		mg/kg		0.01	28-SEP-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	28-SEP-21
Fluoranthene			<0.010		mg/kg		0.01	28-SEP-21
Fluorene			<0.010		mg/kg		0.01	28-SEP-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	28-SEP-21
2-Methylnaphthalene			<0.010		mg/kg		0.01	28-SEP-21
Naphthalene			<0.010		mg/kg		0.01	28-SEP-21
Perylene			<0.010		mg/kg		0.01	28-SEP-21
Phenanthrene			<0.010		mg/kg		0.01	28-SEP-21
Pyrene			<0.010		mg/kg		0.01	28-SEP-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	28-SEP-21
Quinoline			<0.050		mg/kg		0.05	28-SEP-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5603578								
WG3626733-10 MB								
Surrogate: d8-Naphthalene			82.5		%		50-130	28-SEP-21
Surrogate: d10-Acenaphthene			94.5		%		60-130	28-SEP-21
Surrogate: d10-Phenanthrene			95.0		%		60-130	28-SEP-21
Surrogate: d12-Chrysene			99.1		%		60-130	28-SEP-21
WG3626733-7 MB								
Acenaphthene			<0.0050		mg/kg		0.005	27-SEP-21
Acenaphthylene			<0.0050		mg/kg		0.005	27-SEP-21
Anthracene			<0.0040		mg/kg		0.004	27-SEP-21
Acridine			<0.010		mg/kg		0.01	27-SEP-21
Benz(a)anthracene			<0.010		mg/kg		0.01	27-SEP-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	27-SEP-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	27-SEP-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	27-SEP-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	27-SEP-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	27-SEP-21
Chrysene			<0.010		mg/kg		0.01	27-SEP-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	27-SEP-21
Fluoranthene			<0.010		mg/kg		0.01	27-SEP-21
Fluorene			<0.010		mg/kg		0.01	27-SEP-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	27-SEP-21
2-Methylnaphthalene			<0.010		mg/kg		0.01	27-SEP-21
Naphthalene			<0.010		mg/kg		0.01	27-SEP-21
Perylene			<0.010		mg/kg		0.01	27-SEP-21
Phenanthrene			<0.010		mg/kg		0.01	27-SEP-21
Pyrene			<0.010		mg/kg		0.01	27-SEP-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	27-SEP-21
Quinoline			<0.050		mg/kg		0.05	27-SEP-21
Surrogate: d8-Naphthalene			85.4		%		50-130	27-SEP-21
Surrogate: d10-Acenaphthene			94.6		%		60-130	27-SEP-21
Surrogate: d10-Phenanthrene			98.6		%		60-130	27-SEP-21
Surrogate: d12-Chrysene			102.3		%		60-130	27-SEP-21
Batch R5604623								
WG3627661-3 IRM		**ALS PAH RM2**						
Acenaphthene			93.4		%		60-130	29-SEP-21
Acenaphthylene			104.9		%		60-130	29-SEP-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5604623								
WG3627661-3 IRM		**ALS PAH RM2**						
Anthracene			113.6		%		60-130	29-SEP-21
Acridine			117.1		%		60-130	29-SEP-21
Benz(a)anthracene			110.3		%		60-130	29-SEP-21
Benzo(a)pyrene			109.5		%		60-130	29-SEP-21
Benzo(b&j)fluoranthene			103.6		%		60-130	29-SEP-21
Benzo(e)pyrene			110.4		%		60-130	29-SEP-21
Benzo(g,h,i)perylene			95.7		%		60-130	29-SEP-21
Benzo(k)fluoranthene			93.2		%		60-130	29-SEP-21
Chrysene			105.7		%		60-130	29-SEP-21
Dibenz(a,h)anthracene			92.9		%		60-130	29-SEP-21
Fluoranthene			93.7		%		60-130	29-SEP-21
Fluorene			95.6		%		60-130	29-SEP-21
Indeno(1,2,3-c,d)pyrene			124.7		%		60-130	29-SEP-21
2-Methylnaphthalene			92.2		%		60-130	29-SEP-21
Naphthalene			86.7		%		50-130	29-SEP-21
Perylene			110.2		%		60-130	29-SEP-21
Phenanthrene			96.0		%		60-130	29-SEP-21
Pyrene			97.0		%		60-130	29-SEP-21
1-Methylnaphthalene			91.3		%		60-130	29-SEP-21
WG3627661-7 IRM		**ALS PAH RM2**						
Acenaphthene			96.1		%		60-130	29-SEP-21
Acenaphthylene			102.2		%		60-130	29-SEP-21
Anthracene			116.7		%		60-130	29-SEP-21
Acridine			108.0		%		60-130	29-SEP-21
Benz(a)anthracene			102.2		%		60-130	29-SEP-21
Benzo(a)pyrene			98.4		%		60-130	29-SEP-21
Benzo(b&j)fluoranthene			97.4		%		60-130	29-SEP-21
Benzo(e)pyrene			98.9		%		60-130	29-SEP-21
Benzo(g,h,i)perylene			89.7		%		60-130	29-SEP-21
Benzo(k)fluoranthene			82.5		%		60-130	29-SEP-21
Chrysene			98.9		%		60-130	29-SEP-21
Dibenz(a,h)anthracene			87.5		%		60-130	29-SEP-21
Fluoranthene			92.2		%		60-130	29-SEP-21
Fluorene			100.9		%		60-130	29-SEP-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5604623								
WG3627661-7 IRM		**ALS PAH RM2**						
Indeno(1,2,3-c,d)pyrene			118.9		%		60-130	29-SEP-21
2-Methylnaphthalene			95.9		%		60-130	29-SEP-21
Naphthalene			92.0		%		50-130	29-SEP-21
Perylene			104.2		%		60-130	29-SEP-21
Phenanthrene			97.6		%		60-130	29-SEP-21
Pyrene			95.2		%		60-130	29-SEP-21
1-Methylnaphthalene			94.7		%		60-130	29-SEP-21
WG3627661-2 LCS								
Acenaphthene			104.6		%		60-130	29-SEP-21
Acenaphthylene			101.7		%		60-130	29-SEP-21
Anthracene			111.1		%		60-130	29-SEP-21
Acridine			120.0		%		60-130	29-SEP-21
Benz(a)anthracene			118.0		%		60-130	29-SEP-21
Benzo(a)pyrene			113.5		%		60-130	29-SEP-21
Benzo(b&j)fluoranthene			115.3		%		60-130	29-SEP-21
Benzo(e)pyrene			118.5		%		60-130	29-SEP-21
Benzo(g,h,i)perylene			103.0		%		60-130	29-SEP-21
Benzo(k)fluoranthene			108.5		%		60-130	29-SEP-21
Chrysene			110.9		%		60-130	29-SEP-21
Dibenz(a,h)anthracene			101.5		%		60-130	29-SEP-21
Fluoranthene			106.1		%		60-130	29-SEP-21
Fluorene			108.0		%		60-130	29-SEP-21
Indeno(1,2,3-c,d)pyrene			112.4		%		60-130	29-SEP-21
2-Methylnaphthalene			111.0		%		60-130	29-SEP-21
Naphthalene			104.6		%		50-130	29-SEP-21
Perylene			106.4		%		60-130	29-SEP-21
Phenanthrene			111.5		%		60-130	29-SEP-21
Pyrene			110.4		%		60-130	29-SEP-21
1-Methylnaphthalene			108.1		%		60-130	29-SEP-21
Quinoline			89.5		%		60-130	29-SEP-21
WG3627661-6 LCS								
Acenaphthene			100.5		%		60-130	29-SEP-21
Acenaphthylene			99.9		%		60-130	29-SEP-21
Anthracene			106.6		%		60-130	29-SEP-21
Acridine			104.5		%		60-130	29-SEP-21

Environmental

Quality Control Report

Workorder: L2641287 Report Date: 25-OCT-21

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5604623								
WG3627661-6 LCS								
Benz(a)anthracene			111.3		%		60-130	29-SEP-21
Benzo(a)pyrene			110.0		%		60-130	29-SEP-21
Benzo(b&j)fluoranthene			106.9		%		60-130	29-SEP-21
Benzo(e)pyrene			110.3		%		60-130	29-SEP-21
Benzo(g,h,i)perylene			98.4		%		60-130	29-SEP-21
Benzo(k)fluoranthene			103.1		%		60-130	29-SEP-21
Chrysene			103.7		%		60-130	29-SEP-21
Dibenz(a,h)anthracene			97.4		%		60-130	29-SEP-21
Fluoranthene			102.1		%		60-130	29-SEP-21
Fluorene			102.6		%		60-130	29-SEP-21
Indeno(1,2,3-c,d)pyrene			102.7		%		60-130	29-SEP-21
2-Methylnaphthalene			104.4		%		60-130	29-SEP-21
Naphthalene			101.2		%		50-130	29-SEP-21
Perylene			105.1		%		60-130	29-SEP-21
Phenanthrene			106.7		%		60-130	29-SEP-21
Pyrene			103.4		%		60-130	29-SEP-21
1-Methylnaphthalene			103.3		%		60-130	29-SEP-21
Quinoline			98.3		%		60-130	29-SEP-21
WG3627661-1 MB								
Acenaphthene			<0.0050		mg/kg		0.005	28-SEP-21
Acenaphthylene			<0.0050		mg/kg		0.005	28-SEP-21
Anthracene			<0.0040		mg/kg		0.004	28-SEP-21
Acridine			<0.010		mg/kg		0.01	28-SEP-21
Benz(a)anthracene			<0.010		mg/kg		0.01	28-SEP-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	28-SEP-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	28-SEP-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	28-SEP-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	28-SEP-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	28-SEP-21
Chrysene			<0.010		mg/kg		0.01	28-SEP-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	28-SEP-21
Fluoranthene			<0.010		mg/kg		0.01	28-SEP-21
Fluorene			<0.010		mg/kg		0.01	28-SEP-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	28-SEP-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5604623								
WG3627661-1 MB								
2-Methylnaphthalene			<0.010		mg/kg		0.01	28-SEP-21
Naphthalene			<0.010		mg/kg		0.01	28-SEP-21
Perylene			<0.010		mg/kg		0.01	28-SEP-21
Phenanthrene			<0.010		mg/kg		0.01	28-SEP-21
Pyrene			<0.010		mg/kg		0.01	28-SEP-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	28-SEP-21
Quinoline			<0.050		mg/kg		0.05	28-SEP-21
Surrogate: d8-Naphthalene			91.9		%		50-130	28-SEP-21
Surrogate: d10-Acenaphthene			100.4		%		60-130	28-SEP-21
Surrogate: d10-Phenanthrene			102.5		%		60-130	28-SEP-21
Surrogate: d12-Chrysene			107.9		%		60-130	28-SEP-21
WG3627661-4 MB								
Acenaphthene			<0.0050		mg/kg		0.005	29-SEP-21
Acenaphthylene			<0.0050		mg/kg		0.005	29-SEP-21
Anthracene			<0.0040		mg/kg		0.004	29-SEP-21
Acridine			<0.010		mg/kg		0.01	29-SEP-21
Benz(a)anthracene			<0.010		mg/kg		0.01	29-SEP-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	29-SEP-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	29-SEP-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	29-SEP-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	29-SEP-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	29-SEP-21
Chrysene			<0.010		mg/kg		0.01	29-SEP-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	29-SEP-21
Fluoranthene			<0.010		mg/kg		0.01	29-SEP-21
Fluorene			<0.010		mg/kg		0.01	29-SEP-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	29-SEP-21
2-Methylnaphthalene			<0.010		mg/kg		0.01	29-SEP-21
Naphthalene			<0.010		mg/kg		0.01	29-SEP-21
Perylene			<0.010		mg/kg		0.01	29-SEP-21
Phenanthrene			<0.010		mg/kg		0.01	29-SEP-21
Pyrene			<0.010		mg/kg		0.01	29-SEP-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	29-SEP-21
Quinoline			<0.050		mg/kg		0.05	29-SEP-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5604623								
WG3627661-4 MB								
Surrogate: d8-Naphthalene			90.9		%		50-130	29-SEP-21
Surrogate: d10-Acenaphthene			93.3		%		60-130	29-SEP-21
Surrogate: d10-Phenanthrene			100.0		%		60-130	29-SEP-21
Surrogate: d12-Chrysene			108.0		%		60-130	29-SEP-21
PH-1:2-CL	**Soil**							
Batch R5604712								
WG3627849-8 IRM		**SAL-STD11**						
pH (1:2 soil:water)			7.96		pH		7.7-8.3	29-SEP-21
WG3627849-7 LCS								
pH (1:2 soil:water)			7.00		pH		6.8-7.2	29-SEP-21
PSA-PIPET-DETAIL-SK	**Soil**							
Batch R5601876								
WG3622191-1 DUP		**L2641287-1**						
% Gravel (>2mm)		<1.0	1.8	RPD-NA	%	N/A	25	27-SEP-21
% Sand (2.00mm - 1.00mm)		2.5	2.6	J	%	0.1	5	27-SEP-21
% Sand (1.00mm - 0.50mm)		3.0	3.1	J	%	0.1	5	27-SEP-21
% Sand (0.50mm - 0.25mm)		3.3	3.4	J	%	0.1	5	27-SEP-21
% Sand (0.25mm - 0.125mm)		5.7	5.8	J	%	0.1	5	27-SEP-21
% Sand (0.125mm - 0.063mm)		8.1	8.8	J	%	0.7	5	27-SEP-21
% Silt (0.063mm - 0.0312mm)		26.8	27.5	J	%	0.7	5	27-SEP-21
% Silt (0.0312mm - 0.004mm)		37.4	36.6	J	%	0.8	5	27-SEP-21
% Clay (<4um)		12.3	10.5	J	%	1.8	5	27-SEP-21
WG3622191-2 IRM		**2020-PSA_SOIL**						
% Sand (2.00mm - 1.00mm)			2.6		%		0-7.2	27-SEP-21
% Sand (1.00mm - 0.50mm)			3.7		%		0-8.7	27-SEP-21
% Sand (0.50mm - 0.25mm)			8.1		%		4-14	27-SEP-21
% Sand (0.25mm - 0.125mm)			16.8		%		11.7-21.7	27-SEP-21
% Sand (0.125mm - 0.063mm)			13.9		%		8.4-18.4	27-SEP-21
% Silt (0.063mm - 0.0312mm)			12.0		%		8.5-18.5	27-SEP-21
% Silt (0.0312mm - 0.004mm)			22.7		%		15.1-25.1	27-SEP-21
% Clay (<4um)			20.1		%		16.5-26.5	27-SEP-21
Batch R5626402								
WG3639743-2 IRM		**2020-PSA_SOIL**						
% Sand (2.00mm - 1.00mm)			2.3		%		0-7.2	21-OCT-21
% Sand (1.00mm - 0.50mm)			4.1		%		0-8.7	21-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PSA-PIPET-DETAIL-SK	**Soil**							
Batch R5626402								
WG3639743-2 IRM		**2020-PSA_SOIL**						
% Sand (0.50mm - 0.25mm)			9.1		%		4-14	21-OCT-21
% Sand (0.25mm - 0.125mm)			16.2		%		11.7-21.7	21-OCT-21
% Sand (0.125mm - 0.063mm)			14.1		%		8.4-18.4	21-OCT-21
% Silt (0.063mm - 0.0312mm)			12.3		%		8.5-18.5	21-OCT-21
% Silt (0.0312mm - 0.004mm)			20.6		%		15.1-25.1	21-OCT-21
% Clay (<4um)			21.3		%		16.5-26.5	21-OCT-21

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Organic / Inorganic Carbon							
Inorganic Carbon as CaCO3 Equivalent							
	4	14-SEP-21 13:30	21-OCT-21 17:40	28	37	days	EHT
Total Inorganic Carbon in Soil							
	4	14-SEP-21 13:30	21-OCT-21 16:00	28	37	days	EHT

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.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2641287 were received on 16-SEP-21 10:40.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes 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 pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Teck

COC ID: September GGCAMP 2021

TURNAROUND TIME:

PROJECT/CLIENT INFO	
Facility Name / Job#	REP
Project Manager	Allie Ferguson
Email	allie.ferguson@teck.com
Address	421 Pine Avenue
City	Sparwood, Province BC
Postal Code	V0B 2G0, Country Canada
Phone Number	250-425-8202

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	1 403 407 1794

Excel | PDF | EDD

SAMPLE DETAILS

L2641287-COFC

ANALYSIS REQUESTED

Sample ID	Sample Location	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
								N / NONE	N / NONE	N / NONE	N / NONE	N / NONE	N / NONE
RG_GHBP_SE-1_2021-09-13_1600	RG_GHBP	SE	No	9/13/2021	1600	G	2	X	X	X	X	X	X
RG_GHBP_SE-2_2021-09-14_1015	RG_GHBP	SE	No	9/14/2021	1015	G	2	X	X	X	X	X	X
RG_GHBP_SE-3_2021-09-14_1200	RG_GHBP	SE	No	9/14/2021	1200	G	2	X	X	X	X	X	X
RG_GHBP_SE-4_2021-09-14_1330	RG_GHBP	SE	No	9/14/2021	1330	G	2	X	X	X	X	X	X
RG_GHBP_SE-5_2021-09-14_1430	RG_GHBP	SE	No	9/14/2021	1430	G	2	X	X	X	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

ALS PO 750546

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	
Jennifer Ings/Minnow	################		9/16/10:30

NB OF BOTTLES RETURNED/DESCRIPTION

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	Jennifer Ings	Mobile #	519-500-3444
Sampler's Signature		Date/Time	September 15, 2021

Teck Coal Ltd.
ATTN: Allie Ferguson
421 Pine Avenue
Sparwood BC V0B 2G0

Date Received: 24-SEP-21
Report Date: 23-NOV-21 17:13 (MT)
Version: FINAL REV. 2

Client Phone: 250-425-8202

Certificate of Analysis

Lab Work Order #: L2644215
Project P.O. #: VPO00750546
Job Reference: REGIONAL EFFECTS PROGRAM
C of C Numbers:
Legal Site Desc:

Comments: ADDITIONAL 13-OCT-21 06:47

23-NOV-2021 Additional analysis for METALS BY CCMS (TESSIER EXTRACTION.

Lyudmyla Shvets, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644215-1	L2644215-2	L2644215-3	L2644215-4	L2644215-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	22-SEP-21	22-SEP-21	21-SEP-21	21-SEP-21	23-SEP-21
	Sampled Time	09:00	10:00	11:15	10:00	10:00
	Client ID	RG_GHP_SE-1_2021-09-22_0900	RG_GHP_SE-6_2021-09-22_1000	RG_GHP_SE-3_2021-09-21_1115	RG_GHP_SE-4_2021-09-21_1000	RG_GHP_SE-5_2021-09-23_1000
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	60.5	59.6	57.8	61.7	61.1
	pH (1:2 soil:water) (pH)	8.02	8.13	8.21	8.31	8.07
Particle Size	% Gravel (>2mm) (%)	<1.0	<1.0	<1.0	<1.0	<1.0
	% Sand (2.00mm - 1.00mm) (%)	<1.0	<1.0	<1.0	<1.0	<1.0
	% Sand (1.00mm - 0.50mm) (%)	<1.0	<1.0	<1.0	<1.0	<1.0
	% Sand (0.50mm - 0.25mm) (%)	<1.0	<1.0	<1.0	<1.0	<1.0
	% Sand (0.25mm - 0.125mm) (%)	<1.0	<1.0	<1.0	1.1	<1.0
	% Sand (0.125mm - 0.063mm) (%)	1.2	1.1	<1.0	2.7	<1.0
	% Silt (0.063mm - 0.0312mm) (%)	19.0	15.5	14.7	15.1	4.7
	% Silt (0.0312mm - 0.004mm) (%)	53.5	49.1	56.0	51.7	52.7
	% Clay (<4um) (%)	25.0	33.6	28.1	28.9	42.1
	Texture	Silt loam	Silt loam / Silty clay loam	Silt loam	Silt loam	Silty clay loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	16.6	22.3	17.1	21.3	18.2
Metals	Aluminum (Al) (mg/kg)	7930	8520	8210	8620	11100
	Antimony (Sb) (mg/kg)	1.03	1.03	1.01	0.79	1.12
	Arsenic (As) (mg/kg)	5.70	5.77	5.93	5.01	6.51
	Barium (Ba) (mg/kg)	365	310	310	308	361
	Beryllium (Be) (mg/kg)	0.84	0.78	0.74	0.75	0.93
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	0.20
	Boron (B) (mg/kg)	<5.0	<5.0	<5.0	6.0	7.8
	Cadmium (Cd) (mg/kg)	1.48	1.44	1.39	1.15	1.54
	Calcium (Ca) (mg/kg)	54300	60900	43200	60500	53200
	Chromium (Cr) (mg/kg)	12.6	13.1	12.8	13.1	16.8
	Cobalt (Co) (mg/kg)	9.99	9.97	11.1	8.77	12.1
	Copper (Cu) (mg/kg)	24.9	26.1	25.6	22.4	30.5
	Iron (Fe) (mg/kg)	13700	13200	14500	12200	16400
	Lead (Pb) (mg/kg)	11.8	12.3	12.2	10.8	14.1
	Lithium (Li) (mg/kg)	9.1	8.0	8.9	8.3	10.6
	Magnesium (Mg) (mg/kg)	5390	4630	5020	4730	5150
	Manganese (Mn) (mg/kg)	195	567	673	308	688
	Mercury (Hg) (mg/kg)	0.103	0.108	0.130	0.0971	0.135
	Molybdenum (Mo) (mg/kg)	1.36	1.66	1.63	1.32	1.75
	Nickel (Ni) (mg/kg)	65.7	64.5	64.5	56.3	72.8
	Phosphorus (P) (mg/kg)	957	923	967	919	1020
	Potassium (K) (mg/kg)	1780	2070	1870	2150	2790
	Selenium (Se) (mg/kg)	46.4	8.70	8.38	13.8	16.0

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644215-6	L2644215-7			
	Description	SE	SE			
	Sampled Date	21-SEP-21	22-SEP-21			
	Sampled Time	11:15	10:00			
	Client ID	RG_RIVER_SE-1_2021-09-21_1115	RG_RIVER_SE-2_2021-09-22_1000			
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	57.3	60.4			
	pH (1:2 soil:water) (pH)	8.01	8.19			
Particle Size	% Gravel (>2mm) (%)	<1.0	<1.0			
	% Sand (2.00mm - 1.00mm) (%)	<1.0	<1.0			
	% Sand (1.00mm - 0.50mm) (%)	<1.0	<1.0			
	% Sand (0.50mm - 0.25mm) (%)	<1.0	<1.0			
	% Sand (0.25mm - 0.125mm) (%)	<1.0	<1.0			
	% Sand (0.125mm - 0.063mm) (%)	<1.0	1.3			
	% Silt (0.063mm - 0.0312mm) (%)	14.7	9.6			
	% Silt (0.0312mm - 0.004mm) (%)	55.8	48.3			
	% Clay (<4um) (%)	28.0	40.0			
	Texture	Silt loam	Silty clay loam			
Organic / Inorganic Carbon	Total Organic Carbon (%)	17.8	21.2			
Metals	Aluminum (Al) (mg/kg)	10200	9200			
	Antimony (Sb) (mg/kg)	1.08	1.05			
	Arsenic (As) (mg/kg)	6.22	5.84			
	Barium (Ba) (mg/kg)	343	316			
	Beryllium (Be) (mg/kg)	0.88	0.71			
	Bismuth (Bi) (mg/kg)	<0.20	<0.20			
	Boron (B) (mg/kg)	7.2	5.7			
	Cadmium (Cd) (mg/kg)	1.45	1.35			
	Calcium (Ca) (mg/kg)	44800	62700			
	Chromium (Cr) (mg/kg)	15.4	13.9			
	Cobalt (Co) (mg/kg)	11.7	10.1			
	Copper (Cu) (mg/kg)	27.2	26.6			
	Iron (Fe) (mg/kg)	15500	13600			
	Lead (Pb) (mg/kg)	12.8	12.5			
	Lithium (Li) (mg/kg)	10.4	8.7			
	Magnesium (Mg) (mg/kg)	5240	4750			
	Manganese (Mn) (mg/kg)	701	595			
	Mercury (Hg) (mg/kg)	0.120	0.118			
	Molybdenum (Mo) (mg/kg)	1.67	1.72			
	Nickel (Ni) (mg/kg)	67.9	67.8			
	Phosphorus (P) (mg/kg)	1030	924			
	Potassium (K) (mg/kg)	2440	2260			
	Selenium (Se) (mg/kg)	9.40	8.99			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L2644215-1	L2644215-2	L2644215-3	L2644215-4	L2644215-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	22-SEP-21	22-SEP-21	21-SEP-21	21-SEP-21	23-SEP-21
	Sampled Time	09:00	10:00	11:15	10:00	10:00
	Client ID	RG_GHP_SE-1_2021-09-22_0900	RG_GHP_SE-6_2021-09-22_1000	RG_GHP_SE-3_2021-09-21_1115	RG_GHP_SE-4_2021-09-21_1000	RG_GHP_SE-5_2021-09-23_1000
SOIL						
Metals	Silver (Ag) (mg/kg)	0.37	0.36	0.38	0.34	0.47
	Sodium (Na) (mg/kg)	73	71	77	82	83
	Strontium (Sr) (mg/kg)	59.0	62.3	54.3	62.1	67.7
	Sulfur (S) (mg/kg)	2400	1800	1600	2000	1700
	Thallium (Tl) (mg/kg)	0.139	0.092	0.125	0.111	0.122
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	5.0	7.3	6.8	6.9	10.2
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	1.76	1.09	1.13	1.14	1.22
	Vanadium (V) (mg/kg)	30.5	33.4	31.1	32.3	41.2
	Zinc (Zn) (mg/kg)	138	135	137	117	156
	Zirconium (Zr) (mg/kg)	1.1	<1.0	<1.0	<1.0	<1.0
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	DLCI <0.32	DLCI <0.67	DLCI <0.44	DLCI <0.53	DLCI <0.46
	Acenaphthylene (mg/kg)	0.426	0.0347	0.0166	DLCI <0.020	DLCI <0.030
	Acridine (mg/kg)	DLCI <0.59	DLCI <1.1	DLCI <0.80	DLCI <1.0	DLCI <0.82
	Anthracene (mg/kg)	<0.0040	0.0064	<0.0040	0.0074	<0.0040
	Benz(a)anthracene (mg/kg)	0.483	DLCI <0.76	DLCI <0.22	DLCI <0.27	DLCI <0.56
	Benzo(a)pyrene (mg/kg)	0.077	0.133	0.097	0.137	0.089
	Benzo(b&j)fluoranthene (mg/kg)	0.386	0.514	0.478	0.496	0.475
	Benzo(b+j+k)fluoranthene (mg/kg)	0.408	0.540	0.515	0.536	0.508
	Benzo(e)pyrene (mg/kg)	0.364	0.511	0.458	0.480	0.452
	Benzo(g,h,i)perylene (mg/kg)	0.101	0.142	0.120	DLCI <0.13	0.122
	Benzo(k)fluoranthene (mg/kg)	0.022	0.026	0.037	0.039	0.033
	Chrysene (mg/kg)	DLCI <0.62	DLCI <0.87	DLCI <0.72	DLCI <0.96	DLCI <0.59
	Dibenz(a,h)anthracene (mg/kg)	0.0655	DLCI <0.080	DLCI <0.080	0.0879	0.0818
	Fluoranthene (mg/kg)	DLCI <0.18	0.215	0.193	0.239	0.220
	Fluorene (mg/kg)	0.807	1.39	0.851	1.47	1.15
	Indeno(1,2,3-c,d)pyrene (mg/kg)	0.038	0.052	0.044	0.049	0.047
	1-Methylnaphthalene (mg/kg)	3.84	7.39	5.14	6.81	5.23
	2-Methylnaphthalene (mg/kg)	7.09	13.9	9.45	13.1	9.70
	Naphthalene (mg/kg)	2.18	4.68	2.92	4.61	3.02
	Perylene (mg/kg)	<0.010	<0.010	<0.010	<0.010	0.015
	Phenanthrene (mg/kg)	3.13	5.34	4.04	4.84	4.04
	Pyrene (mg/kg)	DLCI <0.35	0.493	0.432	0.459	0.437
	Quinoline (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Surrogate: d10-Acenaphthene (%)	76.4	95.8	92.6	88.0	86.0

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644215-6	L2644215-7			
	Description	SE	SE			
	Sampled Date	21-SEP-21	22-SEP-21			
	Sampled Time	11:15	10:00			
	Client ID	RG_RIVER_SE-1_2021-09-21_1115	RG_RIVER_SE-2_2021-09-22_1000			
Grouping	**Analyte**					
SOIL						
Metals	Silver (Ag) (mg/kg)	0.40	0.38			
	Sodium (Na) (mg/kg)	79	78			
	Strontium (Sr) (mg/kg)	57.6	67.4			
	Sulfur (S) (mg/kg)	1700	1900			
	Thallium (Tl) (mg/kg)	0.145	0.095			
	Tin (Sn) (mg/kg)	<2.0	<2.0			
	Titanium (Ti) (mg/kg)	10.3	8.4			
	Tungsten (W) (mg/kg)	<0.50	<0.50			
	Uranium (U) (mg/kg)	1.20	1.11			
	Vanadium (V) (mg/kg)	38.0	35.6			
	Zinc (Zn) (mg/kg)	139	137			
	Zirconium (Zr) (mg/kg)	<1.0	<1.0			
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	DLCI <0.39	DLCI <0.59			
	Acenaphthylene (mg/kg)	0.0084	0.0429			
	Acridine (mg/kg)	DLCI <0.72	DLCI <1.1			
	Anthracene (mg/kg)	0.0059	0.0041			
	Benz(a)anthracene (mg/kg)	DLCI <0.70	DLCI <0.29			
	Benzo(a)pyrene (mg/kg)	0.086	0.118			
	Benzo(b&j)fluoranthene (mg/kg)	0.462	0.502			
	Benzo(b+j+k)fluoranthene (mg/kg)	0.488	0.536			
	Benzo(e)pyrene (mg/kg)	0.432	0.518			
	Benzo(g,h,i)perylene (mg/kg)	0.115	0.133			
	Benzo(k)fluoranthene (mg/kg)	0.026	0.034			
	Chrysene (mg/kg)	DLCI <0.68	DLCI <0.92			
	Dibenz(a,h)anthracene (mg/kg)	0.0743	0.0901			
	Fluoranthene (mg/kg)	0.205	0.248			
	Fluorene (mg/kg)	0.976	1.58			
	Indeno(1,2,3-c,d)pyrene (mg/kg)	0.040	0.056			
	1-Methylnaphthalene (mg/kg)	4.76	7.23			
	2-Methylnaphthalene (mg/kg)	8.78	13.6			
	Naphthalene (mg/kg)	2.72	4.64			
	Perylene (mg/kg)	<0.010	<0.010			
	Phenanthrene (mg/kg)	3.73	5.13			
	Pyrene (mg/kg)	0.402	0.474			
	Quinoline (mg/kg)	<0.050	<0.050			
	Surrogate: d10-Acenaphthene (%)	92.2	91.4			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644215-1	L2644215-2	L2644215-3	L2644215-4	L2644215-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	22-SEP-21	22-SEP-21	21-SEP-21	21-SEP-21	23-SEP-21
	Sampled Time	09:00	10:00	11:15	10:00	10:00
	Client ID	RG_GHP_SE-1_2021-09-22_0900	RG_GHP_SE-6_2021-09-22_1000	RG_GHP_SE-3_2021-09-21_1115	RG_GHP_SE-4_2021-09-21_1000	RG_GHP_SE-5_2021-09-23_1000
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Surrogate: d12-Chrysene (%)	64.0	66.3	73.0	66.2	65.3
	Surrogate: d8-Naphthalene (%)	67.8	72.5	75.6	68.7	72.8
	Surrogate: d10-Phenanthrene (%)	70.2	72.6	78.1	72.3	71.5
	IACR:Coarse	0.143	0.162	0.139	0.157	0.153
	IACR:Fine	0.274	0.312	0.268	0.301	0.294
	B(a)P Total Potency Equivalent (mg/kg)	0.240	0.276	0.209	0.302	0.259
	IACR (CCME)	4.68	5.3	4.19	4.77	4.8
Exchangeable & Adsorbed Metals	Aluminum (Al)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Barium (Ba)-Leachable (mg/kg)	18.1	16.5	17.3	21.4	17.2
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.109	0.161	0.266	0.113	0.235
	Calcium (Ca)-Leachable (mg/kg)	3780	2990	3420	3170	3710
	Chromium (Cr)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Cobalt (Co)-Leachable (mg/kg)	0.42	0.12	0.11	0.37	0.19
	Copper (Cu)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Iron (Fe)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Lead (Pb)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	23.4	60.2	69.8	81.8	103
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	2.34	1.98	1.88	2.18	2.40
	Phosphorus (P)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Potassium (K)-Leachable (mg/kg)	<100	<100	<100	110	120
	Selenium (Se)-Leachable (mg/kg)	2.62	0.52	0.30	0.85	0.69
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Sodium (Na)-Leachable (mg/kg)	<100	<100	<100	<100	<100
	Strontium (Sr)-Leachable (mg/kg)	5.04	4.24	4.79	4.63	5.48
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Uranium (U)-Leachable (mg/kg)	0.271	0.087	0.074	0.107	0.114
	Vanadium (V)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Zinc (Zn)-Leachable (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644215-6	L2644215-7			
	Description	SE	SE			
	Sampled Date	21-SEP-21	22-SEP-21			
	Sampled Time	11:15	10:00			
	Client ID	RG_RIVER_SE-1_2021-09-21_1115	RG_RIVER_SE-2_2021-09-22_1000			
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Surrogate: d12-Chrysene (%)	73.3	64.3			
	Surrogate: d8-Naphthalene (%)	75.2	67.6			
	Surrogate: d10-Phenanthrene (%)	77.2	71.0			
	IACR:Coarse	0.151	0.153			
	IACR:Fine	0.289	0.294			
	B(a)P Total Potency Equivalent (mg/kg)	0.253	0.288			
	IACR (CCME)	4.9	4.76			
Exchangeable & Adsorbed Metals	Aluminum (Al)-Leachable (mg/kg)	<50	<50			
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10			
	Arsenic (As)-Leachable (mg/kg)	<0.050	<0.050			
	Barium (Ba)-Leachable (mg/kg)	17.8	16.1			
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20			
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20			
	Cadmium (Cd)-Leachable (mg/kg)	0.258	0.166			
	Calcium (Ca)-Leachable (mg/kg)	3780	3140			
	Chromium (Cr)-Leachable (mg/kg)	<0.50	<0.50			
	Cobalt (Co)-Leachable (mg/kg)	<0.10	<0.10			
	Copper (Cu)-Leachable (mg/kg)	<0.50	<0.50			
	Iron (Fe)-Leachable (mg/kg)	<50	<50			
	Lead (Pb)-Leachable (mg/kg)	<0.50	<0.50			
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0			
	Manganese (Mn)-Leachable (mg/kg)	7.3	50.4			
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50			
	Nickel (Ni)-Leachable (mg/kg)	1.40	2.22			
	Phosphorus (P)-Leachable (mg/kg)	<50	<50			
	Potassium (K)-Leachable (mg/kg)	<100	100			
	Selenium (Se)-Leachable (mg/kg)	0.41	0.47			
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10			
	Sodium (Na)-Leachable (mg/kg)	<100	<100			
	Strontium (Sr)-Leachable (mg/kg)	5.09	4.39			
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050			
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0			
	Titanium (Ti)-Leachable (mg/kg)	<1.0	<1.0			
	Uranium (U)-Leachable (mg/kg)	0.086	0.090			
	Vanadium (V)-Leachable (mg/kg)	<0.20	<0.20			
	Zinc (Zn)-Leachable (mg/kg)	<1.0	<1.0			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644215-1	L2644215-2	L2644215-3	L2644215-4	L2644215-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	22-SEP-21	22-SEP-21	21-SEP-21	21-SEP-21	23-SEP-21
	Sampled Time	09:00	10:00	11:15	10:00	10:00
	Client ID	RG_GHP_SE-1_2021-09-22_0900	RG_GHP_SE-6_2021-09-22_1000	RG_GHP_SE-3_2021-09-21_1115	RG_GHP_SE-4_2021-09-21_1000	RG_GHP_SE-5_2021-09-23_1000
Grouping	**Analyte**					
SOIL						
Carbonate Metals	Aluminum (Al)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	0.100	<0.050	0.056	0.096	<0.050
	Barium (Ba)-Leachable (mg/kg)	55.0	52.9	47.9	51.9	50.0
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.559	0.537	0.501	0.481	0.588
	Calcium (Ca)-Leachable (mg/kg)	41400	49400	32000	45600	39900
	Chromium (Cr)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Cobalt (Co)-Leachable (mg/kg)	1.44	0.40	0.36	1.11	0.56
	Copper (Cu)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Iron (Fe)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Lead (Pb)-Leachable (mg/kg)	1.05	<0.50	<0.50	0.85	0.51
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	55.6	109	126	91.5	153
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	11.8	11.2	9.4	10.4	11.4
	Phosphorus (P)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Selenium (Se)-Leachable (mg/kg)	0.82	0.21	<0.20	<0.20	<0.20
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Strontium (Sr)-Leachable (mg/kg)	18.9	20.2	14.4	18.6	19.1
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Uranium (U)-Leachable (mg/kg)	0.516	0.261	0.203	0.327	0.225
	Vanadium (V)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Zinc (Zn)-Leachable (mg/kg)	24.9	15.6	16.2	15.3	16.4
Easily Reducible Metals and Iron Oxides	Aluminum (Al)-Leachable (mg/kg)	631	665	638	592	642
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	0.816	0.473	0.487	0.622	0.468
	Barium (Ba)-Leachable (mg/kg)	49.6	45.2	47.7	37.2	48.3
	Beryllium (Be)-Leachable (mg/kg)	0.33	0.37	0.35	0.33	0.37
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.626	0.435	0.441	0.416	0.471
	Calcium (Ca)-Leachable (mg/kg)	7850	6290	6440	8810	5990
	Chromium (Cr)-Leachable (mg/kg)	0.99	1.08	0.98	0.92	1.01

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644215-6	L2644215-7			
	Description	SE	SE			
	Sampled Date	21-SEP-21	22-SEP-21			
	Sampled Time	11:15	10:00			
	Client ID	RG_RIVER_SE-1_2021-09-21_1115	RG_RIVER_SE-2_2021-09-22_1000			
Grouping	**Analyte**					
SOIL						
Carbonate Metals	Aluminum (Al)-Leachable (mg/kg)	<50	<50			
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10			
	Arsenic (As)-Leachable (mg/kg)	<0.050	<0.050			
	Barium (Ba)-Leachable (mg/kg)	47.9	46.4			
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20			
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20			
	Cadmium (Cd)-Leachable (mg/kg)	0.543	0.507			
	Calcium (Ca)-Leachable (mg/kg)	32800	45000			
	Chromium (Cr)-Leachable (mg/kg)	<5.0	<5.0			
	Cobalt (Co)-Leachable (mg/kg)	0.13	0.31			
	Copper (Cu)-Leachable (mg/kg)	<0.50	<0.50			
	Iron (Fe)-Leachable (mg/kg)	<50	<50			
	Lead (Pb)-Leachable (mg/kg)	<0.50	<0.50			
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0			
	Manganese (Mn)-Leachable (mg/kg)	90.4	91.3			
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50			
	Nickel (Ni)-Leachable (mg/kg)	8.0	9.7			
	Phosphorus (P)-Leachable (mg/kg)	<50	<50			
	Selenium (Se)-Leachable (mg/kg)	<0.20	<0.20			
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10			
	Strontium (Sr)-Leachable (mg/kg)	15.2	18.3			
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050			
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0			
	Titanium (Ti)-Leachable (mg/kg)	<5.0	<5.0			
	Uranium (U)-Leachable (mg/kg)	0.204	0.238			
	Vanadium (V)-Leachable (mg/kg)	<0.20	<0.20			
	Zinc (Zn)-Leachable (mg/kg)	16.4	13.4			
Easily Reducible Metals and Iron Oxides	Aluminum (Al)-Leachable (mg/kg)	621	607			
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10			
	Arsenic (As)-Leachable (mg/kg)	0.486	0.404			
	Barium (Ba)-Leachable (mg/kg)	48.2	39.6			
	Beryllium (Be)-Leachable (mg/kg)	0.36	0.35			
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20			
	Cadmium (Cd)-Leachable (mg/kg)	0.474	0.452			
	Calcium (Ca)-Leachable (mg/kg)	6520	7740			
	Chromium (Cr)-Leachable (mg/kg)	0.95	1.00			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644215-1	L2644215-2	L2644215-3	L2644215-4	L2644215-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	22-SEP-21	22-SEP-21	21-SEP-21	21-SEP-21	23-SEP-21
	Sampled Time	09:00	10:00	11:15	10:00	10:00
	Client ID	RG_GHP_SE-1_2021-09-22_0900	RG_GHP_SE-6_2021-09-22_1000	RG_GHP_SE-3_2021-09-21_1115	RG_GHP_SE-4_2021-09-21_1000	RG_GHP_SE-5_2021-09-23_1000
Grouping	**Analyte**					
SOIL						
Easily Reducible Metals and Iron Oxides	Cobalt (Co)-Leachable (mg/kg)	4.09	5.34	6.55	3.81	6.04
	Copper (Cu)-Leachable (mg/kg)	0.57	0.60	0.57	<0.50	0.71
	Iron (Fe)-Leachable (mg/kg)	3680	3560	3400	3160	3520
	Lead (Pb)-Leachable (mg/kg)	3.36	3.97	3.47	3.49	3.90
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	59.8	319	410	88.1	351
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	30.6	31.2	31.1	27.9	33.8
	Phosphorus (P)-Leachable (mg/kg)	111	125	159	143	134
	Selenium (Se)-Leachable (mg/kg)	2.81	0.86	0.83	0.99	1.16
	Silver (Ag)-Leachable (mg/kg)	<0.10	0.12	0.15	<0.10	0.13
	Strontium (Sr)-Leachable (mg/kg)	8.34	7.29	6.78	8.56	6.67
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Uranium (U)-Leachable (mg/kg)	0.320	0.179	0.228	0.192	0.197
	Vanadium (V)-Leachable (mg/kg)	3.59	3.84	3.27	3.19	3.57
	Zinc (Zn)-Leachable (mg/kg)	51.1	49.3	48.6	42.0	53.5
Organic Bound Metals	Aluminum (Al)-Leachable (mg/kg)	1670	1430	1750	1440	1770
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	0.480	0.382	0.453	0.379	0.410
	Barium (Ba)-Leachable (mg/kg)	26.6	32.2	25.1	25.8	29.8
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.108	0.088	0.100	0.094	0.102
	Calcium (Ca)-Leachable (mg/kg)	1500	1040	1400	1360	1410
	Chromium (Cr)-Leachable (mg/kg)	4.16	3.15	4.07	3.40	3.96
	Cobalt (Co)-Leachable (mg/kg)	1.15	0.81	1.20	0.83	1.15
	Copper (Cu)-Leachable (mg/kg)	10.5	7.78	9.76	8.21	10.6
	Iron (Fe)-Leachable (mg/kg)	1780	1210	1660	1380	1540
	Lead (Pb)-Leachable (mg/kg)	1.51	1.52	1.59	1.33	1.63
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	8.2	18.2	26.6	9.1	26.3
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	12.2	8.45	11.9	9.70	11.5
	Selenium (Se)-Leachable (mg/kg)	34.4	6.91	7.14	10.6	12.3

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644215-6	L2644215-7			
	Description	SE	SE			
	Sampled Date	21-SEP-21	22-SEP-21			
	Sampled Time	11:15	10:00			
	Client ID	RG_RIVER_SE-1_2021-09-21_1115	RG_RIVER_SE-2_2021-09-22_1000			
Grouping	**Analyte**					
SOIL						
Easily Reducible Metals and Iron Oxides	Cobalt (Co)-Leachable (mg/kg)	6.72	5.52			
	Copper (Cu)-Leachable (mg/kg)	0.55	0.63			
	Iron (Fe)-Leachable (mg/kg)	3370	3390			
	Lead (Pb)-Leachable (mg/kg)	3.65	4.12			
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0			
	Manganese (Mn)-Leachable (mg/kg)	515	349			
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50			
	Nickel (Ni)-Leachable (mg/kg)	33.4	31.9			
	Phosphorus (P)-Leachable (mg/kg)	135	103			
	Selenium (Se)-Leachable (mg/kg)	0.81	0.77			
	Silver (Ag)-Leachable (mg/kg)	0.14	0.11			
	Strontium (Sr)-Leachable (mg/kg)	7.06	7.05			
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050			
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0			
	Titanium (Ti)-Leachable (mg/kg)	<1.0	<1.0			
	Uranium (U)-Leachable (mg/kg)	0.239	0.172			
	Vanadium (V)-Leachable (mg/kg)	3.24	3.65			
	Zinc (Zn)-Leachable (mg/kg)	48.5	50.3			
Organic Bound Metals	Aluminum (Al)-Leachable (mg/kg)	1790	1430			
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10			
	Arsenic (As)-Leachable (mg/kg)	0.456	0.388			
	Barium (Ba)-Leachable (mg/kg)	26.9	31.3			
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20			
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20			
	Cadmium (Cd)-Leachable (mg/kg)	0.099	0.091			
	Calcium (Ca)-Leachable (mg/kg)	1430	1290			
	Chromium (Cr)-Leachable (mg/kg)	4.20	3.48			
	Cobalt (Co)-Leachable (mg/kg)	1.30	0.83			
	Copper (Cu)-Leachable (mg/kg)	9.75	7.84			
	Iron (Fe)-Leachable (mg/kg)	1710	1320			
	Lead (Pb)-Leachable (mg/kg)	1.55	1.42			
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0			
	Manganese (Mn)-Leachable (mg/kg)	32.0	20.3			
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50			
	Nickel (Ni)-Leachable (mg/kg)	12.5	9.00			
	Selenium (Se)-Leachable (mg/kg)	7.34	6.89			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L2644215-1	L2644215-2	L2644215-3	L2644215-4	L2644215-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	22-SEP-21	22-SEP-21	21-SEP-21	21-SEP-21	23-SEP-21
	Sampled Time	09:00	10:00	11:15	10:00	10:00
	Client ID	RG_GHP_SE-1_2021-09-22_0900	RG_GHP_SE-6_2021-09-22_1000	RG_GHP_SE-3_2021-09-21_1115	RG_GHP_SE-4_2021-09-21_1000	RG_GHP_SE-5_2021-09-23_1000
SOIL						
Organic Bound Metals	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Strontium (Sr)-Leachable (mg/kg)	5.33	3.64	4.86	4.37	4.71
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	14.6	8.7	10.9	13.9	<1.0
	Uranium (U)-Leachable (mg/kg)	0.426	0.270	0.379	0.285	0.357
	Vanadium (V)-Leachable (mg/kg)	5.66	5.13	5.68	5.30	5.78
	Zinc (Zn)-Leachable (mg/kg)	9.7	8.6	10.6	8.7	11.4
Residual Metals	Aluminum (Al)-Leachable (mg/kg)	6100	5810	7020	5900	7610
	Antimony (Sb)-Leachable (mg/kg)	0.88	0.92	1.04	0.85	1.11
	Arsenic (As)-Leachable (mg/kg)	3.86	4.53	5.28	4.20	5.61
	Barium (Ba)-Leachable (mg/kg)	190	119	163	144	166
	Beryllium (Be)-Leachable (mg/kg)	0.34	0.36	0.38	0.35	0.42
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.074	0.090	0.109	0.082	0.103
	Calcium (Ca)-Leachable (mg/kg)	115	80	109	99	110
	Chromium (Cr)-Leachable (mg/kg)	9.6	9.4	11.2	9.4	12.0
	Cobalt (Co)-Leachable (mg/kg)	2.83	3.19	3.49	3.05	3.72
	Copper (Cu)-Leachable (mg/kg)	15.5	19.6	19.2	17.2	22.0
	Iron (Fe)-Leachable (mg/kg)	9080	9580	11600	9620	12000
	Lead (Pb)-Leachable (mg/kg)	7.58	7.96	9.30	7.31	9.79
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	5.3	<5.0	5.3
	Manganese (Mn)-Leachable (mg/kg)	36.6	43.5	48.0	41.6	51.2
	Molybdenum (Mo)-Leachable (mg/kg)	0.91	1.11	1.29	1.01	1.51
	Nickel (Ni)-Leachable (mg/kg)	11.5	13.0	14.6	12.3	15.8
	Selenium (Se)-Leachable (mg/kg)	10.2	1.84	2.05	3.65	3.54
	Silver (Ag)-Leachable (mg/kg)	0.32	0.23	0.24	0.28	0.31
	Strontium (Sr)-Leachable (mg/kg)	19.3	20.7	21.3	20.2	23.4
	Thallium (Tl)-Leachable (mg/kg)	0.154	0.099	0.166	0.109	0.144
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	13.2	8.7	17.0	13.1	12.4
	Uranium (U)-Leachable (mg/kg)	0.325	0.325	0.366	0.310	0.404
	Vanadium (V)-Leachable (mg/kg)	25.3	25.3	29.6	25.4	31.4
	Zinc (Zn)-Leachable (mg/kg)	62.2	71.0	80.7	69.4	85.2

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644215-6	L2644215-7			
	Description	SE	SE			
	Sampled Date	21-SEP-21	22-SEP-21			
	Sampled Time	11:15	10:00			
	Client ID	RG_RIVER_SE-1_2021-09-21_1115	RG_RIVER_SE-2_2021-09-22_1000			
Grouping	**Analyte**					
SOIL						
Organic Bound Metals	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10			
	Strontium (Sr)-Leachable (mg/kg)	4.91	4.15			
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050			
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0			
	Titanium (Ti)-Leachable (mg/kg)	1.1	4.8			
	Uranium (U)-Leachable (mg/kg)	0.386	0.277			
	Vanadium (V)-Leachable (mg/kg)	5.65	5.34			
	Zinc (Zn)-Leachable (mg/kg)	11.3	81.9			
Residual Metals	Aluminum (Al)-Leachable (mg/kg)	6450	6120			
	Antimony (Sb)-Leachable (mg/kg)	1.05	1.00			
	Arsenic (As)-Leachable (mg/kg)	5.02	4.68			
	Barium (Ba)-Leachable (mg/kg)	151	128			
	Beryllium (Be)-Leachable (mg/kg)	0.38	0.33			
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20			
	Cadmium (Cd)-Leachable (mg/kg)	0.108	0.080			
	Calcium (Ca)-Leachable (mg/kg)	103	80			
	Chromium (Cr)-Leachable (mg/kg)	10.4	9.6			
	Cobalt (Co)-Leachable (mg/kg)	3.37	3.18			
	Copper (Cu)-Leachable (mg/kg)	18.3	19.4			
	Iron (Fe)-Leachable (mg/kg)	11300	9800			
	Lead (Pb)-Leachable (mg/kg)	9.13	7.96			
	Lithium (Li)-Leachable (mg/kg)	5.0	<5.0			
	Manganese (Mn)-Leachable (mg/kg)	45.0	42.9			
	Molybdenum (Mo)-Leachable (mg/kg)	1.33	1.18			
	Nickel (Ni)-Leachable (mg/kg)	14.2	12.6			
	Selenium (Se)-Leachable (mg/kg)	2.15	1.76			
	Silver (Ag)-Leachable (mg/kg)	0.25	0.23			
	Strontium (Sr)-Leachable (mg/kg)	20.1	21.3			
	Thallium (Tl)-Leachable (mg/kg)	0.155	0.128			
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0			
	Titanium (Ti)-Leachable (mg/kg)	13.5	13.2			
	Uranium (U)-Leachable (mg/kg)	0.350	0.322			
	Vanadium (V)-Leachable (mg/kg)	27.5	26.3			
	Zinc (Zn)-Leachable (mg/kg)	77.2	72.5			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLCI	Detection Limit Raised: Chromatographic Interference due to co-elution.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
C-TIC-PCT-SK	Soil	Total Inorganic Carbon in Soil	CSSS (2008) P216-217

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.

C-TOC-CALC-SK	Soil	Total Organic Carbon Calculation	CSSS (2008) 21.2

Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon. (TIC)

C-TOT-LECO-SK	Soil	Total Carbon by combustion method	CSSS (2008) 21.2

The sample is ignited in a combustion analyzer where carbon in the reduced CO2 gas is determined using a thermal conductivity detector.

HG-200.2-CVAA-CL	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

IC-CACO3-CALC-SK	Soil	Inorganic Carbon as CaCO3 Equivalent	Calculation
MET-200.2-CCMS-CL	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

MET-TESS-CM-CCMS-VA	Soil	METALS BY CCMS (TESSIER EXTRACTION #2)	Tessier Extraction 1979/EPA 6020A

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 inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Note: For Extraction #2, the extraction solution is 1M Sodium Acetate adjusted to pH 5 and is intended to extract the "Carbonate" metals.

MET-TESS-EA-CCMS-VA	Soil	METALS BY CCMS (TESSIER EXTRACTION #1)	Tessier Extraction 1979/EPA 6020A

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 inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Note: For Extraction #1, the extraction solution is 1M Magnesium Chloride and is intended to extract the "Exchangeable and Adsorbed" metals.

MET-TESS-FEO-CCMS-VA	Soil	METALS BY CCMS (TESSIER EXTRACTION #3)	Tessier Extraction 1979/EPA 6020A

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 inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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 .

MET-TESS-OB-CCMS-VA	Soil	METALS BY CCMS (TESSIER EXTRACTION #4)	Tessier Extraction 1979/EPA 6020A

"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 inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Reference Information

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.

MET-TESS-RM-CCMS-VA	Soil	METALS BY CCMS (TESSIER RM EXTRACTION)	Tessier Extraction 1979/EPA 6020A

"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 collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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.

MOISTURE-CL	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)

This analysis is carried out gravimetrically by drying the sample at 105 C

PAH-TMB-H/A-MS-CL	Soil	PAH Tumbler Extraction (Hexane/Acetone)	EPA 3570/8270-GC/MS

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Methods 3545 & 8270, published by the United States Environmental Protection Agency (EPA). The procedure uses a mechanical shaking technique to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone. The extract is then solvent exchanged to toluene. The final extract is analysed by capillary column gas chromatography with mass spectrometric detection (GC/MS). Surrogate recoveries may not be reported in cases where interferences from the sample matrix prevent accurate quantitation. Because the two isomers cannot be readily chromatographically separated, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.

PH-1:2-CL	Soil	pH in soil (1:2 Soil:Water Extraction)	CSSS Ch. 16

Soil and de-ionized water (by volume) are mixed in a defined ratio. The slurry is allowed to stand, shaken, and then allowed to stand again prior to taking measurements. After equilibration, the pH of the liquid portion of the extract is measured by a pH meter. Field Measurement is recommended where accurate pH measurements are required, due to the 15 minute recommended hold time.

PSA-PIPET-DETAIL-SK	Soil	Particle size - Sieve and Pipette	SSIR-51 METHOD 3.2.1

Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour 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.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: Teck Coal Ltd.
421 Pine Avenue
Sparwood BC V0B 2G0

Contact: Allie Ferguson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-TIC-PCT-SK	**Soil**							
Batch R5612136								
WG3630724-1 DUP		**L2644215-4**						
Inorganic Carbon		1.79	1.78		%	0.7	20	06-OCT-21
WG3630724-4 IRM		**08-109_SOIL**						
Inorganic Carbon			94.1		%		80-120	06-OCT-21
WG3630724-2 LCS		**0.5**						
Inorganic Carbon			94.5		%		90-110	06-OCT-21
WG3630724-3 MB								
Inorganic Carbon			<0.050		%		0.05	06-OCT-21
C-TOT-LECO-SK	**Soil**							
Batch R5610919								
WG3628019-1 DUP		**L2644215-4**						
Total Carbon by Combustion		23.1	23.7		%	2.8	20	05-OCT-21
WG3628019-2 IRM		**08-109_SOIL**						
Total Carbon by Combustion			102.4		%		80-120	05-OCT-21
WG3628019-4 LCS		**SULFADIAZINE**						
Total Carbon by Combustion			99.8		%		90-110	05-OCT-21
WG3628019-3 MB								
Total Carbon by Combustion			<0.05		%		0.05	05-OCT-21
HG-200.2-CVAA-CL	**Soil**							
Batch R5611541								
WG3632545-4 CRM		**TILL-2**						
Mercury (Hg)			110.1		%		70-130	06-OCT-21
WG3632545-2 LCS								
Mercury (Hg)			101.0		%		80-120	06-OCT-21
WG3632545-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	06-OCT-21
MET-200.2-CCMS-CL	**Soil**							
Batch R5612016								
WG3632545-4 CRM		**TILL-2**						
Aluminum (Al)			97.7		%		70-130	06-OCT-21
Antimony (Sb)			102.1		%		70-130	06-OCT-21
Arsenic (As)			104.6		%		70-130	06-OCT-21
Barium (Ba)			113.8		%		70-130	06-OCT-21
Beryllium (Be)			90.9		%		70-130	06-OCT-21
Bismuth (Bi)			95.2		%		70-130	06-OCT-21
Cadmium (Cd)			105.2		%		70-130	06-OCT-21
Calcium (Ca)			99.4		%		70-130	06-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-CL	**Soil**							
Batch R5612016								
WG3632545-4 CRM		**TILL-2**						
Chromium (Cr)			100.6		%		70-130	06-OCT-21
Cobalt (Co)			104.0		%		70-130	06-OCT-21
Copper (Cu)			102.4		%		70-130	06-OCT-21
Iron (Fe)			100.7		%		70-130	06-OCT-21
Lead (Pb)			101.4		%		70-130	06-OCT-21
Lithium (Li)			100.4		%		70-130	06-OCT-21
Magnesium (Mg)			103.0		%		70-130	06-OCT-21
Manganese (Mn)			106.1		%		70-130	06-OCT-21
Molybdenum (Mo)			92.8		%		70-130	06-OCT-21
Nickel (Ni)			102.4		%		70-130	06-OCT-21
Phosphorus (P)			97.3		%		70-130	06-OCT-21
Potassium (K)			93.3		%		70-130	06-OCT-21
Selenium (Se)			0.41		mg/kg		0.15-0.55	06-OCT-21
Silver (Ag)			0.25		mg/kg		0.16-0.36	06-OCT-21
Sodium (Na)			90.9		%		70-130	06-OCT-21
Strontium (Sr)			99.8		%		70-130	06-OCT-21
Thallium (Tl)			109.0		%		70-130	06-OCT-21
Tin (Sn)			2.2		mg/kg		0.2-4.2	06-OCT-21
Titanium (Ti)			92.8		%		70-130	06-OCT-21
Tungsten (W)			1.47		mg/kg		1-2	06-OCT-21
Uranium (U)			93.0		%		70-130	06-OCT-21
Vanadium (V)			101.3		%		70-130	06-OCT-21
Zinc (Zn)			95.2		%		70-130	06-OCT-21
Zirconium (Zr)			91.6		%		70-130	06-OCT-21
WG3632545-2 LCS								
Aluminum (Al)			105.8		%		80-120	06-OCT-21
Antimony (Sb)			102.3		%		80-120	06-OCT-21
Arsenic (As)			106.0		%		80-120	06-OCT-21
Barium (Ba)			109.6		%		80-120	06-OCT-21
Beryllium (Be)			99.6		%		80-120	06-OCT-21
Bismuth (Bi)			100.5		%		80-120	06-OCT-21
Boron (B)			101.1		%		80-120	06-OCT-21
Cadmium (Cd)			102.1		%		80-120	06-OCT-21
Calcium (Ca)			104.9		%		80-120	06-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-CL	**Soil**							
Batch R5612016								
WG3632545-2 LCS								
Chromium (Cr)			104.2		%		80-120	06-OCT-21
Cobalt (Co)			104.4		%		80-120	06-OCT-21
Copper (Cu)			101.1		%		80-120	06-OCT-21
Iron (Fe)			109.1		%		80-120	06-OCT-21
Lead (Pb)			102.1		%		80-120	06-OCT-21
Lithium (Li)			107.0		%		80-120	06-OCT-21
Magnesium (Mg)			106.3		%		80-120	06-OCT-21
Manganese (Mn)			106.8		%		80-120	06-OCT-21
Molybdenum (Mo)			100.2		%		80-120	06-OCT-21
Nickel (Ni)			104.8		%		80-120	06-OCT-21
Phosphorus (P)			107.4		%		80-120	06-OCT-21
Potassium (K)			104.5		%		80-120	06-OCT-21
Selenium (Se)			109.3		%		80-120	06-OCT-21
Silver (Ag)			100.2		%		80-120	06-OCT-21
Sodium (Na)			105.3		%		80-120	06-OCT-21
Strontium (Sr)			105.0		%		80-120	06-OCT-21
Sulfur (S)			116.8		%		80-120	06-OCT-21
Thallium (Tl)			100.2		%		80-120	06-OCT-21
Tin (Sn)			102.3		%		80-120	06-OCT-21
Titanium (Ti)			101.1		%		80-120	06-OCT-21
Tungsten (W)			104.2		%		80-120	06-OCT-21
Uranium (U)			94.9		%		80-120	06-OCT-21
Vanadium (V)			106.8		%		80-120	06-OCT-21
Zinc (Zn)			96.1		%		80-120	06-OCT-21
Zirconium (Zr)			96.3		%		80-120	06-OCT-21
WG3632545-1 MB								
Aluminum (Al)			<50		mg/kg		50	06-OCT-21
Antimony (Sb)			<0.10		mg/kg		0.1	06-OCT-21
Arsenic (As)			<0.10		mg/kg		0.1	06-OCT-21
Barium (Ba)			<0.50		mg/kg		0.5	06-OCT-21
Beryllium (Be)			<0.10		mg/kg		0.1	06-OCT-21
Bismuth (Bi)			<0.20		mg/kg		0.2	06-OCT-21
Boron (B)			<5.0		mg/kg		5	06-OCT-21
Cadmium (Cd)			<0.020		mg/kg		0.02	06-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-CL	**Soil**							
Batch R5612016								
WG3632545-1 MB								
Calcium (Ca)			<50		mg/kg		50	06-OCT-21
Chromium (Cr)			<0.50		mg/kg		0.5	06-OCT-21
Cobalt (Co)			<0.10		mg/kg		0.1	06-OCT-21
Copper (Cu)			<0.50		mg/kg		0.5	06-OCT-21
Iron (Fe)			<50		mg/kg		50	06-OCT-21
Lead (Pb)			<0.50		mg/kg		0.5	06-OCT-21
Lithium (Li)			<2.0		mg/kg		2	06-OCT-21
Magnesium (Mg)			<20		mg/kg		20	06-OCT-21
Manganese (Mn)			<1.0		mg/kg		1	06-OCT-21
Molybdenum (Mo)			<0.10		mg/kg		0.1	06-OCT-21
Nickel (Ni)			<0.50		mg/kg		0.5	06-OCT-21
Phosphorus (P)			<50		mg/kg		50	06-OCT-21
Potassium (K)			<100		mg/kg		100	06-OCT-21
Selenium (Se)			<0.20		mg/kg		0.2	06-OCT-21
Silver (Ag)			<0.10		mg/kg		0.1	06-OCT-21
Sodium (Na)			<50		mg/kg		50	06-OCT-21
Strontium (Sr)			<0.50		mg/kg		0.5	06-OCT-21
Sulfur (S)			<1000		mg/kg		1000	06-OCT-21
Thallium (Tl)			<0.050		mg/kg		0.05	06-OCT-21
Tin (Sn)			<2.0		mg/kg		2	06-OCT-21
Titanium (Ti)			<1.0		mg/kg		1	06-OCT-21
Tungsten (W)			<0.50		mg/kg		0.5	06-OCT-21
Uranium (U)			<0.050		mg/kg		0.05	06-OCT-21
Vanadium (V)			<0.20		mg/kg		0.2	06-OCT-21
Zinc (Zn)			<2.0		mg/kg		2	06-OCT-21
Zirconium (Zr)			<1.0		mg/kg		1	06-OCT-21
MET-TESS-CM-CCMS-VA	**Soil**							
Batch R5644964								
WG3645358-3 DUP		**L2644215-3**						
Aluminum (Al)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	12-NOV-21
Antimony (Sb)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	12-NOV-21
Arsenic (As)-Leachable		0.056	<0.050	RPD-NA	mg/kg	N/A	30	12-NOV-21
Barium (Ba)-Leachable		47.9	46.5		mg/kg	3.1	30	12-NOV-21
Beryllium (Be)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	12-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-CM-CCMS-VA	**Soil**							
Batch R5644964								
WG3645358-3 DUP		**L2644215-3**						
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	12-NOV-21
Cadmium (Cd)-Leachable		0.501	0.502		mg/kg	0.2	30	12-NOV-21
Calcium (Ca)-Leachable		32000	32400		mg/kg	1.2	30	12-NOV-21
Chromium (Cr)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	12-NOV-21
Cobalt (Co)-Leachable		0.36	0.34		mg/kg	5.3	30	12-NOV-21
Copper (Cu)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	12-NOV-21
Iron (Fe)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	12-NOV-21
Lead (Pb)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	12-NOV-21
Lithium (Li)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	12-NOV-21
Manganese (Mn)-Leachable		126	124		mg/kg	1.7	30	12-NOV-21
Molybdenum (Mo)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	12-NOV-21
Nickel (Ni)-Leachable		9.4	9.3		mg/kg	1.7	30	12-NOV-21
Phosphorus (P)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	12-NOV-21
Selenium (Se)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	12-NOV-21
Silver (Ag)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	12-NOV-21
Strontium (Sr)-Leachable		14.4	15.3		mg/kg	5.6	30	12-NOV-21
Thallium (Tl)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	12-NOV-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	12-NOV-21
Titanium (Ti)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	12-NOV-21
Uranium (U)-Leachable		0.203	0.199		mg/kg	2.1	30	12-NOV-21
Vanadium (V)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	12-NOV-21
Zinc (Zn)-Leachable		16.2	15.5		mg/kg	4.3	30	12-NOV-21
WG3645358-2 LCS								
Aluminum (Al)-Leachable			102.3		%		70-130	12-NOV-21
Antimony (Sb)-Leachable			105.3		%		70-130	12-NOV-21
Arsenic (As)-Leachable			99.1		%		70-130	12-NOV-21
Barium (Ba)-Leachable			98.0		%		70-130	12-NOV-21
Beryllium (Be)-Leachable			99.2		%		70-130	12-NOV-21
Bismuth (Bi)-Leachable			88.6		%		70-130	12-NOV-21
Cadmium (Cd)-Leachable			97.7		%		70-130	12-NOV-21
Calcium (Ca)-Leachable			99.7		%		70-130	12-NOV-21
Chromium (Cr)-Leachable			97.7		%		70-130	12-NOV-21
Cobalt (Co)-Leachable			97.4		%		70-130	12-NOV-21
Copper (Cu)-Leachable			94.4		%		70-130	12-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-CM-CCMS-VA	**Soil**							
Batch R5644964								
WG3645358-2 LCS								
Iron (Fe)-Leachable			96.2		%		70-130	12-NOV-21
Lead (Pb)-Leachable			94.8		%		70-130	12-NOV-21
Lithium (Li)-Leachable			98.6		%		70-130	12-NOV-21
Manganese (Mn)-Leachable			96.2		%		70-130	12-NOV-21
Molybdenum (Mo)-Leachable			101.8		%		70-130	12-NOV-21
Nickel (Ni)-Leachable			96.2		%		70-130	12-NOV-21
Phosphorus (P)-Leachable			105.0		%		70-130	12-NOV-21
Selenium (Se)-Leachable			99.6		%		70-130	12-NOV-21
Silver (Ag)-Leachable			94.7		%		70-130	12-NOV-21
Strontium (Sr)-Leachable			97.6		%		70-130	12-NOV-21
Thallium (Tl)-Leachable			90.5		%		70-130	12-NOV-21
Tin (Sn)-Leachable			102.7		%		70-130	12-NOV-21
Titanium (Ti)-Leachable			99.3		%		70-130	12-NOV-21
Uranium (U)-Leachable			94.5		%		70-130	12-NOV-21
Vanadium (V)-Leachable			103.2		%		70-130	12-NOV-21
Zinc (Zn)-Leachable			99.5		%		70-130	12-NOV-21
WG3645358-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	12-NOV-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	12-NOV-21
Arsenic (As)-Leachable			<0.050		mg/kg		0.05	12-NOV-21
Barium (Ba)-Leachable			<2.0		mg/kg		2	12-NOV-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	12-NOV-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	12-NOV-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	12-NOV-21
Calcium (Ca)-Leachable			<50		mg/kg		50	12-NOV-21
Chromium (Cr)-Leachable			<5.0		mg/kg		5	12-NOV-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	12-NOV-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	12-NOV-21
Iron (Fe)-Leachable			<50		mg/kg		50	12-NOV-21
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	12-NOV-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	12-NOV-21
Manganese (Mn)-Leachable			<5.0		mg/kg		5	12-NOV-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	12-NOV-21
Nickel (Ni)-Leachable			<2.0		mg/kg		2	12-NOV-21

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-CM-CCMS-VA	**Soil**							
Batch R5644964								
WG3645358-1 MB								
Phosphorus (P)-Leachable			<50		mg/kg		50	12-NOV-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	12-NOV-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	12-NOV-21
Strontium (Sr)-Leachable			<5.0		mg/kg		5	12-NOV-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	12-NOV-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	12-NOV-21
Titanium (Ti)-Leachable			<5.0		mg/kg		5	12-NOV-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	12-NOV-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	12-NOV-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	12-NOV-21
MET-TESS-EA-CCMS-VA	**Soil**							
Batch R5644516								
WG3645358-3 DUP		**L2644215-3**						
Aluminum (Al)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	12-NOV-21
Antimony (Sb)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	12-NOV-21
Arsenic (As)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	12-NOV-21
Barium (Ba)-Leachable		17.3	18.1		mg/kg	4.6	30	12-NOV-21
Beryllium (Be)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	12-NOV-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	12-NOV-21
Cadmium (Cd)-Leachable		0.266	0.276		mg/kg	3.5	30	12-NOV-21
Calcium (Ca)-Leachable		3420	3770		mg/kg	9.6	30	12-NOV-21
Chromium (Cr)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	12-NOV-21
Cobalt (Co)-Leachable		0.11	0.13		mg/kg	17	30	12-NOV-21
Copper (Cu)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	12-NOV-21
Iron (Fe)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	12-NOV-21
Lead (Pb)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	12-NOV-21
Lithium (Li)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	12-NOV-21
Manganese (Mn)-Leachable		69.8	70.6		mg/kg	1.2	30	12-NOV-21
Molybdenum (Mo)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	12-NOV-21
Nickel (Ni)-Leachable		1.88	2.00		mg/kg	6.1	30	12-NOV-21
Phosphorus (P)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	12-NOV-21
Potassium (K)-Leachable		<100	<100	RPD-NA	mg/kg	N/A	30	12-NOV-21
Selenium (Se)-Leachable		0.30	0.36		mg/kg	16	30	12-NOV-21
Silver (Ag)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	12-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-EA-CCMS-VA	**Soil**							
Batch R5644516								
WG3645358-3 DUP		**L2644215-3**						
Sodium (Na)-Leachable		<100	<100	RPD-NA	mg/kg	N/A	30	12-NOV-21
Strontium (Sr)-Leachable		4.79	5.03		mg/kg	4.9	30	12-NOV-21
Thallium (Tl)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	12-NOV-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	12-NOV-21
Titanium (Ti)-Leachable		<1.0	<1.0	RPD-NA	mg/kg	N/A	30	12-NOV-21
Uranium (U)-Leachable		0.074	0.082		mg/kg	10	30	12-NOV-21
Vanadium (V)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	12-NOV-21
Zinc (Zn)-Leachable		<1.0	<1.0	RPD-NA	mg/kg	N/A	30	12-NOV-21
WG3645358-2 LCS								
Aluminum (Al)-Leachable			96.7		%		70-130	12-NOV-21
Antimony (Sb)-Leachable			104.3		%		70-130	12-NOV-21
Arsenic (As)-Leachable			93.5		%		70-130	12-NOV-21
Barium (Ba)-Leachable			96.1		%		70-130	12-NOV-21
Beryllium (Be)-Leachable			99.7		%		70-130	12-NOV-21
Bismuth (Bi)-Leachable			87.8		%		70-130	12-NOV-21
Cadmium (Cd)-Leachable			96.0		%		70-130	12-NOV-21
Calcium (Ca)-Leachable			97.0		%		70-130	12-NOV-21
Chromium (Cr)-Leachable			97.4		%		70-130	12-NOV-21
Cobalt (Co)-Leachable			94.2		%		70-130	12-NOV-21
Copper (Cu)-Leachable			92.4		%		70-130	12-NOV-21
Iron (Fe)-Leachable			96.4		%		70-130	12-NOV-21
Lead (Pb)-Leachable			89.8		%		70-130	12-NOV-21
Lithium (Li)-Leachable			104.9		%		70-130	12-NOV-21
Manganese (Mn)-Leachable			102.9		%		70-130	12-NOV-21
Molybdenum (Mo)-Leachable			99.9		%		70-130	12-NOV-21
Nickel (Ni)-Leachable			93.2		%		70-130	12-NOV-21
Phosphorus (P)-Leachable			96.5		%		70-130	12-NOV-21
Potassium (K)-Leachable			97.5		%		70-130	12-NOV-21
Selenium (Se)-Leachable			93.2		%		70-130	12-NOV-21
Silver (Ag)-Leachable			95.8		%		70-130	12-NOV-21
Sodium (Na)-Leachable			99.1		%		70-130	12-NOV-21
Strontium (Sr)-Leachable			98.1		%		70-130	12-NOV-21
Thallium (Tl)-Leachable			87.6		%		70-130	12-NOV-21
Tin (Sn)-Leachable			98.4		%		70-130	12-NOV-21

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-EA-CCMS-VA	**Soil**							
Batch R5644516								
WG3645358-2 LCS								
Titanium (Ti)-Leachable			100.9		%		70-130	12-NOV-21
Uranium (U)-Leachable			92.4		%		70-130	12-NOV-21
Vanadium (V)-Leachable			99.0		%		70-130	12-NOV-21
Zinc (Zn)-Leachable			92.3		%		70-130	12-NOV-21
WG3645358-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	12-NOV-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	12-NOV-21
Arsenic (As)-Leachable			<0.050		mg/kg		0.05	12-NOV-21
Barium (Ba)-Leachable			<0.50		mg/kg		0.5	12-NOV-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	12-NOV-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	12-NOV-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	12-NOV-21
Calcium (Ca)-Leachable			<50		mg/kg		50	12-NOV-21
Chromium (Cr)-Leachable			<0.50		mg/kg		0.5	12-NOV-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	12-NOV-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	12-NOV-21
Iron (Fe)-Leachable			<50		mg/kg		50	12-NOV-21
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	12-NOV-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	12-NOV-21
Manganese (Mn)-Leachable			<1.0		mg/kg		1	12-NOV-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	12-NOV-21
Nickel (Ni)-Leachable			<0.50		mg/kg		0.5	12-NOV-21
Phosphorus (P)-Leachable			<50		mg/kg		50	12-NOV-21
Potassium (K)-Leachable			<100		mg/kg		100	12-NOV-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	12-NOV-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	12-NOV-21
Sodium (Na)-Leachable			<100		mg/kg		100	12-NOV-21
Strontium (Sr)-Leachable			<0.50		mg/kg		0.5	12-NOV-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	12-NOV-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	12-NOV-21
Titanium (Ti)-Leachable			<1.0		mg/kg		1	12-NOV-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	12-NOV-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	12-NOV-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	12-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-FEO-CCMS-VA	**Soil**							
Batch R5649478								
WG3645358-3 DUP		**L2644215-3**						
Aluminum (Al)-Leachable		638	681		mg/kg	6.4	30	16-NOV-21
Antimony (Sb)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	16-NOV-21
Arsenic (As)-Leachable		0.487	0.544		mg/kg	11	30	16-NOV-21
Barium (Ba)-Leachable		47.7	50.5		mg/kg	5.7	30	16-NOV-21
Beryllium (Be)-Leachable		0.35	0.38		mg/kg	5.5	30	16-NOV-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	16-NOV-21
Cadmium (Cd)-Leachable		0.441	0.499		mg/kg	12	30	16-NOV-21
Calcium (Ca)-Leachable		6440	6800		mg/kg	5.4	30	16-NOV-21
Chromium (Cr)-Leachable		0.98	1.05		mg/kg	7.6	30	16-NOV-21
Cobalt (Co)-Leachable		6.55	6.99		mg/kg	6.5	30	16-NOV-21
Copper (Cu)-Leachable		0.57	0.60		mg/kg	5.6	30	16-NOV-21
Iron (Fe)-Leachable		3400	3560		mg/kg	4.7	30	16-NOV-21
Lead (Pb)-Leachable		3.47	3.64		mg/kg	4.9	30	16-NOV-21
Lithium (Li)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	16-NOV-21
Manganese (Mn)-Leachable		410	444		mg/kg	7.9	30	16-NOV-21
Molybdenum (Mo)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	16-NOV-21
Nickel (Ni)-Leachable		31.1	33.8		mg/kg	8.4	30	16-NOV-21
Phosphorus (P)-Leachable		159	138		mg/kg	14	30	16-NOV-21
Selenium (Se)-Leachable		0.83	0.89		mg/kg	6.6	30	16-NOV-21
Silver (Ag)-Leachable		0.15	0.16		mg/kg	4.3	30	16-NOV-21
Strontium (Sr)-Leachable		6.78	7.46		mg/kg	9.6	30	16-NOV-21
Thallium (Tl)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	16-NOV-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	16-NOV-21
Titanium (Ti)-Leachable		<1.0	<1.0	RPD-NA	mg/kg	N/A	30	16-NOV-21
Uranium (U)-Leachable		0.228	0.247		mg/kg	8.1	30	16-NOV-21
Vanadium (V)-Leachable		3.27	3.52		mg/kg	7.5	30	16-NOV-21
Zinc (Zn)-Leachable		48.6	51.8		mg/kg	6.2	30	16-NOV-21
WG3645358-2 LCS								
Aluminum (Al)-Leachable			89.5		%		70-130	16-NOV-21
Antimony (Sb)-Leachable			99.2		%		70-130	16-NOV-21
Arsenic (As)-Leachable			107.5		%		70-130	16-NOV-21
Barium (Ba)-Leachable			94.3		%		70-130	16-NOV-21
Beryllium (Be)-Leachable			95.8		%		70-130	16-NOV-21
Bismuth (Bi)-Leachable			95.7		%		70-130	16-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-FEO-CCMS-VA	**Soil**							
Batch R5649478								
WG3645358-2 LCS								
Cadmium (Cd)-Leachable			97.7		%		70-130	16-NOV-21
Calcium (Ca)-Leachable			95.3		%		70-130	16-NOV-21
Chromium (Cr)-Leachable			95.7		%		70-130	16-NOV-21
Cobalt (Co)-Leachable			93.5		%		70-130	16-NOV-21
Copper (Cu)-Leachable			103.3		%		70-130	16-NOV-21
Iron (Fe)-Leachable			95.0		%		70-130	16-NOV-21
Lead (Pb)-Leachable			96.3		%		70-130	16-NOV-21
Lithium (Li)-Leachable			97.0		%		70-130	16-NOV-21
Manganese (Mn)-Leachable			93.2		%		70-130	16-NOV-21
Molybdenum (Mo)-Leachable			95.2		%		70-130	16-NOV-21
Nickel (Ni)-Leachable			96.5		%		70-130	16-NOV-21
Phosphorus (P)-Leachable			98.2		%		70-130	16-NOV-21
Selenium (Se)-Leachable			123.2		%		70-130	16-NOV-21
Silver (Ag)-Leachable			95.3		%		70-130	16-NOV-21
Strontium (Sr)-Leachable			98.7		%		70-130	16-NOV-21
Thallium (Tl)-Leachable			97.1		%		70-130	16-NOV-21
Tin (Sn)-Leachable			96.8		%		70-130	16-NOV-21
Titanium (Ti)-Leachable			95.5		%		70-130	16-NOV-21
Uranium (U)-Leachable			93.3		%		70-130	16-NOV-21
Vanadium (V)-Leachable			95.1		%		70-130	16-NOV-21
Zinc (Zn)-Leachable			96.8		%		70-130	16-NOV-21
WG3645358-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	16-NOV-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	16-NOV-21
Arsenic (As)-Leachable			<0.050		mg/kg		0.05	16-NOV-21
Barium (Ba)-Leachable			<0.50		mg/kg		0.5	16-NOV-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	16-NOV-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	16-NOV-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	16-NOV-21
Calcium (Ca)-Leachable			<50		mg/kg		50	16-NOV-21
Chromium (Cr)-Leachable			<0.50		mg/kg		0.5	16-NOV-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	16-NOV-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	16-NOV-21
Iron (Fe)-Leachable			<50		mg/kg		50	16-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-FEO-CCMS-VA	**Soil**							
Batch R5649478								
WG3645358-1 MB								
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	16-NOV-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	16-NOV-21
Manganese (Mn)-Leachable			<1.0		mg/kg		1	16-NOV-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	16-NOV-21
Nickel (Ni)-Leachable			<0.50		mg/kg		0.5	16-NOV-21
Phosphorus (P)-Leachable			<50		mg/kg		50	16-NOV-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	16-NOV-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	16-NOV-21
Strontium (Sr)-Leachable			<0.50		mg/kg		0.5	16-NOV-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	16-NOV-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	16-NOV-21
Titanium (Ti)-Leachable			<1.0		mg/kg		1	16-NOV-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	16-NOV-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	16-NOV-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	16-NOV-21
MET-TESS-OB-CCMS-VA	**Soil**							
Batch R5652722								
WG3645358-3 DUP		**L2644215-3**						
Aluminum (Al)-Leachable		1750	1790		mg/kg	2.3	30	17-NOV-21
Antimony (Sb)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	17-NOV-21
Arsenic (As)-Leachable		0.453	0.468		mg/kg	3.1	30	17-NOV-21
Barium (Ba)-Leachable		25.1	26.2		mg/kg	4.3	30	17-NOV-21
Beryllium (Be)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	17-NOV-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	17-NOV-21
Cadmium (Cd)-Leachable		0.100	0.098		mg/kg	1.6	30	17-NOV-21
Calcium (Ca)-Leachable		1400	1460		mg/kg	4.2	30	17-NOV-21
Chromium (Cr)-Leachable		4.07	4.10		mg/kg	0.7	30	17-NOV-21
Cobalt (Co)-Leachable		1.20	1.28		mg/kg	6.1	30	17-NOV-21
Copper (Cu)-Leachable		9.76	9.79		mg/kg	0.3	30	17-NOV-21
Iron (Fe)-Leachable		1660	1630		mg/kg	1.8	30	17-NOV-21
Lead (Pb)-Leachable		1.59	1.63		mg/kg	2.4	30	17-NOV-21
Lithium (Li)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	17-NOV-21
Manganese (Mn)-Leachable		26.6	27.3		mg/kg	2.6	30	17-NOV-21
Molybdenum (Mo)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	17-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-OB-CCMS-VA	**Soil**							
Batch R5652722								
WG3645358-3 DUP		**L2644215-3**						
Nickel (Ni)-Leachable		11.9	12.1		mg/kg	1.7	30	17-NOV-21
Selenium (Se)-Leachable		7.14	6.85		mg/kg	4.1	30	17-NOV-21
Silver (Ag)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	17-NOV-21
Strontium (Sr)-Leachable		4.86	5.00		mg/kg	3.0	30	17-NOV-21
Thallium (Tl)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	17-NOV-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	17-NOV-21
Titanium (Ti)-Leachable		10.9	8.5		mg/kg	25	30	17-NOV-21
Uranium (U)-Leachable		0.379	0.400		mg/kg	5.6	30	17-NOV-21
Vanadium (V)-Leachable		5.68	5.85		mg/kg	2.9	30	17-NOV-21
Zinc (Zn)-Leachable		10.6	10.5		mg/kg	0.2	30	17-NOV-21
WG3645358-2 LCS								
Aluminum (Al)-Leachable			100.5		%		70-130	17-NOV-21
Antimony (Sb)-Leachable			103.6		%		70-130	17-NOV-21
Arsenic (As)-Leachable			100.1		%		70-130	17-NOV-21
Barium (Ba)-Leachable			100.4		%		70-130	17-NOV-21
Beryllium (Be)-Leachable			100.4		%		70-130	17-NOV-21
Bismuth (Bi)-Leachable			100.0		%		70-130	17-NOV-21
Cadmium (Cd)-Leachable			96.6		%		70-130	17-NOV-21
Calcium (Ca)-Leachable			98.5		%		70-130	17-NOV-21
Chromium (Cr)-Leachable			99.4		%		70-130	17-NOV-21
Cobalt (Co)-Leachable			99.7		%		70-130	17-NOV-21
Copper (Cu)-Leachable			101.0		%		70-130	17-NOV-21
Iron (Fe)-Leachable			98.8		%		70-130	17-NOV-21
Lead (Pb)-Leachable			101.3		%		70-130	17-NOV-21
Lithium (Li)-Leachable			102.0		%		70-130	17-NOV-21
Manganese (Mn)-Leachable			99.5		%		70-130	17-NOV-21
Molybdenum (Mo)-Leachable			99.7		%		70-130	17-NOV-21
Nickel (Ni)-Leachable			101.3		%		70-130	17-NOV-21
Selenium (Se)-Leachable			103.4		%		70-130	17-NOV-21
Silver (Ag)-Leachable			104.4		%		70-130	17-NOV-21
Strontium (Sr)-Leachable			99.5		%		70-130	17-NOV-21
Thallium (Tl)-Leachable			99.4		%		70-130	17-NOV-21
Tin (Sn)-Leachable			96.2		%		70-130	17-NOV-21
Titanium (Ti)-Leachable			98.6		%		70-130	17-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-OB-CCMS-VA	**Soil**							
Batch R5652722								
WG3645358-2 LCS								
Uranium (U)-Leachable			98.0		%		70-130	17-NOV-21
Vanadium (V)-Leachable			98.0		%		70-130	17-NOV-21
Zinc (Zn)-Leachable			101.8		%		70-130	17-NOV-21
WG3645358-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	17-NOV-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	17-NOV-21
Arsenic (As)-Leachable			<0.050		mg/kg		0.05	17-NOV-21
Barium (Ba)-Leachable			<0.50		mg/kg		0.5	17-NOV-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	17-NOV-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	17-NOV-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	17-NOV-21
Calcium (Ca)-Leachable			<50		mg/kg		50	17-NOV-21
Chromium (Cr)-Leachable			<0.50		mg/kg		0.5	17-NOV-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	17-NOV-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	17-NOV-21
Iron (Fe)-Leachable			<50		mg/kg		50	17-NOV-21
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	17-NOV-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	17-NOV-21
Manganese (Mn)-Leachable			<1.0		mg/kg		1	17-NOV-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	17-NOV-21
Nickel (Ni)-Leachable			<0.50		mg/kg		0.5	17-NOV-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	17-NOV-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	17-NOV-21
Strontium (Sr)-Leachable			<0.50		mg/kg		0.5	17-NOV-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	17-NOV-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	17-NOV-21
Titanium (Ti)-Leachable			<1.0		mg/kg		1	17-NOV-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	17-NOV-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	17-NOV-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	17-NOV-21
MET-TESS-RM-CCMS-VA	**Soil**							
Batch R5655274								
WG3645358-3 DUP		**L2644215-3**						
Aluminum (Al)-Leachable		7020	6430		mg/kg	8.7	30	21-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-RM-CCMS-VA	**Soil**							
Batch R5655274								
WG3645358-3 DUP		**L2644215-3**						
Antimony (Sb)-Leachable		1.04	0.97		mg/kg	7.6	30	21-NOV-21
Arsenic (As)-Leachable		5.28	5.17		mg/kg	2.3	30	21-NOV-21
Barium (Ba)-Leachable		163	159		mg/kg	2.5	30	21-NOV-21
Beryllium (Be)-Leachable		0.38	0.38		mg/kg	1.1	30	21-NOV-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	21-NOV-21
Cadmium (Cd)-Leachable		0.109	0.105		mg/kg	3.8	30	21-NOV-21
Calcium (Ca)-Leachable		109	108		mg/kg	0.7	30	21-NOV-21
Chromium (Cr)-Leachable		11.2	10.2		mg/kg	9.3	30	21-NOV-21
Cobalt (Co)-Leachable		3.49	3.53		mg/kg	1.3	30	21-NOV-21
Copper (Cu)-Leachable		19.2	19.1		mg/kg	0.5	30	21-NOV-21
Iron (Fe)-Leachable		11600	11600		mg/kg	0.8	30	21-NOV-21
Lead (Pb)-Leachable		9.30	9.33		mg/kg	0.3	30	21-NOV-21
Lithium (Li)-Leachable		5.3	<5.0	RPD-NA	mg/kg	N/A	30	21-NOV-21
Manganese (Mn)-Leachable		48.0	48.0		mg/kg	0.1	30	21-NOV-21
Molybdenum (Mo)-Leachable		1.29	1.32		mg/kg	2.1	30	21-NOV-21
Nickel (Ni)-Leachable		14.6	14.3		mg/kg	2.2	30	21-NOV-21
Selenium (Se)-Leachable		2.05	2.14		mg/kg	4.2	30	21-NOV-21
Silver (Ag)-Leachable		0.24	0.24		mg/kg	3.6	30	21-NOV-21
Strontium (Sr)-Leachable		21.3	19.9		mg/kg	7.0	30	21-NOV-21
Thallium (Tl)-Leachable		0.166	0.146		mg/kg	13	30	21-NOV-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	21-NOV-21
Titanium (Ti)-Leachable		17.0	12.7		mg/kg	29	30	21-NOV-21
Uranium (U)-Leachable		0.366	0.357		mg/kg	2.5	30	21-NOV-21
Vanadium (V)-Leachable		29.6	27.5		mg/kg	7.2	30	21-NOV-21
Zinc (Zn)-Leachable		80.7	81.0		mg/kg	0.4	30	21-NOV-21
WG3645358-2 LCS								
Aluminum (Al)-Leachable			96.8		%		70-130	21-NOV-21
Antimony (Sb)-Leachable			105.4		%		70-130	21-NOV-21
Arsenic (As)-Leachable			98.1		%		70-130	21-NOV-21
Barium (Ba)-Leachable			100.9		%		70-130	21-NOV-21
Beryllium (Be)-Leachable			98.8		%		70-130	21-NOV-21
Bismuth (Bi)-Leachable			100.6		%		70-130	21-NOV-21
Cadmium (Cd)-Leachable			103.3		%		70-130	21-NOV-21
Calcium (Ca)-Leachable			99.9		%		70-130	21-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-RM-CCMS-VA	**Soil**							
Batch R5655274								
WG3645358-2 LCS								
Chromium (Cr)-Leachable			101.6		%		70-130	21-NOV-21
Cobalt (Co)-Leachable			102.4		%		70-130	21-NOV-21
Copper (Cu)-Leachable			100.4		%		70-130	21-NOV-21
Iron (Fe)-Leachable			101.1		%		70-130	21-NOV-21
Lead (Pb)-Leachable			102.0		%		70-130	21-NOV-21
Lithium (Li)-Leachable			104.1		%		70-130	21-NOV-21
Manganese (Mn)-Leachable			102.6		%		70-130	21-NOV-21
Molybdenum (Mo)-Leachable			102.0		%		70-130	21-NOV-21
Nickel (Ni)-Leachable			100.9		%		70-130	21-NOV-21
Selenium (Se)-Leachable			104.5		%		70-130	21-NOV-21
Silver (Ag)-Leachable			103.0		%		70-130	21-NOV-21
Strontium (Sr)-Leachable			99.0		%		70-130	21-NOV-21
Thallium (Tl)-Leachable			100.1		%		70-130	21-NOV-21
Tin (Sn)-Leachable			102.8		%		70-130	21-NOV-21
Titanium (Ti)-Leachable			94.1		%		70-130	21-NOV-21
Uranium (U)-Leachable			97.2		%		70-130	21-NOV-21
Vanadium (V)-Leachable			102.2		%		70-130	21-NOV-21
Zinc (Zn)-Leachable			100.9		%		70-130	21-NOV-21
WG3645358-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	21-NOV-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	21-NOV-21
Arsenic (As)-Leachable			<0.50		mg/kg		0.5	21-NOV-21
Barium (Ba)-Leachable			<2.0		mg/kg		2	21-NOV-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	21-NOV-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	21-NOV-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	21-NOV-21
Calcium (Ca)-Leachable			<50		mg/kg		50	21-NOV-21
Chromium (Cr)-Leachable			<5.0		mg/kg		5	21-NOV-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	21-NOV-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	21-NOV-21
Iron (Fe)-Leachable			<50		mg/kg		50	21-NOV-21
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	21-NOV-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	21-NOV-21
Manganese (Mn)-Leachable			<5.0		mg/kg		5	21-NOV-21

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-RM-CCMS-VA	**Soil**							
Batch R5655274								
WG3645358-1 MB								
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	21-NOV-21
Nickel (Ni)-Leachable			<2.0		mg/kg		2	21-NOV-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	21-NOV-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	21-NOV-21
Strontium (Sr)-Leachable			<5.0		mg/kg		5	21-NOV-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	21-NOV-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	21-NOV-21
Titanium (Ti)-Leachable			<5.0		mg/kg		5	21-NOV-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	21-NOV-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	21-NOV-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	21-NOV-21
MOISTURE-CL	**Soil**							
Batch R5607066								
WG3630257-2 LCS								
Moisture			99.5		%		90-110	04-OCT-21
WG3630257-1 MB								
Moisture			<0.25		%		0.25	04-OCT-21
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5609857								
WG3631673-3 IRM		**ALS PAH RM2**						
Acenaphthene			79.4		%		60-130	04-OCT-21
Acenaphthylene			88.4		%		60-130	04-OCT-21
Anthracene			90.2		%		60-130	04-OCT-21
Acridine			94.8		%		60-130	04-OCT-21
Benz(a)anthracene			82.5		%		60-130	04-OCT-21
Benzo(a)pyrene			77.6		%		60-130	04-OCT-21
Benzo(b&j)fluoranthene			74.7		%		60-130	04-OCT-21
Benzo(e)pyrene			81.5		%		60-130	04-OCT-21
Benzo(g,h,i)perylene			73.4		%		60-130	04-OCT-21
Benzo(k)fluoranthene			84.9		%		60-130	04-OCT-21
Chrysene			83.1		%		60-130	04-OCT-21
Dibenz(a,h)anthracene			76.0		%		60-130	04-OCT-21
Fluoranthene			78.5		%		60-130	04-OCT-21
Fluorene			79.3		%		60-130	04-OCT-21
Indeno(1,2,3-c,d)pyrene			110.3		%		60-130	04-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5609857								
WG3631673-3 IRM		**ALS PAH RM2**						
2-Methylnaphthalene			77.6		%		60-130	04-OCT-21
Naphthalene			73.5		%		50-130	04-OCT-21
Perylene			77.1		%		60-130	04-OCT-21
Phenanthrene			80.3		%		60-130	04-OCT-21
Pyrene			80.3		%		60-130	04-OCT-21
1-Methylnaphthalene			76.4		%		60-130	04-OCT-21
WG3631673-5 IRM		**ALS PAH RM2**						
Acenaphthene			87.9		%		60-130	05-OCT-21
Acenaphthylene			98.3		%		60-130	05-OCT-21
Anthracene			102.2		%		60-130	05-OCT-21
Acridine			104.6		%		60-130	05-OCT-21
Benz(a)anthracene			95.3		%		60-130	05-OCT-21
Benzo(a)pyrene			103.7		%		60-130	05-OCT-21
Benzo(b&j)fluoranthene			91.7		%		60-130	05-OCT-21
Benzo(e)pyrene			99.0		%		60-130	05-OCT-21
Benzo(g,h,i)perylene			89.3		%		60-130	05-OCT-21
Benzo(k)fluoranthene			75.9		%		60-130	05-OCT-21
Chrysene			93.9		%		60-130	05-OCT-21
Dibenz(a,h)anthracene			80.5		%		60-130	05-OCT-21
Fluoranthene			87.0		%		60-130	05-OCT-21
Fluorene			88.9		%		60-130	05-OCT-21
Indeno(1,2,3-c,d)pyrene			122.4		%		60-130	05-OCT-21
2-Methylnaphthalene			82.0		%		60-130	05-OCT-21
Naphthalene			76.1		%		50-130	05-OCT-21
Perylene			104.4		%		60-130	05-OCT-21
Phenanthrene			86.7		%		60-130	05-OCT-21
Pyrene			89.0		%		60-130	05-OCT-21
1-Methylnaphthalene			81.6		%		60-130	05-OCT-21
WG3631673-2 LCS								
Acenaphthene			121.1		%		60-130	04-OCT-21
Acenaphthylene			114.3		%		60-130	04-OCT-21
Anthracene			113.8		%		60-130	04-OCT-21
Acridine			99.6		%		60-130	04-OCT-21
Benz(a)anthracene			113.2		%		60-130	04-OCT-21
Benzo(a)pyrene			95.7		%		60-130	04-OCT-21

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5609857								
WG3631673-2 LCS								
Benzo(b&j)fluoranthene			104.4		%		60-130	04-OCT-21
Benzo(e)pyrene			111.9		%		60-130	04-OCT-21
Benzo(g,h,i)perylene			111.5		%		60-130	04-OCT-21
Benzo(k)fluoranthene			108.8		%		60-130	04-OCT-21
Chrysene			118.7		%		60-130	04-OCT-21
Dibenz(a,h)anthracene			110.6		%		60-130	04-OCT-21
Fluoranthene			118.0		%		60-130	04-OCT-21
Fluorene			115.6		%		60-130	04-OCT-21
Indeno(1,2,3-c,d)pyrene			106.0		%		60-130	04-OCT-21
2-Methylnaphthalene			124.7		%		60-130	04-OCT-21
Naphthalene			114.5		%		50-130	04-OCT-21
Perylene			102.2		%		60-130	04-OCT-21
Phenanthrene			120.5		%		60-130	04-OCT-21
Pyrene			117.4		%		60-130	04-OCT-21
1-Methylnaphthalene			126.2		%		60-130	04-OCT-21
Quinoline			103.7		%		60-130	04-OCT-21
WG3631673-1 MB								
Acenaphthene			<0.0050		mg/kg		0.005	04-OCT-21
Acenaphthylene			<0.0050		mg/kg		0.005	04-OCT-21
Anthracene			<0.0040		mg/kg		0.004	04-OCT-21
Acridine			<0.010		mg/kg		0.01	04-OCT-21
Benz(a)anthracene			<0.010		mg/kg		0.01	04-OCT-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	04-OCT-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	04-OCT-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	04-OCT-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	04-OCT-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	04-OCT-21
Chrysene			<0.010		mg/kg		0.01	04-OCT-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	04-OCT-21
Fluoranthene			<0.010		mg/kg		0.01	04-OCT-21
Fluorene			<0.010		mg/kg		0.01	04-OCT-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	04-OCT-21
2-Methylnaphthalene			<0.010		mg/kg		0.01	04-OCT-21
Naphthalene			<0.010		mg/kg		0.01	04-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5609857								
WG3631673-1 MB								
Perylene			<0.010		mg/kg		0.01	04-OCT-21
Phenanthrene			<0.010		mg/kg		0.01	04-OCT-21
Pyrene			<0.010		mg/kg		0.01	04-OCT-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	04-OCT-21
Quinoline			<0.050		mg/kg		0.05	04-OCT-21
Surrogate: d8-Naphthalene			66.8		%		50-130	04-OCT-21
Surrogate: d10-Acenaphthene			67.8		%		60-130	04-OCT-21
Surrogate: d10-Phenanthrene			74.5		%		60-130	04-OCT-21
Surrogate: d12-Chrysene			79.6		%		60-130	04-OCT-21
WG3631673-6 MB								
Acenaphthene			<0.0050		mg/kg		0.005	05-OCT-21
Acenaphthylene			<0.0050		mg/kg		0.005	05-OCT-21
Anthracene			<0.0040		mg/kg		0.004	05-OCT-21
Acridine			<0.010		mg/kg		0.01	05-OCT-21
Benz(a)anthracene			<0.010		mg/kg		0.01	05-OCT-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	05-OCT-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	05-OCT-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	05-OCT-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	05-OCT-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	05-OCT-21
Chrysene			<0.010		mg/kg		0.01	05-OCT-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	05-OCT-21
Fluoranthene			<0.010		mg/kg		0.01	05-OCT-21
Fluorene			<0.010		mg/kg		0.01	05-OCT-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	05-OCT-21
2-Methylnaphthalene			<0.010		mg/kg		0.01	05-OCT-21
Naphthalene			<0.010		mg/kg		0.01	05-OCT-21
Perylene			<0.010		mg/kg		0.01	05-OCT-21
Phenanthrene			<0.010		mg/kg		0.01	05-OCT-21
Pyrene			<0.010		mg/kg		0.01	05-OCT-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	05-OCT-21
Quinoline			<0.050		mg/kg		0.05	05-OCT-21
Surrogate: d8-Naphthalene			87.4		%		50-130	05-OCT-21
Surrogate: d10-Acenaphthene			84.7		%		60-130	05-OCT-21

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5609857								
WG3631673-6 MB								
Surrogate: d10-Phenanthrene			95.8		%		60-130	05-OCT-21
Surrogate: d12-Chrysene			104.2		%		60-130	05-OCT-21
PH-1:2-CL	**Soil**							
Batch R5613931								
WG3633633-6 DUP		**L2644215-7**						
pH (1:2 soil:water)		8.19	8.14	J	pH	0.05	0.2	07-OCT-21
WG3633633-2 IRM		**SAL-STD11**						
pH (1:2 soil:water)			8.02		pH		7.7-8.3	07-OCT-21
WG3633633-5 IRM		**SAL-STD11**						
pH (1:2 soil:water)			7.99		pH		7.7-8.3	07-OCT-21
WG3633633-1 LCS								
pH (1:2 soil:water)			7.02		pH		6.8-7.2	07-OCT-21
WG3633633-4 LCS								
pH (1:2 soil:water)			7.01		pH		6.8-7.2	07-OCT-21
PSA-PIPET-DETAIL-SK	**Soil**							
Batch R5610002								
WG3627466-2 IRM		**2020-PSA_SOIL**						
% Sand (2.00mm - 1.00mm)			2.3		%		0-7.2	05-OCT-21
% Sand (1.00mm - 0.50mm)			3.6		%		0-8.7	05-OCT-21
% Sand (0.50mm - 0.25mm)			9.0		%		4-14	05-OCT-21
% Sand (0.25mm - 0.125mm)			16.6		%		11.7-21.7	05-OCT-21
% Sand (0.125mm - 0.063mm)			14.1		%		8.4-18.4	05-OCT-21
% Silt (0.063mm - 0.0312mm)			12.0		%		8.5-18.5	05-OCT-21
% Silt (0.0312mm - 0.004mm)			20.6		%		15.1-25.1	05-OCT-21
% Clay (<4um)			21.8		%		16.5-26.5	05-OCT-21

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes 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 pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Teck

Page 1 of 1

COC ID:	September GGCAMP 2021	TURNAROUND TIME:	

PROJECT/CLIENT INFO

Facility Name / Job#	REP		
Project Manager	Allie Ferguson		
Email	[illegible]		
Address	421 Pine Avenue		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	250-425-8202		

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	1 403 407 1794		

Report distribution	Excel	PDF	EDD

L2644215-COFC

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Sample ID	Sample Location	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
								N	N	N	N	N	N
								NONE	NONE	NONE	NONE	NONE	NONE
RG_GHP_SE-1_2021-09-22_0900	RG_GHP	SE	No	9/22/2021	900	G	2	X	X	X	X	X	X
RG_GHP_SE-6_2021-09-22_1000	RG_GHP	SE	No	9/22/2021	1000	G	2	X	X	X	X	X	X
RG_GHP_SE-3_2021-09-21_1115	RG_GHP	SE	No	9/21/2021	1115	G	2	X	X	X	X	X	X
RG_GHP_SE-4_2021-09-21_1000	RG_GHP	SE	No	9/21/2021	1000	G	2	X	X	X	X	X	X
RG_GHP_SE-5_2021-09-23_1000	RG_GHP	SE	No	9/23/2021	1000	G	2	X	X	X	X	X	X
RG_RIVER_SE-1_2021-09-21_1115	RG_RIVER	SE	No	9/21/2021	1115	G	2	X	X	X	X	X	X
RG_RIVER_SE-2_2021-09-22_1000	RG_RIVER	SE	No	9/22/2021	1000	G	2	X	X	X	X	X	X
		SE	No			G	2	X	X	X	X	X	X
		SE	No			G	2	X	X	X	X	X	X
		SE	No			G	2	X	X	X	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

ALS PO 750546

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Jennifer Ings/Minnow	################	[signature]	9/24 8:10

NB OF BOTTLES RETURNED/DESCRIPTION

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	Jennifer Ings	Mobile #	519-500-3444
Sampler's Signature	[signature]	Date/Time	September 23, 2021

5

Teck Coal Ltd.
ATTN: Allie Ferguson
421 Pine Avenue
Sparwood BC V0B 2G0

Date Received: 21-SEP-21
Report Date: 07-JAN-22 13:59 (MT)
Version: FINAL REV. 2

Client Phone: 250-425-8202

Certificate of Analysis

Lab Work Order #: L2644275

Project P.O. #: VPO00750546
Job Reference: REGIONAL EFFECTS PROGRAM
C of C Numbers: September GGCAMP
Legal Site Desc:

Comments: Mercury in soil by CVAAS expired on L2644275-1 to -10 due to capacity.

Lyudmyla Shvets, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644275-1	L2644275-2	L2644275-3	L2644275-4	L2644275-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	16-SEP-21	16-SEP-21	16-SEP-21	16-SEP-21	16-SEP-21
	Sampled Time	08:45	09:30	12:00	12:50	13:30
	Client ID	RG_GANF_SE-4_2021-09-16_0845	RG_GANF_SE-5_2021-09-16_0930	RG_GAUT_SE-1_2021-09-16_1200	RG_GAUT_SE-2_2021-09-16_1250	RG_GAUT_SE-3_2021-09-16_1330
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	82.8	71.3	31.7	44.5	91.6
	pH (1:2 soil:water) (pH)	7.46	7.42	7.53	7.54	7.38
Particle Size	% Gravel (>2mm) (%)	5.9	2.7	5.5	4.0	2.3
	% Sand (2.00mm - 1.00mm) (%)	5.5	8.9	13.7	11.4	12.2
	% Sand (1.00mm - 0.50mm) (%)	8.7	10.6	16.8	13.8	20.1
	% Sand (0.50mm - 0.25mm) (%)	14.6	13.0	15.9	19.9	15.9
	% Sand (0.25mm - 0.125mm) (%)	17.5	14.5	12.2	15.2	10.4
	% Sand (0.125mm - 0.063mm) (%)	10.1	10.9	8.1	7.5	6.3
	% Silt (0.063mm - 0.0312mm) (%)	13.8	14.2	9.2	8.2	10.5
	% Silt (0.0312mm - 0.004mm) (%)	17.4	19.0	12.0	12.2	15.5
	% Clay (<4um) (%)	6.6	6.2	6.5	7.7	6.9
	Texture	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	8.75	9.41	5.44	6.47	8.44
Metals	Aluminum (Al) (mg/kg)	5300	5300	8590	8340	8550
	Antimony (Sb) (mg/kg)	0.81	0.84	0.87	1.01	2.02
	Arsenic (As) (mg/kg)	3.98	3.29	6.71	5.31	5.11
	Barium (Ba) (mg/kg)	223	195	223	219	303
	Beryllium (Be) (mg/kg)	0.63	0.48	0.75	0.73	0.83
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	<5.0	5.6	7.0	7.4	8.4
	Cadmium (Cd) (mg/kg)	0.710	0.566	0.638	0.636	1.29
	Calcium (Ca) (mg/kg)	91500	104000	9380	8750	16000
	Chromium (Cr) (mg/kg)	8.67	7.98	12.1	12.2	12.8
	Cobalt (Co) (mg/kg)	6.49	5.29	10.9	10.2	11.6
	Copper (Cu) (mg/kg)	12.9	11.7	14.9	14.9	23.2
	Iron (Fe) (mg/kg)	11900	9710	22400	17700	14900
	Lead (Pb) (mg/kg)	8.95	7.26	13.0	10.8	12.3
	Lithium (Li) (mg/kg)	9.1	8.4	15.1	12.9	11.9
	Magnesium (Mg) (mg/kg)	3860	3860	3240	2920	3130
	Manganese (Mn) (mg/kg)	389	330	579	440	767
	Mercury (Hg) (mg/kg)	0.0660	0.0690	0.0492	0.0577	0.126 RRV
	Molybdenum (Mo) (mg/kg)	0.81	0.70	1.15	1.09	1.10
	Nickel (Ni) (mg/kg)	23.7	20.4	35.0	33.7	47.7
	Phosphorus (P) (mg/kg)	963	749	1270	1090	1030
	Potassium (K) (mg/kg)	1090	1210	1770	1810	1650
	Selenium (Se) (mg/kg)	1.96	1.35	0.87	1.09	2.86

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		L2644275-6	L2644275-7	L2644275-8	L2644275-9	L2644275-10
	Description	SE	SE	SE	SE	SE
	Sampled Date	16-SEP-21	16-SEP-21	15-SEP-21	15-SEP-21	15-SEP-21
	Sampled Time	14:30	15:00	13:30	14:20	15:15
	Client ID	RG_GAUT_SE-4_2021-09-16_1430	RG_GAUT_SE-5_2021-09-16_1500	RG_GANF-SE-1_2021-09-15_1330	RG_GANF-SE-2_2021-09-15_1420	RG_GANF-SE-2_2021-09-15_1420
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	55.5	67.7	78.4	59.8	67.9
	pH (1:2 soil:water) (pH)	7.46	7.53	7.62	7.41	7.69
Particle Size	% Gravel (>2mm) (%)	15.9	6.5	<1.0	<1.0	<1.0
	% Sand (2.00mm - 1.00mm) (%)	4.3	9.4	5.9	4.6	3.1
	% Sand (1.00mm - 0.50mm) (%)	6.2	12.8	9.6	6.2	4.6
	% Sand (0.50mm - 0.25mm) (%)	9.3	16.8	14.3	13.8	12.6
	% Sand (0.25mm - 0.125mm) (%)	10.5	15.0	17.2	19.0	19.7
	% Sand (0.125mm - 0.063mm) (%)	8.2	8.0	11.4	12.4	12.4
	% Silt (0.063mm - 0.0312mm) (%)	16.8	10.2	14.4	16.1	16.5
	% Silt (0.0312mm - 0.004mm) (%)	21.4	14.4	19.6	20.3	22.2
	% Clay (<4um) (%)	7.4	6.9	7.7	7.7	8.9
	Texture	Loam / Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	11.1	7.24	9.72	8.66	9.93
Metals	Aluminum (Al) (mg/kg)	7710	8210	5270	5590	6280
	Antimony (Sb) (mg/kg)	1.17	1.50	1.03	0.84	0.91
	Arsenic (As) (mg/kg)	5.43	5.33	3.71	4.13	3.85
	Barium (Ba) (mg/kg)	239	253	228	200	225
	Beryllium (Be) (mg/kg)	0.73	0.81	0.61	0.64	0.65
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	7.0	8.9	<5.0	<5.0	6.5
	Cadmium (Cd) (mg/kg)	0.755	0.850	0.757	0.651	0.635
	Calcium (Ca) (mg/kg)	10100	11500	85700	76300	92300
	Chromium (Cr) (mg/kg)	11.8	12.3	8.46	8.78	9.58
	Cobalt (Co) (mg/kg)	10.9	10.7	6.32	6.90	6.30
	Copper (Cu) (mg/kg)	16.6	17.4	13.7	12.7	12.7
	Iron (Fe) (mg/kg)	16700	16000	10900	12600	11900
	Lead (Pb) (mg/kg)	11.3	11.9	8.40	9.00	8.62
	Lithium (Li) (mg/kg)	11.7	12.9	8.2	9.1	9.6
	Magnesium (Mg) (mg/kg)	2860	2800	3950	3760	4090
	Manganese (Mn) (mg/kg)	669	492	365	409	371
	Mercury (Hg) (mg/kg)	0.0770	0.0823	0.0721	0.0696	0.0809
	Molybdenum (Mo) (mg/kg)	1.08	1.03	0.81	0.83	0.89
	Nickel (Ni) (mg/kg)	35.1	37.7	25.5	24.4	23.2
	Phosphorus (P) (mg/kg)	1070	1020	894	969	974
	Potassium (K) (mg/kg)	1640	1720	1090	1190	1420
	Selenium (Se) (mg/kg)	1.32	1.65	2.56	1.56	2.05

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L2644275-1	L2644275-2	L2644275-3	L2644275-4	L2644275-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	16-SEP-21	16-SEP-21	16-SEP-21	16-SEP-21	16-SEP-21
	Sampled Time	08:45	09:30	12:00	12:50	13:30
	Client ID	RG_GANF_SE-4_2021-09-16_0845	RG_GANF_SE-5_2021-09-16_0930	RG_GAUT_SE-1_2021-09-16_1200	RG_GAUT_SE-2_2021-09-16_1250	RG_GAUT_SE-3_2021-09-16_1330
SOIL						
Metals	Silver (Ag) (mg/kg)	0.25	0.22	0.19	0.23	0.51
	Sodium (Na) (mg/kg)	72	73	60	60	68
	Strontium (Sr) (mg/kg)	78.6	81.7	42.8	42.0	66.0
	Sulfur (S) (mg/kg)	1800	1900	<1000	<1000	1200
	Thallium (Tl) (mg/kg)	0.159	0.127	0.162	0.153	0.211
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	11.9	14.0	12.2	16.5	14.1
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	0.915	0.728	0.667	0.618	0.911
	Vanadium (V) (mg/kg)	16.7	16.9	26.8	26.1	26.6
	Zinc (Zn) (mg/kg)	75.3	59.0	104	93.9	99.9
	Zirconium (Zr) (mg/kg)	1.2	<1.0	1.0	<1.0	1.4
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	DLHM 0.291	0.223	0.0423	0.105	0.586
	Acenaphthylene (mg/kg)	DLHM 0.042	0.0358	<0.0050	0.0195	0.103
	Acridine (mg/kg)	DLHM 0.556	0.375	0.074	0.176	0.867
	Anthracene (mg/kg)	DLHM <0.0080	<0.0040	<0.0040	<0.0040	0.0192
	Benz(a)anthracene (mg/kg)	DLHM 0.168	0.125	0.026	0.056	0.319
	Benzo(a)pyrene (mg/kg)	DLHM 0.087	0.071	0.012	0.032	0.151
	Benzo(b&j)fluoranthene (mg/kg)	DLHM 0.434	0.300	0.076	0.147	0.752
	Benzo(b+j+k)fluoranthene (mg/kg)	DLHM 0.459	0.314	0.076	0.158	0.789
	Benzo(e)pyrene (mg/kg)	DLHM 0.405	0.294	0.072	0.141	0.747
	Benzo(g,h,i)perylene (mg/kg)	DLHM 0.147	0.103	0.027	0.052	0.319
	Benzo(k)fluoranthene (mg/kg)	DLHM 0.025	0.014	<0.010	0.012	0.037
	Chrysene (mg/kg)	DLHM 0.903	0.670	0.144	0.340	1.71
	Dibenz(a,h)anthracene (mg/kg)	DLHM 0.069	0.0469	0.0178	0.0274	0.128
	Fluoranthene (mg/kg)	DLHM 0.154	0.119	0.034	0.059	0.263
	Fluorene (mg/kg)	DLHM 0.750	0.515	0.091	0.234	1.26
	Indeno(1,2,3-c,d)pyrene (mg/kg)	DLHM 0.045	0.015	0.010	0.015	0.050
	1-Methylnaphthalene (mg/kg)	DLHM 3.84	2.70	0.480	1.27	6.68
	2-Methylnaphthalene (mg/kg)	DLHM 7.27	5.20	0.891	2.40	12.7
	Naphthalene (mg/kg)	DLHM 2.15	1.55	0.252	0.695	3.66
	Perylene (mg/kg)	DLHM 0.044	0.020	<0.010	0.011	0.050
	Phenanthrene (mg/kg)	DLHM 3.32	2.34	0.414	1.08	5.66
	Pyrene (mg/kg)	DLHM 0.379	0.270	0.067	0.150	0.717
	Quinoline (mg/kg)	DLHM <0.020	<0.050	<0.050	<0.050	<0.050
	Surrogate: d10-Acenaphthene (%)	107.2	100.9	80.3	90.9	102.7

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L2644275-6	L2644275-7	L2644275-8	L2644275-9	L2644275-10
	Description	SE	SE	SE	SE	SE
	Sampled Date	16-SEP-21	16-SEP-21	15-SEP-21	15-SEP-21	15-SEP-21
	Sampled Time	14:30	15:00	13:30	14:20	15:15
	Client ID	RG_GAUT_SE-4_2021-09-16_1430	RG_GAUT_SE-5_2021-09-16_1500	RG_GANF-SE-1_2021-09-15_1330	RG_GANF-SE-2_2021-09-15_1420	RG_GANF-SE-2_2021-09-15_1420
SOIL						
Metals	Silver (Ag) (mg/kg)	0.27	0.30	0.27	0.22	0.23
	Sodium (Na) (mg/kg)	55	59	70	65	75
	Strontium (Sr) (mg/kg)	47.5	53.4	76.5	67.2	79.4
	Sulfur (S) (mg/kg)	<1000	<1000	2000	1400	1700
	Thallium (Tl) (mg/kg)	0.156	0.172	0.147	0.144	0.181
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	14.7	17.9	9.0	10.7	13.2
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)	0.753	0.725	0.852	0.742	0.851
	Vanadium (V) (mg/kg)	25.6	25.9	16.8	17.7	20.1
	Zinc (Zn) (mg/kg)	94.5	94.8	74.8	78.1	74.7
	Zirconium (Zr) (mg/kg)	1.0	1.1	1.1	<1.0	<1.0
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	0.191	DLHM 0.206	DLHM 0.285	0.136	0.155
	Acenaphthylene (mg/kg)	0.0330	DLHM 0.033	DLHM 0.044	0.0231	0.0283
	Acridine (mg/kg)	0.352	DLHM 0.322	DLHM 0.512	0.201	0.248
	Anthracene (mg/kg)	<0.0040	DLHM <0.0080	DLHM <0.0080	<0.0040	<0.0040
	Benz(a)anthracene (mg/kg)	0.119	DLHM 0.118	DLHM 0.166	0.065	0.082
	Benzo(a)pyrene (mg/kg)	0.065	DLHM 0.067	DLHM 0.102	0.031	0.046
	Benzo(b&j)fluoranthene (mg/kg)	0.303	DLHM 0.301	DLHM 0.363	0.145	0.193
	Benzo(b+j+k)fluoranthene (mg/kg)	0.329	0.325	DLHM 0.403	0.159	0.209
	Benzo(e)pyrene (mg/kg)	0.302	DLHM 0.296	DLHM 0.386	0.145	0.191
	Benzo(g,h,i)perylene (mg/kg)	0.112	DLHM 0.126	DLHM 0.153	0.055	0.080
	Benzo(k)fluoranthene (mg/kg)	0.026	DLHM 0.023	DLHM 0.040	0.014	0.016
	Chrysene (mg/kg)	0.655	DLHM 0.663	DLHM 0.854	0.340	0.435
	Dibenz(a,h)anthracene (mg/kg)	0.0544	DLHM 0.045	DLHM 0.066	0.0208	0.0351
	Fluoranthene (mg/kg)	0.101	DLHM 0.105	DLHM 0.133	0.060	0.074
	Fluorene (mg/kg)	0.428	DLHM 0.437	DLHM 0.651	0.301	0.349
	Indeno(1,2,3-c,d)pyrene (mg/kg)	0.029	DLHM 0.030	DLHM 0.031	0.015	0.024
	1-Methylnaphthalene (mg/kg)	2.09	DLHM 2.38	DLHM 3.58	1.66	1.82
	2-Methylnaphthalene (mg/kg)	3.89	DLHM 4.43	DLHM 6.70	3.16	3.42
	Naphthalene (mg/kg)	1.09	DLHM 1.34	DLHM 2.05	0.999	1.02
	Perylene (mg/kg)	0.010	DLHM 0.024	DLHM 0.029	0.014	0.017
	Phenanthrene (mg/kg)	1.98	DLHM 2.14	DLHM 2.87	1.36	1.51
	Pyrene (mg/kg)	0.245	DLHM 0.282	DLHM 0.336	0.153	0.188
	Quinoline (mg/kg)	<0.050	DLHM 0.022	DLHM <0.020	<0.050	<0.050
	Surrogate: d10-Acenaphthene (%)	82.3	85.4	84.1	77.4	84.7

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644275-1	L2644275-2	L2644275-3	L2644275-4	L2644275-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	16-SEP-21	16-SEP-21	16-SEP-21	16-SEP-21	16-SEP-21
	Sampled Time	08:45	09:30	12:00	12:50	13:30
	Client ID	RG_GANF_SE-4_2021-09-16_0845	RG_GANF_SE-5_2021-09-16_0930	RG_GAUT_SE-1_2021-09-16_1200	RG_GAUT_SE-2_2021-09-16_1250	RG_GAUT_SE-3_2021-09-16_1330
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Surrogate: d12-Chrysene (%)	124.6	117.1	97.3	99.9	115.7
	Surrogate: d8-Naphthalene (%)	102.4	96.1	79.9	87.0	99.3
	Surrogate: d10-Phenanthrene (%)	118.2	110.0	91.4	96.8	110.9
	IACR:Coarse	0.137	0.093	<0.050	<0.050	0.237
	IACR:Fine	0.263	0.180	<0.050	0.096	0.456
	B(a)P Total Potency Equivalent (mg/kg)	0.234	0.171	0.043	0.086	0.415
	IACR (CCME)	4.38	3.07	0.77	1.54	7.74
Exchangeable & Adsorbed Metals	Aluminum (Al)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	0.051	<0.050	<0.050	<0.050	0.052
	Barium (Ba)-Leachable (mg/kg)	29.5	17.6	36.0	41.0	69.9
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.055	<0.050	0.129	0.151	0.156
	Calcium (Ca)-Leachable (mg/kg)	5080	3150	2510	3230	8260
	Chromium (Cr)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Cobalt (Co)-Leachable (mg/kg)	0.23	0.19	<0.10	<0.10	0.59
	Copper (Cu)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Iron (Fe)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Lead (Pb)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	106	72.5	4.8	7.7	227
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	0.51	<0.50	<0.50	0.52	1.17
	Phosphorus (P)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Potassium (K)-Leachable (mg/kg)	150	150	140	140	170
	Selenium (Se)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Sodium (Na)-Leachable (mg/kg)	<100	<100	<100	<100	<100
	Strontium (Sr)-Leachable (mg/kg)	10.9	7.53	10.5	12.6	30.0
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Uranium (U)-Leachable (mg/kg)	0.051	<0.050	<0.050	<0.050	<0.050
	Vanadium (V)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Zinc (Zn)-Leachable (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644275-6	L2644275-7	L2644275-8	L2644275-9	L2644275-10
	Description	SE	SE	SE	SE	SE
	Sampled Date	16-SEP-21	16-SEP-21	15-SEP-21	15-SEP-21	15-SEP-21
	Sampled Time	14:30	15:00	13:30	14:20	15:15
	Client ID	RG_GAUT_SE-4_2021-09-16_1430	RG_GAUT_SE-5_2021-09-16_1500	RG_GANF-SE-1_2021-09-15_1330	RG_GANF-SE-2_2021-09-15_1420	RG_GANF-SE-2_2021-09-15_1420
Grouping	**Analyte**					
SOIL						
Polycyclic Aromatic Hydrocarbons	Surrogate: d12-Chrysene (%)	89.2	92.5	86.0	86.0	91.3
	Surrogate: d8-Naphthalene (%)	77.1	81.5	79.4	76.7	80.5
	Surrogate: d10-Phenanthrene (%)	85.3	89.7	84.3	82.1	88.1
	IACR:Coarse	0.104	0.101	0.137	0.052	0.067
	IACR:Fine	0.199	0.193	0.262	0.099	0.128
	B(a)P Total Potency Equivalent (mg/kg)	0.174	0.167	0.237	0.080	0.117
	IACR (CCME)	3.16	3.11	4.02	1.54	2.06
Exchangeable & Adsorbed Metals	Aluminum (Al)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	<0.050	<0.050	0.053	<0.050	0.055
	Barium (Ba)-Leachable (mg/kg)	53.8	57.7	28.7	23.0	27.5
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.150	0.194	0.054	<0.050	0.061
	Calcium (Ca)-Leachable (mg/kg)	4600	6650	4530	3680	4870
	Chromium (Cr)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Cobalt (Co)-Leachable (mg/kg)	0.49	0.33	0.27	0.23	0.28
	Copper (Cu)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Iron (Fe)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Lead (Pb)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	211	61.5	85.8	86.9	112
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	0.90	0.86	0.56	<0.50	0.51
	Phosphorus (P)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Potassium (K)-Leachable (mg/kg)	150	150	170	150	160
	Selenium (Se)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Sodium (Na)-Leachable (mg/kg)	<100	<100	<100	<100	<100
	Strontium (Sr)-Leachable (mg/kg)	18.4	23.9	9.72	7.72	10.5
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Uranium (U)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	0.050
	Vanadium (V)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Zinc (Zn)-Leachable (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644275-1	L2644275-2	L2644275-3	L2644275-4	L2644275-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	16-SEP-21	16-SEP-21	16-SEP-21	16-SEP-21	16-SEP-21
	Sampled Time	08:45	09:30	12:00	12:50	13:30
	Client ID	RG_GANF_SE-4_2021-09-16_0845	RG_GANF_SE-5_2021-09-16_0930	RG_GAUT_SE-1_2021-09-16_1200	RG_GAUT_SE-2_2021-09-16_1250	RG_GAUT_SE-3_2021-09-16_1330
Grouping	**Analyte**					
SOIL						
Carbonate Metals	Aluminum (Al)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	0.108	0.060	<0.050	<0.050	0.138
	Barium (Ba)-Leachable (mg/kg)	55.0	50.1	36.9	37.4	37.9
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.216	0.179	0.117	0.144	0.279
	Calcium (Ca)-Leachable (mg/kg)	47100	50400	1940	2470	3400
	Chromium (Cr)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Cobalt (Co)-Leachable (mg/kg)	0.79	0.67	0.41	0.50	1.44
	Copper (Cu)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Iron (Fe)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Lead (Pb)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	129	122	65.7	87.4	239
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	2.3	2.3	2.3	2.5	3.5
	Phosphorus (P)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Selenium (Se)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Strontium (Sr)-Leachable (mg/kg)	27.7	28.5	<5.0	6.5	7.5
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Uranium (U)-Leachable (mg/kg)	0.235	0.139	<0.050	<0.050	0.087
	Vanadium (V)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Zinc (Zn)-Leachable (mg/kg)	6.5	5.6	5.1	6.0	9.1
Easily Reducible Metals and Iron Oxides	Aluminum (Al)-Leachable (mg/kg)	408	374	645	656	658
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	0.377	0.417	0.368	0.395	0.644
	Barium (Ba)-Leachable (mg/kg)	45.0	66.8	41.0	44.6	69.8
	Beryllium (Be)-Leachable (mg/kg)	0.34	0.22	0.26	0.25	0.33
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.327	0.313	0.218	0.232	0.638
	Calcium (Ca)-Leachable (mg/kg)	29900	71700	2200	2270	3300
	Chromium (Cr)-Leachable (mg/kg)	0.63	0.62	1.09	0.82	0.59

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L2644275-6	L2644275-7	L2644275-8	L2644275-9	L2644275-10
	Description	SE	SE	SE	SE	SE
	Sampled Date	16-SEP-21	16-SEP-21	15-SEP-21	15-SEP-21	15-SEP-21
	Sampled Time	14:30	15:00	13:30	14:20	15:15
	Client ID	RG_GAUT_SE-4_2021-09-16_1430	RG_GAUT_SE-5_2021-09-16_1500	RG_GANF-SE-1_2021-09-15_1330	RG_GANF-SE-2_2021-09-15_1420	RG_GANF-SE-2_2021-09-15_1420
SOIL						
Carbonate Metals	Aluminum (Al)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	0.064	<0.050	0.073	0.051	0.104
	Barium (Ba)-Leachable (mg/kg)	36.8	38.3	57.7	55.3	57.6
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.171	0.194	0.244	0.233	0.218
	Calcium (Ca)-Leachable (mg/kg)	2510	2970	46900	48500	50000
	Chromium (Cr)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Cobalt (Co)-Leachable (mg/kg)	1.04	1.06	0.91	0.78	0.90
	Copper (Cu)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Iron (Fe)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Lead (Pb)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	187	162	148	134	135
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	2.6	2.7	2.8	2.5	2.3
	Phosphorus (P)-Leachable (mg/kg)	<50	<50	<50	<50	<50
	Selenium (Se)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Strontium (Sr)-Leachable (mg/kg)	5.7	6.5	26.8	27.1	28.2
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Uranium (U)-Leachable (mg/kg)	0.062	0.058	0.188	0.147	0.230
	Vanadium (V)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Zinc (Zn)-Leachable (mg/kg)	6.1	7.4	7.6	6.5	7.1
Easily Reducible Metals and Iron Oxides	Aluminum (Al)-Leachable (mg/kg)	685	687	404	425	392
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	0.512	0.520	0.406	0.281	0.421
	Barium (Ba)-Leachable (mg/kg)	56.7	66.5	50.7	40.4	47.3
	Beryllium (Be)-Leachable (mg/kg)	0.32	0.33	0.27	0.26	0.30
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.397	0.452	0.358	0.287	0.325
	Calcium (Ca)-Leachable (mg/kg)	2970	3030	37500	24600	33100
	Chromium (Cr)-Leachable (mg/kg)	0.70	0.61	0.57	0.66	0.54

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644275-1	L2644275-2	L2644275-3	L2644275-4	L2644275-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	16-SEP-21	16-SEP-21	16-SEP-21	16-SEP-21	16-SEP-21
	Sampled Time	08:45	09:30	12:00	12:50	13:30
	Client ID	RG_GANF_SE-4_2021-09-16_0845	RG_GANF_SE-5_2021-09-16_0930	RG_GAUT_SE-1_2021-09-16_1200	RG_GAUT_SE-2_2021-09-16_1250	RG_GAUT_SE-3_2021-09-16_1330
Grouping	**Analyte**					
SOIL						
Easily Reducible Metals and Iron Oxides	Cobalt (Co)-Leachable (mg/kg)	2.43	2.77	6.65	7.01	5.07
	Copper (Cu)-Leachable (mg/kg)	<0.50	<0.50	0.51	<0.50	<0.50
	Iron (Fe)-Leachable (mg/kg)	2380	2230	3990	3960	4480
	Lead (Pb)-Leachable (mg/kg)	2.65	3.36	3.29	2.96	1.92
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	111	148	326	301	224
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	7.86	7.89	13.7	13.8	17.4
	Phosphorus (P)-Leachable (mg/kg)	83	66	129	125	107
	Selenium (Se)-Leachable (mg/kg)	0.37	0.26	<0.20	<0.20	0.36
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Strontium (Sr)-Leachable (mg/kg)	18.1	39.9	4.91	5.45	7.78
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Uranium (U)-Leachable (mg/kg)	0.256	0.233	0.107	0.103	0.188
	Vanadium (V)-Leachable (mg/kg)	1.66	1.76	2.73	2.66	2.41
	Zinc (Zn)-Leachable (mg/kg)	25.3	22.5	25.7	27.1	38.6
Organic Bound Metals	Aluminum (Al)-Leachable (mg/kg)	1740	1160	1270	1530	3150
	Antimony (Sb)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	0.30
	Arsenic (As)-Leachable (mg/kg)	0.599	0.323	0.155	0.248	1.36
	Barium (Ba)-Leachable (mg/kg)	22.6	20.4	15.8	18.1	39.4
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.074	0.057	<0.050	<0.050	0.137
	Calcium (Ca)-Leachable (mg/kg)	2640	2470	898	935	1550
	Chromium (Cr)-Leachable (mg/kg)	4.22	2.31	2.04	2.62	5.66
	Cobalt (Co)-Leachable (mg/kg)	1.41	0.90	0.95	1.18	2.76
	Copper (Cu)-Leachable (mg/kg)	7.30	4.75	1.99	3.10	14.4
	Iron (Fe)-Leachable (mg/kg)	2900	1800	1090	1500	5440
	Lead (Pb)-Leachable (mg/kg)	1.38	<0.50	0.77	0.96	3.89
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	12.3	8.6	23.9	24.1	33.8
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	9.67	5.70	4.60	5.59	19.3
	Selenium (Se)-Leachable (mg/kg)	2.52	1.00	0.45	0.61	2.50

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644275-6	L2644275-7	L2644275-8	L2644275-9	L2644275-10
	Description	SE	SE	SE	SE	SE
	Sampled Date	16-SEP-21	16-SEP-21	15-SEP-21	15-SEP-21	15-SEP-21
	Sampled Time	14:30	15:00	13:30	14:20	15:15
	Client ID	RG_GAUT_SE-4_2021-09-16_1430	RG_GAUT_SE-5_2021-09-16_1500	RG_GANF-SE-1_2021-09-15_1330	RG_GANF-SE-2_2021-09-15_1420	RG_GANF-SE-2_2021-09-15_1420
Grouping	**Analyte**					
SOIL						
Easily Reducible Metals and Iron Oxides	Cobalt (Co)-Leachable (mg/kg)	5.68	6.14	2.51	2.91	2.17
	Copper (Cu)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Iron (Fe)-Leachable (mg/kg)	4280	4320	2480	2640	2320
	Lead (Pb)-Leachable (mg/kg)	2.62	2.28	2.99	2.97	2.77
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	286	292	132	169	98.1
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	14.8	17.2	8.73	8.48	7.46
	Phosphorus (P)-Leachable (mg/kg)	127	129	63	58	52
	Selenium (Se)-Leachable (mg/kg)	<0.20	0.21	0.40	0.21	0.36
	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Strontium (Sr)-Leachable (mg/kg)	6.47	7.34	21.7	15.2	20.1
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0
	Uranium (U)-Leachable (mg/kg)	0.141	0.174	0.209	0.160	0.247
	Vanadium (V)-Leachable (mg/kg)	2.58	2.43	1.84	1.82	1.68
	Zinc (Zn)-Leachable (mg/kg)	32.1	34.0	27.7	25.3	24.4
Organic Bound Metals	Aluminum (Al)-Leachable (mg/kg)	2030	2570	1570	1410	1700
	Antimony (Sb)-Leachable (mg/kg)	<0.10	0.10	<0.10	<0.10	<0.10
	Arsenic (As)-Leachable (mg/kg)	0.573	0.855	0.498	0.407	0.556
	Barium (Ba)-Leachable (mg/kg)	24.2	32.7	21.6	21.0	22.4
	Beryllium (Be)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.065	0.087	0.071	0.061	0.074
	Calcium (Ca)-Leachable (mg/kg)	1230	1260	2620	2060	2730
	Chromium (Cr)-Leachable (mg/kg)	3.73	4.59	3.30	2.95	4.11
	Cobalt (Co)-Leachable (mg/kg)	1.49	2.21	1.34	1.06	1.31
	Copper (Cu)-Leachable (mg/kg)	6.79	9.77	6.65	4.80	7.36
	Iron (Fe)-Leachable (mg/kg)	2560	3750	2630	2060	2860
	Lead (Pb)-Leachable (mg/kg)	1.55	2.51	0.95	0.76	1.16
	Lithium (Li)-Leachable (mg/kg)	<5.0	<5.0	<5.0	<5.0	<5.0
	Manganese (Mn)-Leachable (mg/kg)	25.7	32.0	11.9	12.2	10.9
	Molybdenum (Mo)-Leachable (mg/kg)	<0.50	<0.50	<0.50	<0.50	<0.50
	Nickel (Ni)-Leachable (mg/kg)	8.59	13.5	8.58	6.53	9.11
	Selenium (Se)-Leachable (mg/kg)	1.09	1.66	2.10	1.43	2.35

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2644275-1	L2644275-2	L2644275-3	L2644275-4	L2644275-5
	Description	SE	SE	SE	SE	SE
	Sampled Date	16-SEP-21	16-SEP-21	16-SEP-21	16-SEP-21	16-SEP-21
	Sampled Time	08:45	09:30	12:00	12:50	13:30
	Client ID	RG_GANF_SE-4_2021-09-16_0845	RG_GANF_SE-5_2021-09-16_0930	RG_GAUT_SE-1_2021-09-16_1200	RG_GAUT_SE-2_2021-09-16_1250	RG_GAUT_SE-3_2021-09-16_1330
Grouping	**Analyte**					
SOIL						
Organic Bound Metals	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Strontium (Sr)-Leachable (mg/kg)	6.05	5.07	4.37	4.35	6.28
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	25.4	17.6	<1.0	1.2	1.3
	Uranium (U)-Leachable (mg/kg)	0.273	0.163	0.175	0.206	0.457
	Vanadium (V)-Leachable (mg/kg)	4.44	3.05	2.27	3.34	7.85
	Zinc (Zn)-Leachable (mg/kg)	7.5	4.5	4.7	5.6	23.8
Residual Metals	Aluminum (Al)-Leachable (mg/kg)	5960	5530	8250	8660	7140
	Antimony (Sb)-Leachable (mg/kg)	0.92	0.73	0.71	0.95	1.76
	Arsenic (As)-Leachable (mg/kg)	3.24	3.23	5.71	5.62	3.23
	Barium (Ba)-Leachable (mg/kg)	113	93.0	118	128	127
	Beryllium (Be)-Leachable (mg/kg)	0.25	0.23	0.36	0.35	0.30
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.061	0.057	0.096	0.086	0.069
	Calcium (Ca)-Leachable (mg/kg)	436	589	1010	812	149
	Chromium (Cr)-Leachable (mg/kg)	8.1	7.6	11.4	11.1	9.6
	Cobalt (Co)-Leachable (mg/kg)	2.06	2.11	3.49	3.37	1.95
	Copper (Cu)-Leachable (mg/kg)	8.93	8.77	12.9	13.0	11.1
	Iron (Fe)-Leachable (mg/kg)	7670	8740	16400	14700	6510
	Lead (Pb)-Leachable (mg/kg)	5.21	4.21	7.90	8.27	6.40
	Lithium (Li)-Leachable (mg/kg)	5.2	5.2	8.6	8.2	6.0
	Manganese (Mn)-Leachable (mg/kg)	28.6	33.4	61.9	55.4	24.7
	Molybdenum (Mo)-Leachable (mg/kg)	0.62	0.52	1.02	0.97	0.77
	Nickel (Ni)-Leachable (mg/kg)	7.8	8.0	13.9	13.3	8.1
	Selenium (Se)-Leachable (mg/kg)	0.51	0.34	0.39	0.39	0.50
	Silver (Ag)-Leachable (mg/kg)	0.25	0.14	<0.10	<0.10	0.43
	Strontium (Sr)-Leachable (mg/kg)	15.1	13.8	18.4	18.5	18.2
	Thallium (Tl)-Leachable (mg/kg)	0.143	0.106	0.138	0.152	0.163
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	13.2	11.0	13.8	17.1	22.4
	Uranium (U)-Leachable (mg/kg)	0.212	0.214	0.355	0.335	0.226
	Vanadium (V)-Leachable (mg/kg)	19.1	16.8	25.4	26.1	23.3
	Zinc (Zn)-Leachable (mg/kg)	46.0	45.0	72.1	72.1	41.5

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID		L2644275-6	L2644275-7	L2644275-8	L2644275-9	L2644275-10
Description		SE	SE	SE	SE	SE
Sampled Date		16-SEP-21	16-SEP-21	15-SEP-21	15-SEP-21	15-SEP-21
Sampled Time		14:30	15:00	13:30	14:20	15:15
Client ID		RG_GAUT_SE-4_2021-09-16_1430	RG_GAUT_SE-5_2021-09-16_1500	RG_GANF-SE-1_2021-09-15_1330	RG_GANF-SE-2_2021-09-15_1420	RG_GANF-SE-2_2021-09-15_1420
Grouping	**Analyte**					
SOIL						
Organic Bound Metals	Silver (Ag)-Leachable (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Strontium (Sr)-Leachable (mg/kg)	5.30	5.48	5.84	5.45	6.07
	Thallium (Tl)-Leachable (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	1.5	<1.0	23.1	17.1	27.0
	Uranium (U)-Leachable (mg/kg)	0.324	0.376	0.226	0.211	0.267
	Vanadium (V)-Leachable (mg/kg)	4.61	6.17	4.04	3.73	4.26
	Zinc (Zn)-Leachable (mg/kg)	9.4	13.5	7.1	5.7	7.5
Residual Metals	Aluminum (Al)-Leachable (mg/kg)	7600	7630	7190	6510	5380
	Antimony (Sb)-Leachable (mg/kg)	1.17	1.64	1.05	0.93	0.89
	Arsenic (As)-Leachable (mg/kg)	5.13	4.60	3.49	4.24	2.91
	Barium (Ba)-Leachable (mg/kg)	122	122	118	114	107
	Beryllium (Be)-Leachable (mg/kg)	0.31	0.35	0.31	0.31	0.26
	Bismuth (Bi)-Leachable (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)-Leachable (mg/kg)	0.096	0.078	0.070	0.080	0.057
	Calcium (Ca)-Leachable (mg/kg)	506	293	547	703	463
	Chromium (Cr)-Leachable (mg/kg)	10.3	10.4	9.8	8.8	7.4
	Cobalt (Co)-Leachable (mg/kg)	3.09	2.72	2.33	2.59	1.94
	Copper (Cu)-Leachable (mg/kg)	13.2	12.6	9.87	10.7	8.55
	Iron (Fe)-Leachable (mg/kg)	11800	10500	9010	10400	7180
	Lead (Pb)-Leachable (mg/kg)	8.08	7.78	5.40	5.87	4.72
	Lithium (Li)-Leachable (mg/kg)	6.5	6.5	6.2	6.2	<5.0
	Manganese (Mn)-Leachable (mg/kg)	46.6	38.6	34.5	38.3	26.3
	Molybdenum (Mo)-Leachable (mg/kg)	0.93	0.95	0.62	0.66	0.58
	Nickel (Ni)-Leachable (mg/kg)	12.2	10.9	8.9	9.7	7.5
	Selenium (Se)-Leachable (mg/kg)	0.44	0.47	0.54	0.46	0.49
	Silver (Ag)-Leachable (mg/kg)	0.20	0.31	0.25	0.15	0.26
	Strontium (Sr)-Leachable (mg/kg)	17.9	17.7	16.2	16.0	15.7
	Thallium (Tl)-Leachable (mg/kg)	0.147	0.155	0.153	0.137	0.132
	Tin (Sn)-Leachable (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)-Leachable (mg/kg)	19.4	19.2	15.5	13.7	11.4
	Uranium (U)-Leachable (mg/kg)	0.304	0.261	0.243	0.274	0.215
	Vanadium (V)-Leachable (mg/kg)	24.9	24.7	22.2	19.9	16.9
	Zinc (Zn)-Leachable (mg/kg)	67.6	59.7	52.0	54.8	43.6

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Additional Comments for Sample Listed:

Samplenum	Matrix	Report Remarks	Sample Comments
L2644275-10	Soil	Note: Watery Sample	
L2644275-2	Soil	Note: Watery sample	
L2644275-3	Soil	Note: Watery sample	
L2644275-6	Soil	Note: Watery sample	
L2644275-9	Soil	Note: Watery Sample	

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Copper (Cu)-Leachable	B	L2644275-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Manganese (Mn)-Leachable	DUP-H	L2644275-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Dibenz(a,h)anthracene	DUP-H	L2644275-10, -4, -5, -6, -7, -8, -9
Duplicate	Pyrene	DUP-H,J	L2644275-10, -4, -5, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
DLHM	Detection Limit Adjusted: Sample has High Moisture Content
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
DUP-H,J	Duplicate results outside ALS DQO, due to sample heterogeneity. Duplicate results and limits are expressed in terms of absolute difference.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
C-TIC-PCT-SK	Soil	Total Inorganic Carbon in Soil	CSSS (2008) P216-217

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.

C-TOC-CALC-SK	Soil	Total Organic Carbon Calculation	CSSS (2008) 21.2

Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon. (TIC)

C-TOT-LECO-SK	Soil	Total Carbon by combustion method	CSSS (2008) 21.2

The sample is ignited in a combustion analyzer where carbon in the reduced CO2 gas is determined using a thermal conductivity detector.

HG-200.2-CVAA-CL	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

IC-CACO3-CALC-SK	Soil	Inorganic Carbon as CaCO3 Equivalent	Calculation
MET-200.2-CCMS-CL	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

MET-TESS-CM-CCMS-VA	Soil	METALS BY CCMS (TESSIER EXTRACTION #2)	Tessier Extraction 1979/EPA 6020A

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 inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Note: For Extraction #2, the extraction solution is 1M Sodium Acetate adjusted to pH 5 and is intended to extract the "Carbonate" metals.

MET-TESS-EA-CCMS-VA	Soil	METALS BY CCMS (TESSIER EXTRACTION #1)	Tessier Extraction 1979/EPA 6020A

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

Reference Information

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 inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

Note: For Extraction #1, the extraction solution is 1M Magnesium Chloride and is intended to extract the "Exchangeable and Adsorbed" metals.

MET-TESS-FEO-CCMS-VA Soil METALS BY CCMS (TESSIER EXTRACTION #3) Tessier Extraction 1979/EPA 6020A

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 inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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 .

MET-TESS-OB-CCMS-VA Soil METALS BY CCMS (TESSIER EXTRACTION #4) Tessier Extraction 1979/EPA 6020A

"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 inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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.

MET-TESS-RM-CCMS-VA Soil METALS BY CCMS (TESSIER RM EXTRACTION) Tessier Extraction 1979/EPA 6020A

"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 collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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.

MOISTURE-CL Soil % Moisture CCME PHC in Soil - Tier 1 (mod)

This analysis is carried out gravimetrically by drying the sample at 105 C

PAH-TMB-H/A-MS-CL Soil PAH Tumbler Extraction (Hexane/Acetone) EPA 3570/8270-GC/MS

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Methods 3545 & 8270, published by the United States Environmental Protection Agency (EPA). The procedure uses a mechanical shaking technique to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone. The extract is then solvent exchanged to toluene. The final extract is analysed by capillary column gas chromatography with mass spectrometric detection (GC/MS). Surrogate recoveries may not be reported in cases where interferences from the sample matrix prevent accurate quantitation. Because the two isomers cannot be readily chromatographically separated, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.

PH-1:2-CL Soil pH in soil (1:2 Soil:Water Extraction) CSSS Ch. 16

Soil and de-ionized water (by volume) are mixed in a defined ratio. The slurry is allowed to stand, shaken, and then allowed to stand again prior to taking measurements. After equilibration, the pH of the liquid portion of the extract is measured by a pH meter. Field Measurement is recommended where accurate pH measurements are required, due to the 15 minute recommended hold time.

PSA-PIPET-DETAIL-SK Soil Particle size - Sieve and Pipette SSIR-51 METHOD 3.2.1

Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

September GGCAMP

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour 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.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: Teck Coal Ltd.
421 Pine Avenue
Sparwood BC V0B 2G0

Contact: Allie Ferguson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-TIC-PCT-SK	**Soil**							
Batch R5614542								
WG3630730-1 DUP		**L2644275-6**						
Inorganic Carbon		0.316	0.332		%	4.9	20	08-OCT-21
WG3630730-4 IRM		**08-109_SOIL**						
Inorganic Carbon			94.5		%		80-120	08-OCT-21
WG3630730-2 LCS		**0.5**						
Inorganic Carbon			95.5		%		90-110	08-OCT-21
WG3630730-3 MB								
Inorganic Carbon			<0.050		%		0.05	08-OCT-21
C-TOT-LECO-SK	**Soil**							
Batch R5608937								
WG3627089-2 IRM		**08-109_SOIL**						
Total Carbon by Combustion			106.7		%		80-120	04-OCT-21
WG3627089-4 LCS		**SULFADIAZINE**						
Total Carbon by Combustion			103.7		%		90-110	04-OCT-21
WG3627089-3 MB								
Total Carbon by Combustion			<0.05		%		0.05	04-OCT-21
Batch R5614538								
WG3631664-3 IRM		**08-109_SOIL**						
Total Carbon by Combustion			95.3		%		80-120	06-OCT-21
WG3631664-5 LCS		**SULFADIAZINE**						
Total Carbon by Combustion			99.2		%		90-110	06-OCT-21
WG3631664-4 MB								
Total Carbon by Combustion			<0.05		%		0.05	06-OCT-21
HG-200.2-CVAA-CL	**Soil**							
Batch R5621116								
WG3639020-4 CRM		**TILL-2**						
Mercury (Hg)			105.8		%		70-130	16-OCT-21
WG3639020-3 LCS								
Mercury (Hg)			97.5		%		80-120	16-OCT-21
WG3639020-2 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	16-OCT-21
MET-200.2-CCMS-CL	**Soil**							
Batch R5621400								
WG3639020-4 CRM		**TILL-2**						
Aluminum (Al)			84.7		%		70-130	16-OCT-21
Antimony (Sb)			93.3		%		70-130	16-OCT-21
Arsenic (As)			96.3		%		70-130	16-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-CL	**Soil**							
Batch R5621400								
WG3639020-4 CRM		**TILL-2**						
Barium (Ba)			92.3		%		70-130	16-OCT-21
Beryllium (Be)			95.4		%		70-130	16-OCT-21
Bismuth (Bi)			98.3		%		70-130	16-OCT-21
Cadmium (Cd)			93.5		%		70-130	16-OCT-21
Calcium (Ca)			88.4		%		70-130	16-OCT-21
Chromium (Cr)			98.6		%		70-130	16-OCT-21
Cobalt (Co)			93.6		%		70-130	16-OCT-21
Copper (Cu)			94.6		%		70-130	16-OCT-21
Iron (Fe)			95.6		%		70-130	16-OCT-21
Lead (Pb)			98.1		%		70-130	16-OCT-21
Lithium (Li)			95.0		%		70-130	16-OCT-21
Magnesium (Mg)			89.6		%		70-130	16-OCT-21
Manganese (Mn)			88.7		%		70-130	16-OCT-21
Molybdenum (Mo)			93.3		%		70-130	16-OCT-21
Nickel (Ni)			96.9		%		70-130	16-OCT-21
Phosphorus (P)			95.7		%		70-130	16-OCT-21
Potassium (K)			89.7		%		70-130	16-OCT-21
Selenium (Se)			0.29		mg/kg		0.15-0.55	16-OCT-21
Silver (Ag)			0.26		mg/kg		0.16-0.36	16-OCT-21
Sodium (Na)			106.5		%		70-130	16-OCT-21
Strontium (Sr)			92.5		%		70-130	16-OCT-21
Thallium (Tl)			98.1		%		70-130	16-OCT-21
Tin (Sn)			2.1		mg/kg		0.2-4.2	16-OCT-21
Titanium (Ti)			89.8		%		70-130	16-OCT-21
Tungsten (W)			1.35		mg/kg		1-2	16-OCT-21
Uranium (U)			93.3		%		70-130	16-OCT-21
Vanadium (V)			94.3		%		70-130	16-OCT-21
Zinc (Zn)			93.4		%		70-130	16-OCT-21
Zirconium (Zr)			100.1		%		70-130	16-OCT-21
WG3639020-3 LCS								
Aluminum (Al)			100.9		%		80-120	16-OCT-21
Antimony (Sb)			87.8		%		80-120	16-OCT-21
Arsenic (As)			107.1		%		80-120	16-OCT-21
Barium (Ba)			106.7		%		80-120	16-OCT-21

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-CL	**Soil**							
Batch R5621400								
WG3639020-3 LCS								
Beryllium (Be)			106.9		%		80-120	16-OCT-21
Bismuth (Bi)			107.9		%		80-120	16-OCT-21
Boron (B)			112.6		%		80-120	16-OCT-21
Cadmium (Cd)			108.7		%		80-120	16-OCT-21
Calcium (Ca)			97.2		%		80-120	16-OCT-21
Chromium (Cr)			108.9		%		80-120	16-OCT-21
Cobalt (Co)			108.5		%		80-120	16-OCT-21
Copper (Cu)			105.1		%		80-120	16-OCT-21
Iron (Fe)			108.1		%		80-120	16-OCT-21
Lead (Pb)			106.4		%		80-120	16-OCT-21
Lithium (Li)			110.7		%		80-120	16-OCT-21
Magnesium (Mg)			101.3		%		80-120	16-OCT-21
Manganese (Mn)			105.3		%		80-120	16-OCT-21
Molybdenum (Mo)			107.9		%		80-120	16-OCT-21
Nickel (Ni)			106.1		%		80-120	16-OCT-21
Potassium (K)			105.7		%		80-120	16-OCT-21
Selenium (Se)			103.5		%		80-120	16-OCT-21
Silver (Ag)			113.5		%		80-120	16-OCT-21
Sodium (Na)			102.9		%		80-120	16-OCT-21
Strontium (Sr)			103.3		%		80-120	16-OCT-21
Sulfur (S)			110.1		%		80-120	16-OCT-21
Thallium (Tl)			108.1		%		80-120	16-OCT-21
Tin (Sn)			107.6		%		80-120	16-OCT-21
Titanium (Ti)			106.0		%		80-120	16-OCT-21
Tungsten (W)			111.5		%		80-120	16-OCT-21
Uranium (U)			108.7		%		80-120	16-OCT-21
Vanadium (V)			107.5		%		80-120	16-OCT-21
Zinc (Zn)			103.5		%		80-120	16-OCT-21
Zirconium (Zr)			113.2		%		80-120	16-OCT-21
WG3639020-2 MB								
Aluminum (Al)			<50		mg/kg		50	16-OCT-21
Antimony (Sb)			<0.10		mg/kg		0.1	16-OCT-21
Arsenic (As)			<0.10		mg/kg		0.1	16-OCT-21
Barium (Ba)			<0.50		mg/kg		0.5	16-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-CL	**Soil**							
Batch R5621400								
WG3639020-2 MB								
Beryllium (Be)			<0.10		mg/kg		0.1	16-OCT-21
Bismuth (Bi)			<0.20		mg/kg		0.2	16-OCT-21
Boron (B)			<5.0		mg/kg		5	16-OCT-21
Cadmium (Cd)			<0.020		mg/kg		0.02	16-OCT-21
Calcium (Ca)			<50		mg/kg		50	16-OCT-21
Chromium (Cr)			<0.50		mg/kg		0.5	16-OCT-21
Cobalt (Co)			<0.10		mg/kg		0.1	16-OCT-21
Copper (Cu)			<0.50		mg/kg		0.5	16-OCT-21
Iron (Fe)			<50		mg/kg		50	16-OCT-21
Lead (Pb)			<0.50		mg/kg		0.5	16-OCT-21
Lithium (Li)			<2.0		mg/kg		2	16-OCT-21
Magnesium (Mg)			<20		mg/kg		20	16-OCT-21
Manganese (Mn)			<1.0		mg/kg		1	16-OCT-21
Molybdenum (Mo)			<0.10		mg/kg		0.1	16-OCT-21
Nickel (Ni)			<0.50		mg/kg		0.5	16-OCT-21
Phosphorus (P)			<50		mg/kg		50	16-OCT-21
Potassium (K)			<100		mg/kg		100	16-OCT-21
Selenium (Se)			<0.20		mg/kg		0.2	16-OCT-21
Silver (Ag)			<0.10		mg/kg		0.1	16-OCT-21
Sodium (Na)			<50		mg/kg		50	16-OCT-21
Strontium (Sr)			<0.50		mg/kg		0.5	16-OCT-21
Sulfur (S)			<1000		mg/kg		1000	16-OCT-21
Thallium (Tl)			<0.050		mg/kg		0.05	16-OCT-21
Tin (Sn)			<2.0		mg/kg		2	16-OCT-21
Titanium (Ti)			<1.0		mg/kg		1	16-OCT-21
Tungsten (W)			<0.50		mg/kg		0.5	16-OCT-21
Uranium (U)			<0.050		mg/kg		0.05	16-OCT-21
Vanadium (V)			<0.20		mg/kg		0.2	16-OCT-21
Zinc (Zn)			<2.0		mg/kg		2	16-OCT-21
Zirconium (Zr)			<1.0		mg/kg		1	16-OCT-21
MET-TESS-CM-CCMS-VA	**Soil**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-CM-CCMS-VA	**Soil**							
Batch R5620077								
WG3629665-3 DUP		**L2644275-3**						
Aluminum (Al)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	28-OCT-21
Antimony (Sb)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	28-OCT-21
Arsenic (As)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	28-OCT-21
Barium (Ba)-Leachable		36.9	38.5		mg/kg	4.4	30	28-OCT-21
Beryllium (Be)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	28-OCT-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	28-OCT-21
Cadmium (Cd)-Leachable		0.117	0.110		mg/kg	6.5	30	28-OCT-21
Calcium (Ca)-Leachable		1940	1810		mg/kg	7.4	30	28-OCT-21
Chromium (Cr)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	28-OCT-21
Cobalt (Co)-Leachable		0.41	0.45		mg/kg	10	30	28-OCT-21
Copper (Cu)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	28-OCT-21
Iron (Fe)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	28-OCT-21
Lead (Pb)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	28-OCT-21
Lithium (Li)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	28-OCT-21
Manganese (Mn)-Leachable		65.7	67.6		mg/kg	2.8	30	28-OCT-21
Molybdenum (Mo)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	28-OCT-21
Nickel (Ni)-Leachable		2.3	2.5		mg/kg	6.6	30	28-OCT-21
Phosphorus (P)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	28-OCT-21
Selenium (Se)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	28-OCT-21
Silver (Ag)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	28-OCT-21
Strontium (Sr)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	28-OCT-21
Thallium (Tl)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	28-OCT-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	28-OCT-21
Titanium (Ti)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	28-OCT-21
Uranium (U)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	28-OCT-21
Vanadium (V)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	28-OCT-21
Zinc (Zn)-Leachable		5.1	5.2		mg/kg	2.9	30	28-OCT-21
WG3629665-2 LCS								
Aluminum (Al)-Leachable			100.1		%		70-130	28-OCT-21
Antimony (Sb)-Leachable			101.4		%		70-130	28-OCT-21
Arsenic (As)-Leachable			100.5		%		70-130	28-OCT-21
Barium (Ba)-Leachable			100.8		%		70-130	28-OCT-21
Beryllium (Be)-Leachable			99.8		%		70-130	28-OCT-21
Bismuth (Bi)-Leachable			90.7		%		70-130	28-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-CM-CCMS-VA	**Soil**							
Batch R5620077								
WG3629665-2 LCS								
Cadmium (Cd)-Leachable			96.9		%		70-130	28-OCT-21
Calcium (Ca)-Leachable			100.5		%		70-130	28-OCT-21
Chromium (Cr)-Leachable			97.7		%		70-130	28-OCT-21
Cobalt (Co)-Leachable			97.1		%		70-130	28-OCT-21
Copper (Cu)-Leachable			94.1		%		70-130	28-OCT-21
Iron (Fe)-Leachable			96.1		%		70-130	28-OCT-21
Lead (Pb)-Leachable			92.0		%		70-130	28-OCT-21
Lithium (Li)-Leachable			99.4		%		70-130	28-OCT-21
Manganese (Mn)-Leachable			95.3		%		70-130	28-OCT-21
Molybdenum (Mo)-Leachable			101.8		%		70-130	28-OCT-21
Nickel (Ni)-Leachable			93.8		%		70-130	28-OCT-21
Phosphorus (P)-Leachable			104.6		%		70-130	28-OCT-21
Selenium (Se)-Leachable			99.3		%		70-130	28-OCT-21
Silver (Ag)-Leachable			97.9		%		70-130	28-OCT-21
Strontium (Sr)-Leachable			104.5		%		70-130	28-OCT-21
Thallium (Tl)-Leachable			91.8		%		70-130	28-OCT-21
Tin (Sn)-Leachable			99.95		%		70-130	28-OCT-21
Titanium (Ti)-Leachable			99.5		%		70-130	28-OCT-21
Uranium (U)-Leachable			93.8		%		70-130	28-OCT-21
Vanadium (V)-Leachable			98.7		%		70-130	28-OCT-21
Zinc (Zn)-Leachable			100.4		%		70-130	28-OCT-21
WG3629665-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	28-OCT-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	28-OCT-21
Arsenic (As)-Leachable			<0.050		mg/kg		0.05	28-OCT-21
Barium (Ba)-Leachable			<2.0		mg/kg		2	28-OCT-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	28-OCT-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	28-OCT-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	28-OCT-21
Calcium (Ca)-Leachable			<50		mg/kg		50	28-OCT-21
Chromium (Cr)-Leachable			<5.0		mg/kg		5	28-OCT-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	28-OCT-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	28-OCT-21
Iron (Fe)-Leachable			<50		mg/kg		50	28-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-CM-CCMS-VA	**Soil**							
Batch R5620077								
WG3629665-1 MB								
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	28-OCT-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	28-OCT-21
Manganese (Mn)-Leachable			<5.0		mg/kg		5	28-OCT-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	28-OCT-21
Nickel (Ni)-Leachable			<2.0		mg/kg		2	28-OCT-21
Phosphorus (P)-Leachable			<50		mg/kg		50	28-OCT-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	28-OCT-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	28-OCT-21
Strontium (Sr)-Leachable			<5.0		mg/kg		5	28-OCT-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	28-OCT-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	28-OCT-21
Titanium (Ti)-Leachable			<5.0		mg/kg		5	28-OCT-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	28-OCT-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	28-OCT-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	28-OCT-21
MET-TESS-EA-CCMS-VA	**Soil**							
Batch R5616798								
WG3629665-3 DUP		**L2644275-3**						
Aluminum (Al)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	12-OCT-21
Antimony (Sb)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	12-OCT-21
Arsenic (As)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	12-OCT-21
Barium (Ba)-Leachable		36.0	36.8		mg/kg	2.3	30	12-OCT-21
Beryllium (Be)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	12-OCT-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	12-OCT-21
Cadmium (Cd)-Leachable		0.129	0.120		mg/kg	7.1	30	12-OCT-21
Calcium (Ca)-Leachable		2510	2510		mg/kg	0.0	30	12-OCT-21
Chromium (Cr)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	12-OCT-21
Cobalt (Co)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	12-OCT-21
Iron (Fe)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	12-OCT-21
Lead (Pb)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	12-OCT-21
Lithium (Li)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	12-OCT-21
Manganese (Mn)-Leachable		4.8	6.8	DUP-H	mg/kg	2.1	2	12-OCT-21
Molybdenum (Mo)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	12-OCT-21
Nickel (Ni)-Leachable		<0.50	0.50	RPD-NA	mg/kg	N/A	30	12-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-EA-CCMS-VA	**Soil**							
Batch R5616798								
WG3629665-3 DUP		**L2644275-3**						
Phosphorus (P)-Leachable		<50	<50	RPD-NA	mg/kg	N/A	30	12-OCT-21
Potassium (K)-Leachable		140	150		mg/kg	6.8	30	12-OCT-21
Selenium (Se)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	12-OCT-21
Silver (Ag)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	12-OCT-21
Sodium (Na)-Leachable		<100	<100	RPD-NA	mg/kg	N/A	30	12-OCT-21
Strontium (Sr)-Leachable		10.5	10.4		mg/kg	0.0	30	12-OCT-21
Thallium (Tl)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	12-OCT-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	12-OCT-21
Titanium (Ti)-Leachable		<1.0	<1.0	RPD-NA	mg/kg	N/A	30	12-OCT-21
Uranium (U)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	12-OCT-21
Vanadium (V)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	12-OCT-21
Zinc (Zn)-Leachable		<1.0	<1.0	RPD-NA	mg/kg	N/A	30	12-OCT-21
WG3629665-2 LCS								
Aluminum (Al)-Leachable			105.4		%		70-130	12-OCT-21
Antimony (Sb)-Leachable			103.3		%		70-130	12-OCT-21
Arsenic (As)-Leachable			100.9		%		70-130	12-OCT-21
Barium (Ba)-Leachable			100.7		%		70-130	12-OCT-21
Beryllium (Be)-Leachable			101.0		%		70-130	12-OCT-21
Bismuth (Bi)-Leachable			93.7		%		70-130	12-OCT-21
Cadmium (Cd)-Leachable			101.5		%		70-130	12-OCT-21
Calcium (Ca)-Leachable			100.9		%		70-130	12-OCT-21
Chromium (Cr)-Leachable			99.3		%		70-130	12-OCT-21
Cobalt (Co)-Leachable			98.2		%		70-130	12-OCT-21
Copper (Cu)-Leachable			95.2		%		70-130	12-OCT-21
Iron (Fe)-Leachable			99.2		%		70-130	12-OCT-21
Lead (Pb)-Leachable			95.4		%		70-130	12-OCT-21
Lithium (Li)-Leachable			111.8		%		70-130	12-OCT-21
Manganese (Mn)-Leachable			98.0		%		70-130	12-OCT-21
Molybdenum (Mo)-Leachable			101.9		%		70-130	12-OCT-21
Nickel (Ni)-Leachable			94.5		%		70-130	12-OCT-21
Phosphorus (P)-Leachable			104.1		%		70-130	12-OCT-21
Potassium (K)-Leachable			98.2		%		70-130	12-OCT-21
Selenium (Se)-Leachable			97.4		%		70-130	12-OCT-21
Silver (Ag)-Leachable			99.8		%		70-130	12-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-EA-CCMS-VA	**Soil**							
Batch R5616798								
WG3629665-2 LCS								
Sodium (Na)-Leachable			105.5		%		70-130	12-OCT-21
Strontium (Sr)-Leachable			100.6		%		70-130	12-OCT-21
Thallium (Tl)-Leachable			93.6		%		70-130	12-OCT-21
Tin (Sn)-Leachable			101.2		%		70-130	12-OCT-21
Titanium (Ti)-Leachable			101.1		%		70-130	12-OCT-21
Uranium (U)-Leachable			98.8		%		70-130	12-OCT-21
Vanadium (V)-Leachable			102.5		%		70-130	12-OCT-21
Zinc (Zn)-Leachable			96.1		%		70-130	12-OCT-21
WG3629665-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	12-OCT-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	12-OCT-21
Arsenic (As)-Leachable			<0.050		mg/kg		0.05	12-OCT-21
Barium (Ba)-Leachable			<0.50		mg/kg		0.5	12-OCT-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	12-OCT-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	12-OCT-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	12-OCT-21
Calcium (Ca)-Leachable			<50		mg/kg		50	12-OCT-21
Chromium (Cr)-Leachable			<0.50		mg/kg		0.5	12-OCT-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	12-OCT-21
Iron (Fe)-Leachable			<50		mg/kg		50	12-OCT-21
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	12-OCT-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	12-OCT-21
Manganese (Mn)-Leachable			<1.0		mg/kg		1	12-OCT-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	12-OCT-21
Nickel (Ni)-Leachable			<0.50		mg/kg		0.5	12-OCT-21
Phosphorus (P)-Leachable			<50		mg/kg		50	12-OCT-21
Potassium (K)-Leachable			<100		mg/kg		100	12-OCT-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	12-OCT-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	12-OCT-21
Sodium (Na)-Leachable			<100		mg/kg		100	12-OCT-21
Strontium (Sr)-Leachable			<0.50		mg/kg		0.5	12-OCT-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	12-OCT-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	12-OCT-21
Titanium (Ti)-Leachable			<1.0		mg/kg		1	12-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-EA-CCMS-VA	**Soil**							
Batch R5616798								
WG3629665-1 MB								
Uranium (U)-Leachable			<0.050		mg/kg		0.05	12-OCT-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	12-OCT-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	12-OCT-21
Batch R5620077								
WG3629665-1 MB								
Copper (Cu)-Leachable			1.18	B	mg/kg		0.5	12-OCT-21
Batch R5620406								
WG3629665-3 DUP		**L2644275-3**						
Copper (Cu)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	15-OCT-21
MET-TESS-FEO-CCMS-VA	**Soil**							
Batch R5622597								
WG3629665-3 DUP		**L2644275-3**						
Aluminum (Al)-Leachable		645	604		mg/kg	6.5	30	18-OCT-21
Antimony (Sb)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	18-OCT-21
Arsenic (As)-Leachable		0.368	0.351		mg/kg	4.6	30	18-OCT-21
Barium (Ba)-Leachable		41.0	39.9		mg/kg	2.7	30	18-OCT-21
Beryllium (Be)-Leachable		0.26	0.25		mg/kg	5.9	30	18-OCT-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	18-OCT-21
Cadmium (Cd)-Leachable		0.218	0.208		mg/kg	4.7	30	18-OCT-21
Calcium (Ca)-Leachable		2200	1940		mg/kg	12	30	18-OCT-21
Chromium (Cr)-Leachable		1.09	0.96		mg/kg	12	30	18-OCT-21
Cobalt (Co)-Leachable		6.65	6.47		mg/kg	2.7	30	18-OCT-21
Copper (Cu)-Leachable		0.51	0.53		mg/kg	4.5	30	18-OCT-21
Iron (Fe)-Leachable		3990	3950		mg/kg	1.0	30	18-OCT-21
Lead (Pb)-Leachable		3.29	3.30		mg/kg	0.4	30	18-OCT-21
Lithium (Li)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	18-OCT-21
Manganese (Mn)-Leachable		326	321		mg/kg	1.4	30	18-OCT-21
Molybdenum (Mo)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	18-OCT-21
Nickel (Ni)-Leachable		13.7	13.2		mg/kg	3.6	30	18-OCT-21
Phosphorus (P)-Leachable		129	126		mg/kg	2.5	30	18-OCT-21
Selenium (Se)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	18-OCT-21
Silver (Ag)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	18-OCT-21
Strontium (Sr)-Leachable		4.91	4.69		mg/kg	4.7	30	18-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-FEO-CCMS-VA	**Soil**							
Batch R5622597								
WG3629665-3 DUP		**L2644275-3**						
Thallium (Tl)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	18-OCT-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	18-OCT-21
Titanium (Ti)-Leachable		<1.0	<1.0	RPD-NA	mg/kg	N/A	30	18-OCT-21
Uranium (U)-Leachable		0.107	0.094		mg/kg	13	30	18-OCT-21
Vanadium (V)-Leachable		2.73	2.60		mg/kg	4.8	30	18-OCT-21
Zinc (Zn)-Leachable		25.7	24.9		mg/kg	3.2	30	18-OCT-21
WG3629665-2 LCS								
Aluminum (Al)-Leachable			101.3		%		70-130	18-OCT-21
Antimony (Sb)-Leachable			102.7		%		70-130	18-OCT-21
Arsenic (As)-Leachable			103.6		%		70-130	18-OCT-21
Barium (Ba)-Leachable			100.8		%		70-130	18-OCT-21
Beryllium (Be)-Leachable			101.8		%		70-130	18-OCT-21
Bismuth (Bi)-Leachable			99.7		%		70-130	18-OCT-21
Cadmium (Cd)-Leachable			104.3		%		70-130	18-OCT-21
Calcium (Ca)-Leachable			100.4		%		70-130	18-OCT-21
Chromium (Cr)-Leachable			102.1		%		70-130	18-OCT-21
Cobalt (Co)-Leachable			100.1		%		70-130	18-OCT-21
Copper (Cu)-Leachable			99.7		%		70-130	18-OCT-21
Iron (Fe)-Leachable			99.4		%		70-130	18-OCT-21
Lead (Pb)-Leachable			100.3		%		70-130	18-OCT-21
Lithium (Li)-Leachable			102.3		%		70-130	18-OCT-21
Manganese (Mn)-Leachable			98.4		%		70-130	18-OCT-21
Molybdenum (Mo)-Leachable			100.2		%		70-130	18-OCT-21
Nickel (Ni)-Leachable			100.5		%		70-130	18-OCT-21
Phosphorus (P)-Leachable			106.9		%		70-130	18-OCT-21
Selenium (Se)-Leachable			119.3		%		70-130	18-OCT-21
Silver (Ag)-Leachable			100.5		%		70-130	18-OCT-21
Strontium (Sr)-Leachable			99.1		%		70-130	18-OCT-21
Thallium (Tl)-Leachable			102.5		%		70-130	18-OCT-21
Tin (Sn)-Leachable			100.9		%		70-130	18-OCT-21
Titanium (Ti)-Leachable			96.1		%		70-130	18-OCT-21
Uranium (U)-Leachable			101.4		%		70-130	18-OCT-21
Vanadium (V)-Leachable			100.8		%		70-130	18-OCT-21
Zinc (Zn)-Leachable			101.3		%		70-130	18-OCT-21
WG3629665-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-FEO-CCMS-VA	**Soil**							
Batch R5622597								
WG3629665-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	18-OCT-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	18-OCT-21
Arsenic (As)-Leachable			<0.050		mg/kg		0.05	18-OCT-21
Barium (Ba)-Leachable			<0.50		mg/kg		0.5	18-OCT-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	18-OCT-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	18-OCT-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	18-OCT-21
Calcium (Ca)-Leachable			<50		mg/kg		50	18-OCT-21
Chromium (Cr)-Leachable			<0.50		mg/kg		0.5	18-OCT-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	18-OCT-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	18-OCT-21
Iron (Fe)-Leachable			<50		mg/kg		50	18-OCT-21
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	18-OCT-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	18-OCT-21
Manganese (Mn)-Leachable			<1.0		mg/kg		1	18-OCT-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	18-OCT-21
Nickel (Ni)-Leachable			<0.50		mg/kg		0.5	18-OCT-21
Phosphorus (P)-Leachable			<50		mg/kg		50	18-OCT-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	18-OCT-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	18-OCT-21
Strontium (Sr)-Leachable			<0.50		mg/kg		0.5	18-OCT-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	18-OCT-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	18-OCT-21
Titanium (Ti)-Leachable			<1.0		mg/kg		1	18-OCT-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	18-OCT-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	18-OCT-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	18-OCT-21
MET-TESS-OB-CCMS-VA	**Soil**							
Batch R5630004								
WG3629665-3 DUP		**L2644275-3**						
Aluminum (Al)-Leachable		1270	1210		mg/kg	4.5	30	26-OCT-21
Antimony (Sb)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	26-OCT-21
Arsenic (As)-Leachable		0.155	0.132		mg/kg	16	30	26-OCT-21
Barium (Ba)-Leachable		15.8	16.8		mg/kg	5.9	30	26-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-OB-CCMS-VA	**Soil**							
Batch R5630004								
WG3629665-3 DUP		**L2644275-3**						
Beryllium (Be)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	26-OCT-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	26-OCT-21
Cadmium (Cd)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	26-OCT-21
Calcium (Ca)-Leachable		898	887		mg/kg	1.2	30	26-OCT-21
Chromium (Cr)-Leachable		2.04	1.89		mg/kg	7.3	30	26-OCT-21
Cobalt (Co)-Leachable		0.95	1.00		mg/kg	5.8	30	26-OCT-21
Copper (Cu)-Leachable		1.99	1.84		mg/kg	7.9	30	26-OCT-21
Iron (Fe)-Leachable		1090	1060		mg/kg	3.0	30	26-OCT-21
Lead (Pb)-Leachable		0.77	0.84		mg/kg	9.1	30	26-OCT-21
Lithium (Li)-Leachable		<5.0	<5.0	RPD-NA	mg/kg	N/A	30	26-OCT-21
Manganese (Mn)-Leachable		23.9	26.5		mg/kg	11	30	26-OCT-21
Molybdenum (Mo)-Leachable		<0.50	<0.50	RPD-NA	mg/kg	N/A	30	26-OCT-21
Nickel (Ni)-Leachable		4.60	4.53		mg/kg	1.6	30	26-OCT-21
Selenium (Se)-Leachable		0.45	0.37		mg/kg	21	30	26-OCT-21
Silver (Ag)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	26-OCT-21
Strontium (Sr)-Leachable		4.37	4.27		mg/kg	2.4	30	26-OCT-21
Thallium (Tl)-Leachable		<0.050	<0.050	RPD-NA	mg/kg	N/A	30	26-OCT-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	26-OCT-21
Titanium (Ti)-Leachable		<1.0	<1.0	RPD-NA	mg/kg	N/A	30	26-OCT-21
Uranium (U)-Leachable		0.175	0.165		mg/kg	6.1	30	26-OCT-21
Vanadium (V)-Leachable		2.27	2.03		mg/kg	11	30	26-OCT-21
Zinc (Zn)-Leachable		4.7	4.7		mg/kg	0.5	30	26-OCT-21
WG3629665-2 LCS								
Aluminum (Al)-Leachable			105.2		%		70-130	26-OCT-21
Antimony (Sb)-Leachable			98.0		%		70-130	26-OCT-21
Arsenic (As)-Leachable			97.7		%		70-130	26-OCT-21
Barium (Ba)-Leachable			101.4		%		70-130	26-OCT-21
Beryllium (Be)-Leachable			107.1		%		70-130	26-OCT-21
Bismuth (Bi)-Leachable			105.4		%		70-130	26-OCT-21
Cadmium (Cd)-Leachable			98.0		%		70-130	26-OCT-21
Calcium (Ca)-Leachable			106.4		%		70-130	26-OCT-21
Chromium (Cr)-Leachable			102.2		%		70-130	26-OCT-21
Cobalt (Co)-Leachable			101.5		%		70-130	26-OCT-21
Copper (Cu)-Leachable			103.1		%		70-130	26-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-OB-CCMS-VA	**Soil**							
Batch R5630004								
WG3629665-2 LCS								
Iron (Fe)-Leachable			99.0		%		70-130	26-OCT-21
Lead (Pb)-Leachable			108.7		%		70-130	26-OCT-21
Lithium (Li)-Leachable			110.7		%		70-130	26-OCT-21
Manganese (Mn)-Leachable			104.2		%		70-130	26-OCT-21
Molybdenum (Mo)-Leachable			104.9		%		70-130	26-OCT-21
Nickel (Ni)-Leachable			101.5		%		70-130	26-OCT-21
Selenium (Se)-Leachable			95.7		%		70-130	26-OCT-21
Silver (Ag)-Leachable			104.7		%		70-130	26-OCT-21
Strontium (Sr)-Leachable			110.6		%		70-130	26-OCT-21
Thallium (Tl)-Leachable			104.3		%		70-130	26-OCT-21
Tin (Sn)-Leachable			98.3		%		70-130	26-OCT-21
Titanium (Ti)-Leachable			102.8		%		70-130	26-OCT-21
Uranium (U)-Leachable			106.4		%		70-130	26-OCT-21
Vanadium (V)-Leachable			103.0		%		70-130	26-OCT-21
Zinc (Zn)-Leachable			103.1		%		70-130	26-OCT-21
WG3629665-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	26-OCT-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	26-OCT-21
Arsenic (As)-Leachable			<0.050		mg/kg		0.05	26-OCT-21
Barium (Ba)-Leachable			<0.50		mg/kg		0.5	26-OCT-21
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	26-OCT-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	26-OCT-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	26-OCT-21
Calcium (Ca)-Leachable			<50		mg/kg		50	26-OCT-21
Chromium (Cr)-Leachable			<0.50		mg/kg		0.5	26-OCT-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	26-OCT-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	26-OCT-21
Iron (Fe)-Leachable			<50		mg/kg		50	26-OCT-21
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	26-OCT-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	26-OCT-21
Manganese (Mn)-Leachable			<1.0		mg/kg		1	26-OCT-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	26-OCT-21
Nickel (Ni)-Leachable			<0.50		mg/kg		0.5	26-OCT-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	26-OCT-21

ALS Environmental

Quality Control Report

Workorder: L2644275 Report Date: 07-JAN-22

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-OB-CCMS-VA	**Soil**							
Batch R5630004								
WG3629665-1 MB								
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	26-OCT-21
Strontium (Sr)-Leachable			<0.50		mg/kg		0.5	26-OCT-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	26-OCT-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	26-OCT-21
Titanium (Ti)-Leachable			<1.0		mg/kg		1	26-OCT-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	26-OCT-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	26-OCT-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	26-OCT-21
MET-TESS-RM-CCMS-VA	**Soil**							
Batch R5626368								
WG3629665-3 DUP		**L2644275-3**						
Aluminum (Al)-Leachable		8250	9840		mg/kg	18	30	21-OCT-21
Antimony (Sb)-Leachable		0.71	0.69		mg/kg	2.6	30	21-OCT-21
Arsenic (As)-Leachable		5.71	6.37		mg/kg	11	30	21-OCT-21
Barium (Ba)-Leachable		118	134		mg/kg	12	30	21-OCT-21
Beryllium (Be)-Leachable		0.36	0.38		mg/kg	6.6	30	21-OCT-21
Bismuth (Bi)-Leachable		<0.20	<0.20	RPD-NA	mg/kg	N/A	30	21-OCT-21
Cadmium (Cd)-Leachable		0.096	0.115		mg/kg	18	30	21-OCT-21
Calcium (Ca)-Leachable		1010	1110		mg/kg	9.5	30	21-OCT-21
Chromium (Cr)-Leachable		11.4	13.0		mg/kg	13	30	21-OCT-21
Cobalt (Co)-Leachable		3.49	3.85		mg/kg	9.9	30	21-OCT-21
Copper (Cu)-Leachable		12.9	14.3		mg/kg	10	30	21-OCT-21
Iron (Fe)-Leachable		16400	20000		mg/kg	20	30	21-OCT-21
Lead (Pb)-Leachable		7.90	8.29		mg/kg	4.8	30	21-OCT-21
Lithium (Li)-Leachable		8.6	11.0		mg/kg	25	30	21-OCT-21
Manganese (Mn)-Leachable		61.9	71.7		mg/kg	15	30	21-OCT-21
Molybdenum (Mo)-Leachable		1.02	1.08		mg/kg	5.4	30	21-OCT-21
Nickel (Ni)-Leachable		13.9	15.4		mg/kg	10	30	21-OCT-21
Selenium (Se)-Leachable		0.39	0.57	J	mg/kg	0.19	0.4	21-OCT-21
Silver (Ag)-Leachable		<0.10	<0.10	RPD-NA	mg/kg	N/A	30	21-OCT-21
Strontium (Sr)-Leachable		18.4	18.4		mg/kg	0.3	30	21-OCT-21
Thallium (Tl)-Leachable		0.138	0.150		mg/kg	8.6	30	21-OCT-21
Tin (Sn)-Leachable		<2.0	<2.0	RPD-NA	mg/kg	N/A	30	21-OCT-21
Titanium (Ti)-Leachable		13.8	15.2		mg/kg	9.3	30	21-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-RM-CCMS-VA	**Soil**							
Batch R5626368								
WG3629665-3 DUP		**L2644275-3**						
Uranium (U)-Leachable		0.355	0.362		mg/kg	2.0	30	21-OCT-21
Vanadium (V)-Leachable		25.4	29.9		mg/kg	16	30	21-OCT-21
Zinc (Zn)-Leachable		72.1	80.8		mg/kg	11	30	21-OCT-21
WG3629665-2 LCS								
Aluminum (Al)-Leachable			107.8		%		70-130	22-OCT-21
Antimony (Sb)-Leachable			104.7		%		70-130	22-OCT-21
Arsenic (As)-Leachable			106.7		%		70-130	22-OCT-21
Barium (Ba)-Leachable			112.3		%		70-130	22-OCT-21
Beryllium (Be)-Leachable			105.2		%		70-130	22-OCT-21
Bismuth (Bi)-Leachable			94.9		%		70-130	22-OCT-21
Cadmium (Cd)-Leachable			110.9		%		70-130	22-OCT-21
Calcium (Ca)-Leachable			100.8		%		70-130	22-OCT-21
Chromium (Cr)-Leachable			110.8		%		70-130	22-OCT-21
Cobalt (Co)-Leachable			106.8		%		70-130	22-OCT-21
Copper (Cu)-Leachable			106.9		%		70-130	22-OCT-21
Iron (Fe)-Leachable			105.1		%		70-130	22-OCT-21
Lead (Pb)-Leachable			105.0		%		70-130	22-OCT-21
Lithium (Li)-Leachable			105.6		%		70-130	22-OCT-21
Manganese (Mn)-Leachable			110.9		%		70-130	22-OCT-21
Molybdenum (Mo)-Leachable			102.0		%		70-130	22-OCT-21
Nickel (Ni)-Leachable			107.6		%		70-130	22-OCT-21
Selenium (Se)-Leachable			111.2		%		70-130	22-OCT-21
Silver (Ag)-Leachable			106.5		%		70-130	22-OCT-21
Strontium (Sr)-Leachable			103.2		%		70-130	22-OCT-21
Thallium (Tl)-Leachable			103.1		%		70-130	22-OCT-21
Tin (Sn)-Leachable			104.2		%		70-130	22-OCT-21
Titanium (Ti)-Leachable			109.9		%		70-130	22-OCT-21
Uranium (U)-Leachable			105.5		%		70-130	22-OCT-21
Vanadium (V)-Leachable			106.4		%		70-130	22-OCT-21
Zinc (Zn)-Leachable			110.7		%		70-130	22-OCT-21
WG3629665-1 MB								
Aluminum (Al)-Leachable			<50		mg/kg		50	21-OCT-21
Antimony (Sb)-Leachable			<0.10		mg/kg		0.1	21-OCT-21
Arsenic (As)-Leachable			<0.50		mg/kg		0.5	21-OCT-21
Barium (Ba)-Leachable			<2.0		mg/kg		2	21-OCT-21

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TESS-RM-CCMS-VA	**Soil**							
Batch R5626368								
WG3629665-1 MB								
Beryllium (Be)-Leachable			<0.20		mg/kg		0.2	21-OCT-21
Bismuth (Bi)-Leachable			<0.20		mg/kg		0.2	21-OCT-21
Cadmium (Cd)-Leachable			<0.050		mg/kg		0.05	21-OCT-21
Calcium (Ca)-Leachable			<50		mg/kg		50	21-OCT-21
Chromium (Cr)-Leachable			<5.0		mg/kg		5	21-OCT-21
Cobalt (Co)-Leachable			<0.10		mg/kg		0.1	21-OCT-21
Copper (Cu)-Leachable			<0.50		mg/kg		0.5	21-OCT-21
Iron (Fe)-Leachable			<50		mg/kg		50	21-OCT-21
Lead (Pb)-Leachable			<0.50		mg/kg		0.5	21-OCT-21
Lithium (Li)-Leachable			<5.0		mg/kg		5	21-OCT-21
Manganese (Mn)-Leachable			<5.0		mg/kg		5	21-OCT-21
Molybdenum (Mo)-Leachable			<0.50		mg/kg		0.5	21-OCT-21
Nickel (Ni)-Leachable			<2.0		mg/kg		2	21-OCT-21
Selenium (Se)-Leachable			<0.20		mg/kg		0.2	21-OCT-21
Silver (Ag)-Leachable			<0.10		mg/kg		0.1	21-OCT-21
Strontium (Sr)-Leachable			<5.0		mg/kg		5	21-OCT-21
Thallium (Tl)-Leachable			<0.050		mg/kg		0.05	21-OCT-21
Tin (Sn)-Leachable			<2.0		mg/kg		2	21-OCT-21
Titanium (Ti)-Leachable			<5.0		mg/kg		5	21-OCT-21
Uranium (U)-Leachable			<0.050		mg/kg		0.05	21-OCT-21
Vanadium (V)-Leachable			<0.20		mg/kg		0.2	21-OCT-21
Zinc (Zn)-Leachable			<1.0		mg/kg		1	21-OCT-21
MOISTURE-CL	**Soil**							
Batch R5604160								
WG3626758-2 LCS								
Moisture			95.0		%		90-110	29-SEP-21
WG3626758-1 MB								
Moisture			<0.25		%		0.25	29-SEP-21
Batch R5605872								
WG3628719-2 LCS								
Moisture			100.5		%		90-110	01-OCT-21
WG3628719-1 MB								
Moisture			<0.25		%		0.25	01-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-CL	**Soil**							
Batch R5605880								
WG3628730-3 DUP		**L2644275-4**						
Moisture		44.5	43.2		%	3.0	20	01-OCT-21
WG3628730-2 LCS								
Moisture			99.8		%		90-110	01-OCT-21
WG3628730-1 MB								
Moisture			<0.25		%		0.25	01-OCT-21
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5606098								
WG3629474-16 DUP		**L2644275-4**						
Acenaphthene		0.105	0.120		mg/kg	13	50	01-OCT-21
Acenaphthylene		0.0195	0.0208		mg/kg	6.5	50	01-OCT-21
Anthracene		<0.0040	<0.0040	RPD-NA	mg/kg	N/A	50	01-OCT-21
Acridine		0.176	0.203		mg/kg	14	50	01-OCT-21
Benz(a)anthracene		0.056	0.064		mg/kg	14	50	01-OCT-21
Benzo(a)pyrene		0.032	0.037		mg/kg	14	50	01-OCT-21
Benzo(b&j)fluoranthene		0.147	0.178		mg/kg	19	50	01-OCT-21
Benzo(e)pyrene		0.141	0.178		mg/kg	23	50	01-OCT-21
Benzo(g,h,i)perylene		0.052	0.067		mg/kg	24	50	01-OCT-21
Benzo(k)fluoranthene		0.012	0.017		mg/kg	34	50	01-OCT-21
Chrysene		0.340	0.362		mg/kg	6.4	50	01-OCT-21
Dibenz(a,h)anthracene		0.0274	0.0306		mg/kg	11	50	01-OCT-21
Fluoranthene		0.059	0.059		mg/kg	1.0	50	01-OCT-21
Fluorene		0.234	0.265		mg/kg	13	50	01-OCT-21
Indeno(1,2,3-c,d)pyrene		0.015	0.020		mg/kg	27	50	01-OCT-21
2-Methylnaphthalene		2.40	2.63		mg/kg	9.2	50	01-OCT-21
Naphthalene		0.695	0.771		mg/kg	10	50	01-OCT-21
Perylene		0.011	<0.010	RPD-NA	mg/kg	N/A	50	01-OCT-21
Phenanthrene		1.08	1.18		mg/kg	8.9	50	01-OCT-21
Pyrene		0.150	0.160		mg/kg	6.8	50	01-OCT-21
1-Methylnaphthalene		1.27	1.40		mg/kg	9.4	50	01-OCT-21
Quinoline		<0.050	<0.050	RPD-NA	mg/kg	N/A	50	01-OCT-21
WG3629474-10 IRM		**ALS PAH RM2**						
Acenaphthene			89.7		%		60-130	01-OCT-21
Acenaphthylene			98.2		%		60-130	01-OCT-21
Anthracene			101.9		%		60-130	01-OCT-21
Acridine			88.5		%		60-130	01-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5606098								
WG3629474-10 IRM		**ALS PAH RM2**						
Benz(a)anthracene			92.7		%		60-130	01-OCT-21
Benzo(a)pyrene			85.1		%		60-130	01-OCT-21
Benzo(b&j)fluoranthene			85.0		%		60-130	01-OCT-21
Benzo(e)pyrene			94.7		%		60-130	01-OCT-21
Benzo(g,h,i)perylene			89.0		%		60-130	01-OCT-21
Benzo(k)fluoranthene			73.9		%		60-130	01-OCT-21
Chrysene			91.0		%		60-130	01-OCT-21
Dibenz(a,h)anthracene			88.3		%		60-130	01-OCT-21
Fluoranthene			86.8		%		60-130	01-OCT-21
Fluorene			91.2		%		60-130	01-OCT-21
Indeno(1,2,3-c,d)pyrene			112.3		%		60-130	01-OCT-21
2-Methylnaphthalene			84.1		%		60-130	01-OCT-21
Naphthalene			78.9		%		50-130	01-OCT-21
Perylene			90.4		%		60-130	01-OCT-21
Phenanthrene			88.5		%		60-130	01-OCT-21
Pyrene			88.8		%		60-130	01-OCT-21
1-Methylnaphthalene			85.4		%		60-130	01-OCT-21
WG3629474-14 IRM		**ALS PAH RM2**						
Acenaphthene			76.8		%		60-130	01-OCT-21
Acenaphthylene			83.8		%		60-130	01-OCT-21
Anthracene			90.7		%		60-130	01-OCT-21
Acridine			86.7		%		60-130	01-OCT-21
Benz(a)anthracene			80.8		%		60-130	01-OCT-21
Benzo(a)pyrene			79.2		%		60-130	01-OCT-21
Benzo(b&j)fluoranthene			74.7		%		60-130	01-OCT-21
Benzo(e)pyrene			80.6		%		60-130	01-OCT-21
Benzo(g,h,i)perylene			75.2		%		60-130	01-OCT-21
Benzo(k)fluoranthene			64.2		%		60-130	01-OCT-21
Chrysene			78.5		%		60-130	01-OCT-21
Dibenz(a,h)anthracene			70.1		%		60-130	01-OCT-21
Fluoranthene			74.6		%		60-130	01-OCT-21
Fluorene			78.3		%		60-130	01-OCT-21
Indeno(1,2,3-c,d)pyrene			93.0		%		60-130	01-OCT-21
2-Methylnaphthalene			75.9		%		60-130	01-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5606098								
WG3629474-14 IRM		**ALS PAH RM2**						
Naphthalene			68.9		%		50-130	01-OCT-21
Perylene			83.6		%		60-130	01-OCT-21
Phenanthrene			77.6		%		60-130	01-OCT-21
Pyrene			77.3		%		60-130	01-OCT-21
1-Methylnaphthalene			72.8		%		60-130	01-OCT-21
WG3629474-18 IRM		**ALS PAH RM2**						
Acenaphthene			101.0		%		60-130	02-OCT-21
Acenaphthylene			99.6		%		60-130	02-OCT-21
Anthracene			112.9		%		60-130	02-OCT-21
Acridine			99.7		%		60-130	02-OCT-21
Benz(a)anthracene			98.0		%		60-130	02-OCT-21
Benzo(a)pyrene			85.8		%		60-130	02-OCT-21
Benzo(b&j)fluoranthene			91.2		%		60-130	02-OCT-21
Benzo(e)pyrene			98.3		%		60-130	02-OCT-21
Benzo(g,h,i)perylene			96.4		%		60-130	02-OCT-21
Benzo(k)fluoranthene			76.5		%		60-130	02-OCT-21
Chrysene			95.1		%		60-130	02-OCT-21
Dibenz(a,h)anthracene			87.7		%		60-130	02-OCT-21
Fluoranthene			92.1		%		60-130	02-OCT-21
Fluorene			101.0		%		60-130	02-OCT-21
Indeno(1,2,3-c,d)pyrene			105.8		%		60-130	02-OCT-21
2-Methylnaphthalene			95.8		%		60-130	02-OCT-21
Naphthalene			89.5		%		50-130	02-OCT-21
Perylene			91.8		%		60-130	02-OCT-21
Phenanthrene			97.6		%		60-130	02-OCT-21
Pyrene			94.9		%		60-130	02-OCT-21
1-Methylnaphthalene			93.4		%		60-130	02-OCT-21
WG3629474-3 IRM		**ALS PAH RM2**						
Acenaphthene			77.6		%		60-130	30-SEP-21
Acenaphthylene			86.8		%		60-130	30-SEP-21
Anthracene			92.5		%		60-130	30-SEP-21
Acridine			91.4		%		60-130	30-SEP-21
Benz(a)anthracene			86.0		%		60-130	30-SEP-21
Benzo(a)pyrene			82.8		%		60-130	30-SEP-21
Benzo(b&j)fluoranthene			82.9		%		60-130	30-SEP-21

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5606098								
WG3629474-3 IRM		**ALS PAH RM2**						
Benzo(e)pyrene			87.5		%		60-130	30-SEP-21
Benzo(g,h,i)perylene			77.9		%		60-130	30-SEP-21
Benzo(k)fluoranthene			63.5		%		60-130	30-SEP-21
Chrysene			84.1		%		60-130	30-SEP-21
Dibenz(a,h)anthracene			76.5		%		60-130	30-SEP-21
Fluoranthene			77.8		%		60-130	30-SEP-21
Fluorene			81.0		%		60-130	30-SEP-21
Indeno(1,2,3-c,d)pyrene			116.5		%		60-130	30-SEP-21
2-Methylnaphthalene			79.0		%		60-130	30-SEP-21
Naphthalene			76.2		%		50-130	30-SEP-21
Perylene			85.9		%		60-130	30-SEP-21
Phenanthrene			80.9		%		60-130	30-SEP-21
Pyrene			80.3		%		60-130	30-SEP-21
1-Methylnaphthalene			77.4		%		60-130	30-SEP-21
WG3629474-6 IRM		**ALS PAH RM2**						
Acenaphthene			88.0		%		60-130	01-OCT-21
Acenaphthylene			89.4		%		60-130	01-OCT-21
Anthracene			98.4		%		60-130	01-OCT-21
Acridine			80.9		%		60-130	01-OCT-21
Benz(a)anthracene			86.4		%		60-130	01-OCT-21
Benzo(a)pyrene			80.4		%		60-130	01-OCT-21
Benzo(b&j)fluoranthene			78.9		%		60-130	01-OCT-21
Benzo(e)pyrene			84.8		%		60-130	01-OCT-21
Benzo(g,h,i)perylene			78.5		%		60-130	01-OCT-21
Benzo(k)fluoranthene			68.1		%		60-130	01-OCT-21
Chrysene			85.6		%		60-130	01-OCT-21
Dibenz(a,h)anthracene			75.4		%		60-130	01-OCT-21
Fluoranthene			81.8		%		60-130	01-OCT-21
Fluorene			90.2		%		60-130	01-OCT-21
Indeno(1,2,3-c,d)pyrene			110.5		%		60-130	01-OCT-21
2-Methylnaphthalene			81.7		%		60-130	01-OCT-21
Naphthalene			75.2		%		50-130	01-OCT-21
Perylene			68.0		%		60-130	01-OCT-21
Phenanthrene			85.5		%		60-130	01-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5606098								
WG3629474-6 IRM		**ALS PAH RM2**						
Pyrene			84.4		%		60-130	01-OCT-21
1-Methylnaphthalene			81.5		%		60-130	01-OCT-21
WG3629474-13 LCS								
Acenaphthene			88.2		%		60-130	01-OCT-21
Acenaphthylene			86.5		%		60-130	01-OCT-21
Anthracene			92.3		%		60-130	01-OCT-21
Acridine			89.4		%		60-130	01-OCT-21
Benz(a)anthracene			91.8		%		60-130	01-OCT-21
Benzo(a)pyrene			84.1		%		60-130	01-OCT-21
Benzo(b&j)fluoranthene			85.9		%		60-130	01-OCT-21
Benzo(e)pyrene			90.2		%		60-130	01-OCT-21
Benzo(g,h,i)perylene			85.5		%		60-130	01-OCT-21
Benzo(k)fluoranthene			86.8		%		60-130	01-OCT-21
Chrysene			87.6		%		60-130	01-OCT-21
Dibenz(a,h)anthracene			81.2		%		60-130	01-OCT-21
Fluoranthene			86.1		%		60-130	01-OCT-21
Fluorene			91.0		%		60-130	01-OCT-21
Indeno(1,2,3-c,d)pyrene			81.5		%		60-130	01-OCT-21
2-Methylnaphthalene			91.3		%		60-130	01-OCT-21
Naphthalene			90.1		%		50-130	01-OCT-21
Perylene			83.9		%		60-130	01-OCT-21
Phenanthrene			93.3		%		60-130	01-OCT-21
Pyrene			88.3		%		60-130	01-OCT-21
1-Methylnaphthalene			90.1		%		60-130	01-OCT-21
Quinoline			82.6		%		60-130	01-OCT-21
WG3629474-17 LCS								
Acenaphthene			102.3		%		60-130	02-OCT-21
Acenaphthylene			98.2		%		60-130	02-OCT-21
Anthracene			102.3		%		60-130	02-OCT-21
Acridine			96.5		%		60-130	02-OCT-21
Benz(a)anthracene			101.9		%		60-130	02-OCT-21
Benzo(a)pyrene			90.0		%		60-130	02-OCT-21
Benzo(b&j)fluoranthene			96.3		%		60-130	02-OCT-21
Benzo(e)pyrene			99.9		%		60-130	02-OCT-21
Benzo(g,h,i)perylene			100.5		%		60-130	02-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5606098								
WG3629474-17 LCS								
Benzo(k)fluoranthene			91.4		%		60-130	02-OCT-21
Chrysene			99.0		%		60-130	02-OCT-21
Dibenz(a,h)anthracene			91.3		%		60-130	02-OCT-21
Fluoranthene			100.6		%		60-130	02-OCT-21
Fluorene			100.3		%		60-130	02-OCT-21
Indeno(1,2,3-c,d)pyrene			82.0		%		60-130	02-OCT-21
2-Methylnaphthalene			101.4		%		60-130	02-OCT-21
Naphthalene			100.7		%		50-130	02-OCT-21
Perylene			92.7		%		60-130	02-OCT-21
Phenanthrene			103.0		%		60-130	02-OCT-21
Pyrene			101.9		%		60-130	02-OCT-21
1-Methylnaphthalene			100.7		%		60-130	02-OCT-21
Quinoline			91.8		%		60-130	02-OCT-21
COMMENTS: Watery Sample								
WG3629474-2 LCS								
Acenaphthene			106.1		%		60-130	30-SEP-21
Acenaphthylene			102.8		%		60-130	30-SEP-21
Anthracene			109.4		%		60-130	30-SEP-21
Acridine			101.3		%		60-130	30-SEP-21
Benz(a)anthracene			113.1		%		60-130	30-SEP-21
Benzo(a)pyrene			105.6		%		60-130	30-SEP-21
Benzo(b&j)fluoranthene			107.8		%		60-130	30-SEP-21
Benzo(e)pyrene			111.7		%		60-130	30-SEP-21
Benzo(g,h,i)perylene			104.6		%		60-130	30-SEP-21
Benzo(k)fluoranthene			106.2		%		60-130	30-SEP-21
Chrysene			106.4		%		60-130	30-SEP-21
Dibenz(a,h)anthracene			99.9		%		60-130	30-SEP-21
Fluoranthene			104.3		%		60-130	30-SEP-21
Fluorene			105.2		%		60-130	30-SEP-21
Indeno(1,2,3-c,d)pyrene			105.8		%		60-130	30-SEP-21
2-Methylnaphthalene			106.2		%		60-130	30-SEP-21
Naphthalene			104.1		%		50-130	30-SEP-21
Perylene			103.6		%		60-130	30-SEP-21
Phenanthrene			109.9		%		60-130	30-SEP-21
Pyrene			107.9		%		60-130	30-SEP-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5606098								
WG3629474-2 LCS								
1-Methylnaphthalene			104.3		%		60-130	30-SEP-21
Quinoline			97.2		%		60-130	30-SEP-21
WG3629474-5 LCS								
Acenaphthene			90.4		%		60-130	01-OCT-21
Acenaphthylene			86.8		%		60-130	01-OCT-21
Anthracene			91.2		%		60-130	01-OCT-21
Acridine			88.0		%		60-130	01-OCT-21
Benz(a)anthracene			92.4		%		60-130	01-OCT-21
Benzo(a)pyrene			86.5		%		60-130	01-OCT-21
Benzo(b&j)fluoranthene			87.4		%		60-130	01-OCT-21
Benzo(e)pyrene			92.7		%		60-130	01-OCT-21
Benzo(g,h,i)perylene			86.3		%		60-130	01-OCT-21
Benzo(k)fluoranthene			87.5		%		60-130	01-OCT-21
Chrysene			90.4		%		60-130	01-OCT-21
Dibenz(a,h)anthracene			81.5		%		60-130	01-OCT-21
Fluoranthene			88.9		%		60-130	01-OCT-21
Fluorene			89.6		%		60-130	01-OCT-21
Indeno(1,2,3-c,d)pyrene			91.1		%		60-130	01-OCT-21
2-Methylnaphthalene			89.1		%		60-130	01-OCT-21
Naphthalene			90.1		%		50-130	01-OCT-21
Perylene			85.8		%		60-130	01-OCT-21
Phenanthrene			91.9		%		60-130	01-OCT-21
Pyrene			89.6		%		60-130	01-OCT-21
1-Methylnaphthalene			87.4		%		60-130	01-OCT-21
Quinoline			79.0		%		60-130	01-OCT-21
WG3629474-9 LCS								
Acenaphthene			102.9		%		60-130	01-OCT-21
Acenaphthylene			99.8		%		60-130	01-OCT-21
Anthracene			106.0		%		60-130	01-OCT-21
Acridine			99.6		%		60-130	01-OCT-21
Benz(a)anthracene			101.2		%		60-130	01-OCT-21
Benzo(a)pyrene			94.2		%		60-130	01-OCT-21
Benzo(b&j)fluoranthene			95.9		%		60-130	01-OCT-21
Benzo(e)pyrene			101.4		%		60-130	01-OCT-21
Benzo(g,h,i)perylene			100.0		%		60-130	01-OCT-21

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5606098								
WG3629474-9 LCS								
Benzo(k)fluoranthene			99.6		%		60-130	01-OCT-21
Chrysene			102.0		%		60-130	01-OCT-21
Dibenz(a,h)anthracene			88.8		%		60-130	01-OCT-21
Fluoranthene			101.9		%		60-130	01-OCT-21
Fluorene			104.5		%		60-130	01-OCT-21
Indeno(1,2,3-c,d)pyrene			104.6		%		60-130	01-OCT-21
2-Methylnaphthalene			103.4		%		60-130	01-OCT-21
Naphthalene			101.8		%		50-130	01-OCT-21
Perylene			93.7		%		60-130	01-OCT-21
Phenanthrene			107.6		%		60-130	01-OCT-21
Pyrene			103.0		%		60-130	01-OCT-21
1-Methylnaphthalene			99.0		%		60-130	01-OCT-21
Quinoline			91.2		%		60-130	01-OCT-21
WG3629474-1 MB								
Acenaphthene			<0.0050		mg/kg		0.005	30-SEP-21
Acenaphthylene			<0.0050		mg/kg		0.005	30-SEP-21
Anthracene			<0.0040		mg/kg		0.004	30-SEP-21
Acridine			<0.010		mg/kg		0.01	30-SEP-21
Benz(a)anthracene			<0.010		mg/kg		0.01	30-SEP-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	30-SEP-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	30-SEP-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	30-SEP-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	30-SEP-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	30-SEP-21
Chrysene			<0.010		mg/kg		0.01	30-SEP-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	30-SEP-21
Fluoranthene			<0.010		mg/kg		0.01	30-SEP-21
Fluorene			<0.010		mg/kg		0.01	30-SEP-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	30-SEP-21
2-Methylnaphthalene			<0.010		mg/kg		0.01	30-SEP-21
Naphthalene			<0.010		mg/kg		0.01	30-SEP-21
Perylene			<0.010		mg/kg		0.01	30-SEP-21
Phenanthrene			<0.010		mg/kg		0.01	30-SEP-21
Pyrene			<0.010		mg/kg		0.01	30-SEP-21

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5606098								
WG3629474-1 MB								
1-Methylnaphthalene			<0.050		mg/kg		0.05	30-SEP-21
Quinoline			<0.050		mg/kg		0.05	30-SEP-21
Surrogate: d8-Naphthalene			80.6		%		50-130	30-SEP-21
Surrogate: d10-Acenaphthene			80.3		%		60-130	30-SEP-21
Surrogate: d10-Phenanthrene			87.6		%		60-130	30-SEP-21
Surrogate: d12-Chrysene			88.5		%		60-130	30-SEP-21
WG3629474-11 MB								
Acenaphthene			<0.0050		mg/kg		0.005	01-OCT-21
Acenaphthylene			<0.0050		mg/kg		0.005	01-OCT-21
Anthracene			<0.0040		mg/kg		0.004	01-OCT-21
Acridine			<0.010		mg/kg		0.01	01-OCT-21
Benz(a)anthracene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	01-OCT-21
Chrysene			<0.010		mg/kg		0.01	01-OCT-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	01-OCT-21
Fluoranthene			<0.010		mg/kg		0.01	01-OCT-21
Fluorene			<0.010		mg/kg		0.01	01-OCT-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	01-OCT-21
2-Methylnaphthalene			<0.010		mg/kg		0.01	01-OCT-21
Naphthalene			<0.010		mg/kg		0.01	01-OCT-21
Perylene			<0.010		mg/kg		0.01	01-OCT-21
Phenanthrene			<0.010		mg/kg		0.01	01-OCT-21
Pyrene			<0.010		mg/kg		0.01	01-OCT-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	01-OCT-21
Quinoline			<0.050		mg/kg		0.05	01-OCT-21
Surrogate: d8-Naphthalene			76.4		%		50-130	01-OCT-21
Surrogate: d10-Acenaphthene			78.0		%		60-130	01-OCT-21
Surrogate: d10-Phenanthrene			83.7		%		60-130	01-OCT-21
Surrogate: d12-Chrysene			82.1		%		60-130	01-OCT-21
WG3629474-15 MB								
Acenaphthene			<0.0050		mg/kg		0.005	01-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5606098								
WG3629474-15 MB								
Acenaphthylene			<0.0050		mg/kg		0.005	01-OCT-21
Anthracene			<0.0040		mg/kg		0.004	01-OCT-21
Acridine			<0.010		mg/kg		0.01	01-OCT-21
Benz(a)anthracene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	01-OCT-21
Chrysene			<0.010		mg/kg		0.01	01-OCT-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	01-OCT-21
Fluoranthene			<0.010		mg/kg		0.01	01-OCT-21
Fluorene			<0.010		mg/kg		0.01	01-OCT-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	01-OCT-21
2-Methylnaphthalene			<0.010		mg/kg		0.01	01-OCT-21
Naphthalene			<0.010		mg/kg		0.01	01-OCT-21
Perylene			<0.010		mg/kg		0.01	01-OCT-21
Phenanthrene			<0.010		mg/kg		0.01	01-OCT-21
Pyrene			<0.010		mg/kg		0.01	01-OCT-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	01-OCT-21
Quinoline			<0.050		mg/kg		0.05	01-OCT-21
Surrogate: d8-Naphthalene			81.0		%		50-130	01-OCT-21
Surrogate: d10-Acenaphthene			84.4		%		60-130	01-OCT-21
Surrogate: d10-Phenanthrene			93.3		%		60-130	01-OCT-21
Surrogate: d12-Chrysene			96.2		%		60-130	01-OCT-21
WG3629474-7 MB								
Acenaphthene			<0.0050		mg/kg		0.005	01-OCT-21
Acenaphthylene			<0.0050		mg/kg		0.005	01-OCT-21
Anthracene			<0.0040		mg/kg		0.004	01-OCT-21
Acridine			<0.010		mg/kg		0.01	01-OCT-21
Benz(a)anthracene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	01-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5606098								
WG3629474-7 MB								
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	01-OCT-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	01-OCT-21
Chrysene			<0.010		mg/kg		0.01	01-OCT-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	01-OCT-21
Fluoranthene			<0.010		mg/kg		0.01	01-OCT-21
Fluorene			<0.010		mg/kg		0.01	01-OCT-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	01-OCT-21
2-Methylnaphthalene			<0.010		mg/kg		0.01	01-OCT-21
Naphthalene			<0.010		mg/kg		0.01	01-OCT-21
Perylene			<0.010		mg/kg		0.01	01-OCT-21
Phenanthrene			<0.010		mg/kg		0.01	01-OCT-21
Pyrene			<0.010		mg/kg		0.01	01-OCT-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	01-OCT-21
Quinoline			<0.050		mg/kg		0.05	01-OCT-21
Surrogate: d8-Naphthalene			76.0		%		50-130	01-OCT-21
Surrogate: d10-Acenaphthene			82.9		%		60-130	01-OCT-21
Surrogate: d10-Phenanthrene			93.2		%		60-130	01-OCT-21
Surrogate: d12-Chrysene			96.2		%		60-130	01-OCT-21
Batch R5607287								
WG3630689-10 IRM		**ALS PAH RM2**						
Acenaphthene			94.9		%		60-130	03-OCT-21
Acenaphthylene			95.8		%		60-130	03-OCT-21
Anthracene			105.3		%		60-130	03-OCT-21
Acridine			87.1		%		60-130	03-OCT-21
Benz(a)anthracene			92.1		%		60-130	03-OCT-21
Benzo(a)pyrene			87.5		%		60-130	03-OCT-21
Benzo(b&j)fluoranthene			85.7		%		60-130	03-OCT-21
Benzo(e)pyrene			91.6		%		60-130	03-OCT-21
Benzo(g,h,i)perylene			86.4		%		60-130	03-OCT-21
Benzo(k)fluoranthene			83.5		%		60-130	03-OCT-21
Chrysene			89.3		%		60-130	03-OCT-21
Dibenz(a,h)anthracene			81.8		%		60-130	03-OCT-21
Fluoranthene			86.9		%		60-130	03-OCT-21
Fluorene			96.6		%		60-130	03-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5607287								
WG3630689-10 IRM		**ALS PAH RM2**						
Indeno(1,2,3-c,d)pyrene			103.9		%		60-130	03-OCT-21
2-Methylnaphthalene			90.4		%		60-130	03-OCT-21
Naphthalene			88.8		%		50-130	03-OCT-21
Perylene			94.7		%		60-130	03-OCT-21
Phenanthrene			92.3		%		60-130	03-OCT-21
Pyrene			89.1		%		60-130	03-OCT-21
1-Methylnaphthalene			90.3		%		60-130	03-OCT-21
WG3630689-14 IRM		**ALS PAH RM2**						
Acenaphthene			86.6		%		60-130	04-OCT-21
Acenaphthylene			90.7		%		60-130	04-OCT-21
Anthracene			98.1		%		60-130	04-OCT-21
Acridine			91.2		%		60-130	04-OCT-21
Benz(a)anthracene			85.0		%		60-130	04-OCT-21
Benzo(a)pyrene			77.5		%		60-130	04-OCT-21
Benzo(b&j)fluoranthene			79.7		%		60-130	04-OCT-21
Benzo(e)pyrene			87.2		%		60-130	04-OCT-21
Benzo(g,h,i)perylene			79.3		%		60-130	04-OCT-21
Benzo(k)fluoranthene			67.3		%		60-130	04-OCT-21
Chrysene			80.7		%		60-130	04-OCT-21
Dibenz(a,h)anthracene			74.4		%		60-130	04-OCT-21
Fluoranthene			80.2		%		60-130	04-OCT-21
Fluorene			87.8		%		60-130	04-OCT-21
Indeno(1,2,3-c,d)pyrene			90.1		%		60-130	04-OCT-21
2-Methylnaphthalene			83.9		%		60-130	04-OCT-21
Naphthalene			81.4		%		50-130	04-OCT-21
Perylene			80.6		%		60-130	04-OCT-21
Phenanthrene			85.6		%		60-130	04-OCT-21
Pyrene			82.0		%		60-130	04-OCT-21
1-Methylnaphthalene			84.1		%		60-130	04-OCT-21
WG3630689-4 IRM		**ALS PAH RM2**						
Acenaphthene			79.2		%		60-130	02-OCT-21
Acenaphthylene			85.0		%		60-130	02-OCT-21
Anthracene			90.6		%		60-130	02-OCT-21
Acridine			87.4		%		60-130	02-OCT-21
Benz(a)anthracene			83.7		%		60-130	02-OCT-21

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5607287								
WG3630689-4 IRM		**ALS PAH RM2**						
Benzo(a)pyrene			81.3		%		60-130	02-OCT-21
Benzo(b&j)fluoranthene			76.5		%		60-130	02-OCT-21
Benzo(e)pyrene			82.9		%		60-130	02-OCT-21
Benzo(g,h,i)perylene			72.2		%		60-130	02-OCT-21
Benzo(k)fluoranthene			63.6		%		60-130	02-OCT-21
Chrysene			82.4		%		60-130	02-OCT-21
Dibenz(a,h)anthracene			72.5		%		60-130	02-OCT-21
Fluoranthene			75.9		%		60-130	02-OCT-21
Fluorene			82.2		%		60-130	02-OCT-21
Indeno(1,2,3-c,d)pyrene			96.0		%		60-130	02-OCT-21
2-Methylnaphthalene			77.2		%		60-130	02-OCT-21
Naphthalene			73.2		%		50-130	02-OCT-21
Perylene			80.2		%		60-130	02-OCT-21
Phenanthrene			80.6		%		60-130	02-OCT-21
Pyrene			78.5		%		60-130	02-OCT-21
1-Methylnaphthalene			76.1		%		60-130	02-OCT-21
WG3630689-11 LCS								
Acenaphthene			124.3		%		60-130	03-OCT-21
Acenaphthylene			120.9		%		60-130	03-OCT-21
Anthracene			122.7		%		60-130	03-OCT-21
Acridine			125.5		%		60-130	03-OCT-21
Benz(a)anthracene			119.7		%		60-130	03-OCT-21
Benzo(a)pyrene			118.4		%		60-130	03-OCT-21
Benzo(b&j)fluoranthene			107.5		%		60-130	03-OCT-21
Benzo(e)pyrene			119.9		%		60-130	03-OCT-21
Benzo(g,h,i)perylene			120.7		%		60-130	03-OCT-21
Benzo(k)fluoranthene			125.4		%		60-130	03-OCT-21
Chrysene			125.9		%		60-130	03-OCT-21
Dibenz(a,h)anthracene			118.9		%		60-130	03-OCT-21
Fluoranthene			126.5		%		60-130	03-OCT-21
Fluorene			121.6		%		60-130	03-OCT-21
Indeno(1,2,3-c,d)pyrene			116.4		%		60-130	03-OCT-21
2-Methylnaphthalene			126.1		%		60-130	03-OCT-21
Naphthalene			122.3		%		50-130	03-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5607287								
WG3630689-11 LCS								
Perylene			124.8		%		60-130	03-OCT-21
Phenanthrene			125.3		%		60-130	03-OCT-21
Pyrene			122.0		%		60-130	03-OCT-21
1-Methylnaphthalene			125.8		%		60-130	03-OCT-21
Quinoline			112.1		%		60-130	03-OCT-21
WG3630689-15 LCS								
Acenaphthene			125.0		%		60-130	04-OCT-21
Acenaphthylene			120.1		%		60-130	04-OCT-21
Anthracene			121.7		%		60-130	04-OCT-21
Acridine			116.9		%		60-130	04-OCT-21
Benz(a)anthracene			122.2		%		60-130	04-OCT-21
Benzo(a)pyrene			120.6		%		60-130	04-OCT-21
Benzo(b&j)fluoranthene			107.0		%		60-130	04-OCT-21
Benzo(e)pyrene			118.9		%		60-130	04-OCT-21
Benzo(g,h,i)perylene			116.2		%		60-130	04-OCT-21
Benzo(k)fluoranthene			119.1		%		60-130	04-OCT-21
Chrysene			124.1		%		60-130	04-OCT-21
Dibenz(a,h)anthracene			117.2		%		60-130	04-OCT-21
Fluoranthene			123.9		%		60-130	04-OCT-21
Fluorene			122.8		%		60-130	04-OCT-21
Indeno(1,2,3-c,d)pyrene			105.0		%		60-130	04-OCT-21
2-Methylnaphthalene			122.8		%		60-130	04-OCT-21
Naphthalene			121.9		%		50-130	04-OCT-21
Perylene			120.9		%		60-130	04-OCT-21
Phenanthrene			120.8		%		60-130	04-OCT-21
Pyrene			119.3		%		60-130	04-OCT-21
1-Methylnaphthalene			124.3		%		60-130	04-OCT-21
Quinoline			98.2		%		60-130	04-OCT-21
WG3630689-3 LCS								
Acenaphthene			81.6		%		60-130	02-OCT-21
Acenaphthylene			81.1		%		60-130	02-OCT-21
Anthracene			86.5		%		60-130	02-OCT-21
Acridine			72.54		%		60-130	02-OCT-21
Benz(a)anthracene			88.9		%		60-130	02-OCT-21
Benzo(a)pyrene			84.2		%		60-130	02-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5607287								
WG3630689-3 LCS								
Benzo(b&j)fluoranthene			86.1		%		60-130	02-OCT-21
Benzo(e)pyrene			88.1		%		60-130	02-OCT-21
Benzo(g,h,i)perylene			77.5		%		60-130	02-OCT-21
Benzo(k)fluoranthene			81.6		%		60-130	02-OCT-21
Chrysene			85.1		%		60-130	02-OCT-21
Dibenz(a,h)anthracene			76.8		%		60-130	02-OCT-21
Fluoranthene			82.7		%		60-130	02-OCT-21
Fluorene			83.9		%		60-130	02-OCT-21
Indeno(1,2,3-c,d)pyrene			84.9		%		60-130	02-OCT-21
2-Methylnaphthalene			84.6		%		60-130	02-OCT-21
Naphthalene			81.4		%		50-130	02-OCT-21
Perylene			81.3		%		60-130	02-OCT-21
Phenanthrene			87.9		%		60-130	02-OCT-21
Pyrene			83.9		%		60-130	02-OCT-21
1-Methylnaphthalene			84.4		%		60-130	02-OCT-21
Quinoline			68.8		%		60-130	02-OCT-21
WG3630689-1 MB								
Acenaphthene			<0.0050		mg/kg		0.005	02-OCT-21
Acenaphthylene			<0.0050		mg/kg		0.005	02-OCT-21
Anthracene			<0.0040		mg/kg		0.004	02-OCT-21
Acridine			<0.010		mg/kg		0.01	02-OCT-21
Benz(a)anthracene			<0.010		mg/kg		0.01	02-OCT-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	02-OCT-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	02-OCT-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	02-OCT-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	02-OCT-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	02-OCT-21
Chrysene			<0.010		mg/kg		0.01	02-OCT-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	02-OCT-21
Fluoranthene			<0.010		mg/kg		0.01	02-OCT-21
Fluorene			<0.010		mg/kg		0.01	02-OCT-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	02-OCT-21
2-Methylnaphthalene			<0.010		mg/kg		0.01	02-OCT-21
Naphthalene			<0.010		mg/kg		0.01	02-OCT-21

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5607287								
WG3630689-1 MB								
Perylene			<0.010		mg/kg		0.01	02-OCT-21
Phenanthrene			<0.010		mg/kg		0.01	02-OCT-21
Pyrene			<0.010		mg/kg		0.01	02-OCT-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	02-OCT-21
Quinoline			<0.050		mg/kg		0.05	02-OCT-21
Surrogate: d8-Naphthalene			80.3		%		50-130	02-OCT-21
Surrogate: d10-Acenaphthene			84.9		%		60-130	02-OCT-21
Surrogate: d10-Phenanthrene			94.2		%		60-130	02-OCT-21
Surrogate: d12-Chrysene			99.4		%		60-130	02-OCT-21
WG3630689-12 MB								
Acenaphthene			<0.0050		mg/kg		0.005	03-OCT-21
Acenaphthylene			<0.0050		mg/kg		0.005	03-OCT-21
Anthracene			<0.0040		mg/kg		0.004	03-OCT-21
Acridine			<0.010		mg/kg		0.01	03-OCT-21
Benz(a)anthracene			<0.010		mg/kg		0.01	03-OCT-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	03-OCT-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	03-OCT-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	03-OCT-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	03-OCT-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	03-OCT-21
Chrysene			<0.010		mg/kg		0.01	03-OCT-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	03-OCT-21
Fluoranthene			<0.010		mg/kg		0.01	03-OCT-21
Fluorene			<0.010		mg/kg		0.01	03-OCT-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	03-OCT-21
2-Methylnaphthalene			<0.010		mg/kg		0.01	03-OCT-21
Naphthalene			<0.010		mg/kg		0.01	03-OCT-21
Perylene			<0.010		mg/kg		0.01	03-OCT-21
Phenanthrene			<0.010		mg/kg		0.01	03-OCT-21
Pyrene			<0.010		mg/kg		0.01	03-OCT-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	03-OCT-21
Quinoline			<0.050		mg/kg		0.05	03-OCT-21
Surrogate: d8-Naphthalene			68.9		%		50-130	03-OCT-21
Surrogate: d10-Acenaphthene			75.1		%		60-130	03-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5607287								
WG3630689-12 MB								
Surrogate: d10-Phenanthrene			81.3		%		60-130	03-OCT-21
Surrogate: d12-Chrysene			86.1		%		60-130	03-OCT-21
WG3630689-5 MB								
Acenaphthene			<0.0050		mg/kg		0.005	02-OCT-21
Acenaphthylene			<0.0050		mg/kg		0.005	02-OCT-21
Anthracene			<0.0040		mg/kg		0.004	02-OCT-21
Acridine			<0.010		mg/kg		0.01	02-OCT-21
Benz(a)anthracene			<0.010		mg/kg		0.01	02-OCT-21
Benzo(a)pyrene			<0.010		mg/kg		0.01	02-OCT-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	02-OCT-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	02-OCT-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	02-OCT-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	02-OCT-21
Chrysene			<0.010		mg/kg		0.01	02-OCT-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	02-OCT-21
Fluoranthene			<0.010		mg/kg		0.01	02-OCT-21
Fluorene			<0.010		mg/kg		0.01	02-OCT-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	02-OCT-21
2-Methylnaphthalene			<0.010		mg/kg		0.01	02-OCT-21
Naphthalene			<0.010		mg/kg		0.01	02-OCT-21
Perylene			<0.010		mg/kg		0.01	02-OCT-21
Phenanthrene			<0.010		mg/kg		0.01	02-OCT-21
Pyrene			<0.010		mg/kg		0.01	02-OCT-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	02-OCT-21
Quinoline			<0.050		mg/kg		0.05	02-OCT-21
Surrogate: d8-Naphthalene			77.1		%		50-130	02-OCT-21
Surrogate: d10-Acenaphthene			80.9		%		60-130	02-OCT-21
Surrogate: d10-Phenanthrene			88.7		%		60-130	02-OCT-21
Surrogate: d12-Chrysene			90.5		%		60-130	02-OCT-21
WG3630689-8 MB								
Acenaphthene			<0.0050		mg/kg		0.005	03-OCT-21
Acenaphthylene			<0.0050		mg/kg		0.005	03-OCT-21
Anthracene			<0.0040		mg/kg		0.004	03-OCT-21
Acridine			<0.010		mg/kg		0.01	03-OCT-21
Benz(a)anthracene			<0.010		mg/kg		0.01	03-OCT-21

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TMB-H/A-MS-CL	**Soil**							
Batch R5607287								
WG3630689-8 MB								
Benzo(a)pyrene			<0.010		mg/kg		0.01	03-OCT-21
Benzo(b&j)fluoranthene			<0.010		mg/kg		0.01	03-OCT-21
Benzo(e)pyrene			<0.010		mg/kg		0.01	03-OCT-21
Benzo(g,h,i)perylene			<0.010		mg/kg		0.01	03-OCT-21
Benzo(k)fluoranthene			<0.010		mg/kg		0.01	03-OCT-21
Chrysene			<0.010		mg/kg		0.01	03-OCT-21
Dibenz(a,h)anthracene			<0.0050		mg/kg		0.005	03-OCT-21
Fluoranthene			<0.010		mg/kg		0.01	03-OCT-21
Fluorene			<0.010		mg/kg		0.01	03-OCT-21
Indeno(1,2,3-c,d)pyrene			<0.010		mg/kg		0.01	03-OCT-21
2-Methylnaphthalene			<0.010		mg/kg		0.01	03-OCT-21
Naphthalene			<0.010		mg/kg		0.01	03-OCT-21
Perylene			<0.010		mg/kg		0.01	03-OCT-21
Phenanthrene			<0.010		mg/kg		0.01	03-OCT-21
Pyrene			<0.010		mg/kg		0.01	03-OCT-21
1-Methylnaphthalene			<0.050		mg/kg		0.05	03-OCT-21
Quinoline			<0.050		mg/kg		0.05	03-OCT-21
Surrogate: d8-Naphthalene			81.5		%		50-130	03-OCT-21
Surrogate: d10-Acenaphthene			84.0		%		60-130	03-OCT-21
Surrogate: d10-Phenanthrene			88.8		%		60-130	03-OCT-21
Surrogate: d12-Chrysene			90.1		%		60-130	03-OCT-21
PH-1:2-CL	**Soil**							
Batch R5623500								
WG3640067-3 DUP		**L2644275-10**						
pH (1:2 soil:water)		7.69	7.74	J	pH	0.05	0.2	18-OCT-21
WG3640067-2 IRM		**SAL-STD11**						
pH (1:2 soil:water)			7.95		pH		7.7-8.3	18-OCT-21
WG3640067-1 LCS								
pH (1:2 soil:water)			7.03		pH		6.8-7.2	18-OCT-21
PSA-PIPET-DETAIL-SK	**Soil**							
Batch R5610017								
WG3627494-2 IRM		**2020-PSA_SOIL**						
% Sand (2.00mm - 1.00mm)			2.9		%		0-7.2	05-OCT-21
% Sand (1.00mm - 0.50mm)			3.6		%		0-8.7	05-OCT-21
% Sand (0.50mm - 0.25mm)			8.4		%		4-14	05-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PSA-PIPET-DETAIL-SK	**Soil**							
Batch R5610017								
WG3627494-2 IRM		**2020-PSA_SOIL**						
% Sand (0.25mm - 0.125mm)			16.3		%		11.7-21.7	05-OCT-21
% Sand (0.125mm - 0.063mm)			14.0		%		8.4-18.4	05-OCT-21
% Silt (0.063mm - 0.0312mm)			12.2		%		8.5-18.5	05-OCT-21
% Silt (0.0312mm - 0.004mm)			21.0		%		15.1-25.1	05-OCT-21
% Clay (<4um)			21.5		%		16.5-26.5	05-OCT-21

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Metals							
Mercury in Soil by CVAAS							
	1	16-SEP-21 08:45	16-OCT-21 09:43	28	30	days	EHT
	2	16-SEP-21 09:30	16-OCT-21 09:43	28	30	days	EHT
	3	16-SEP-21 12:00	16-OCT-21 09:43	28	30	days	EHT
	4	16-SEP-21 12:50	16-OCT-21 09:43	28	30	days	EHT
	5	16-SEP-21 13:30	16-OCT-21 09:43	28	30	days	EHT
	6	16-SEP-21 14:30	16-OCT-21 09:43	28	30	days	EHT
	7	16-SEP-21 15:00	16-OCT-21 09:43	28	30	days	EHT
	8	15-SEP-21 13:30	16-OCT-21 09:43	28	31	days	EHT
	9	15-SEP-21 14:20	16-OCT-21 09:43	28	31	days	EHT
	10	15-SEP-21 15:15	16-OCT-21 09:43	28	31	days	EHT

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.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2644275 were received on 21-SEP-21 08:50.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes 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 pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Teck

COC ID:	September GGCAMP 2021	TURNAROUND TIME:	

PROJECT/CLIENT INFO				LABORATORY			
Facility Name / Job#	REP			Lab Name	ALS Calgary		
Project Manager	Allie Ferguson			Lab Contact	Lyudmyla Shvets		
Email	allie.ferguson@teck.com			Email	lyudmyla.shvets@alsglobal.com		
Address	421 Pine Avenue			Address	2559 29 Street NE		
City	Sparwood	Province	BC	City	Calgary	Province	AB
Postal Code	V0B 2G0	Country	Canada	Postal Code	T1Y 7B5	Country	Canada
Phone Number	250-425-8202			Phone Number	1 403 407 1794		

Excel	PDF	EDD

L2644275-COFC

SAMPLE DETAILS / ANALYSIS REQUESTED

Sample ID	Sample Location	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
Preservative								NONE	NONE	NONE	NONE	NONE	NONE
564 RG_GANF_SE-1_2021-09-16_0845	RG_GANF	SE	No	9/16/2021	845	G	2	X	X	X	X	X	X
565 RG_GANF_SE-2_2021-09-16_0930	RG_GANF	SE	No	9/16/2021	930	G	2	X	X	X	X	X	X
RG_GAUT_SE-1_2021-09-16_1200	RG_GAUT	SE	No	9/16/2021	1200	G	2	X	X	X	X	X	X
RG_GAUT_SE-2_2021-09-16_1250	RG_GAUT	SE	No	9/16/2021	1250	G	2	X	X	X	X	X	X
RG_GAUT_SE-3_2021-09-16_1330	RG_GAUT	SE	No	9/16/2021	1330	G	2	X	X	X	X	X	X
RG_GAUT_SE-4_2021-09-16_1430	RG_GAUT	SE	No	9/16/2021	1430	G	2	X	X	X	X	X	X
RG_GAUT_SE-5_2021-09-16_1500	RG_GAUT	SE	No	9/16/2021	1500	G	2	X	X	X	X	X	X
RG_GANF-SE-1_2021_09_15_1330	RG_GANF	SE	No	9/15/2021	1330	G	2	X	X	X	X	X	X
RG_GANF-SE-2_2021_09_15_1420	RG_GANF	SE	No	9/15/2021	1420	G	2	X	X	X	X	X	X
RG_GANF-SE-3_2021_09_15_1515	RG_GANF	SE	No	9/15/2021	1515	G	2	X	X	X	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	
ALS PO 750546	Jennifer Ings/Minnow	################	DK	9/21 0850

NB OF BOTTLES RETURNED/DESCRIPTION					
Regular (default)	x	Sampler's Name	Jennifer Ings	Mobile #	519-500-3444
Priority (2-3 business days) - 50% surcharge		Sampler's Signature	Jennifer Ings	Date/Time	September 20, 2021
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

2L

ALS - WATER CHEMISTRY

CERTIFICATE OF ANALYSIS

Work Order	: **CG2104017**		
Amendment	: **1**		
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 11-Sep-2021 10:15
PO	: VPO00750546	Date Analysis Commenced	: 13-Sep-2021
C-O-C number	: September GGCAMP 2021	Issue Date	: 30-Sep-2021 17:05
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*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Anthony Calero	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Dion Chan	Lab Assistant	Metals, Burnaby, British Columbia
Erin Sanchez		Inorganics, Calgary, Alberta
Hannah Phung	Lab Assistant	Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Ilnaz Badbezanchi	Team Leader - Metals preparation	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	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
Woochan Song	Lab Analyst	Metals, Burnaby, British Columbia

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*
DLA	*Detection Limit adjusted for required dilution.*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
HTD	*Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.*
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_GHFF_WS_GGCAMP_2021-09-09_NP	RG_GHNF_WS_GGCAMP_2021-09-10_NP	----	----	----
				Client sampling date / time	09-Sep-2021 11:36	10-Sep-2021 10:45	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2104017-001	CG2104017-002	--------	--------	--------
					Result	Result	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	8.0	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	256	366	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	15.2	<1.0	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	271	366	----	----	----
conductivity	----	E100	2.0	µS/cm	1810	2190	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	1200	1550	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	481	414	----	----	----
pH	----	E108	0.10	pH units	8.36	8.23	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	1600	1910	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	1.9	1.4	----	----	----
turbidity	----	E121	0.10	NTU	0.24	0.63	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	312	446	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	9.1	<1.0	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	<1.0	----	----	----
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	<0.250 DLDS	<0.250 DLDS	----	----	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	2.08	1.46	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.148	<0.100 DLDS	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.354 TKNI	0.282 TKNI	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	7.67	8.96 HTD	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0050 DLDS	0.0050 HTD	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0012	<0.0010	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0029	0.0022	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	1040	1120	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.29	2.46	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.86	2.44	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHFF_WS_GGCAMP_2021-09-09_NP	RG_GHNF_WS_GGCAMP_2021-09-10_NP	----	----	----
				Client sampling date / time	09-Sep-2021 11:36	10-Sep-2021 10:45	----	----	----
					CG2104017-001	CG2104017-002	--------	--------	--------
					Result	Result	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	27.7	31.3	----	----	----
cation sum	----	EC101	0.10	meq/L	24.2	31.2	----	----	----
ion balance (cations/anions ratio)	----	EC101	0.010	%	87.4	99.7	----	----	----
ion balance (cation-anion difference)	----	EC101	0.010	%	6.74	0.160	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0077	<0.0060 DLA	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00050	0.00071	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00022	0.00024	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0434	0.0324	----	----	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	<0.040 DLA	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000100 DLA	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.020 DLA	----	----	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.0229	0.0116	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	186	273	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00012	<0.00020 DLA	----	----	----
cobalt, total	7440-48-4	E420	0.10	µg/L	<0.10	<0.20 DLA	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00100 DLA	----	----	----
iron, total	7439-89-6	E420	0.010	mg/L	0.011	<0.020 DLA	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000100 DLA	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0187	0.0204	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	173	216	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.00104	0.00832	----	----	----
mercury, total	7439-97-6	E508-L	0.00050	µg/L	<0.00050	<0.00050	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00175	0.00200	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.0121	0.0237	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	2.67	2.96	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	180	242	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	3.66	3.31	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000020 DLA	----	----	----
sodium, total	17341-25-2	E420	0.050	mg/L	2.42	1.90	----	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHFF_WS_GGCAMP_2021-09-09_NP	RG_GHNF_WS_GGCAMP_2021-09-10_NP	----	----	----
				Client sampling date / time	09-Sep-2021 11:36	10-Sep-2021 10:45	----	----	----
					CG2104017-001	CG2104017-002	--------	--------	--------
					Result	Result	----	----	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.188	0.176	----	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	303	364	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000020 DLA	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00020 DLA	----	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00060 DLA	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.0100	0.0138	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00100 DLA	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0060 DLA	----	----	----
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	0.00052	0.00070	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00016	0.00018	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0485	0.0351	----	----	----
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	0.0064	0.0092	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	200	275	----	----	----
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	0.00022	0.00045	----	----	----
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	0.0194	0.0197	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	171	210	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00047	0.00849	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00174	0.00192	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.0118	0.0230	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	2.98	3.41	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	RG_GHFF_WS_GGCAMP_2021-09-09_NP	RG_GHNF_WS_GGCAMP_2021-09-10_NP	----	----	----
				Client sampling date / time	09-Sep-2021 11:36	10-Sep-2021 10:45	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2104017-001	CG2104017-002	--------	--------	--------
					Result	Result	----	----	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	200	290	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.72	3.32	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	----	----	----
sodium, dissolved	17341-25-2	E421	0.050	mg/L	2.65	2.18	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.198	0.182	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	326	393	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	0.000013	----	----	----
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	0.00914	0.0126	----	----	----
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	0.0021	----	----	----
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.

ALS Environmental

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2104017**	Page	: 1 of 16
Amendment	: 1		
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 11-Sep-2021 10:15
PO	: VPO00750546	Issue Date	: 30-Sep-2021 17:05
C-O-C number	: September GGCAMP 2021		
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 Services number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Matrix Spike 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
Matrix Spike (MS) Recoveries								
Anions and Nutrients	Anonymous	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	36.0 % MSTN	70.0-130%	Recovery less than lower data quality objective

Result Qualifiers

Qualifier	*Description*
MSTN	*TKN Matrix Spike recovery was low due to interference from high nitrate, which causes negative bias on TKN.*

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_GGCAMP_2021-09-10_NP	E298	10-Sep-2021	23-Sep-2021	----	----		23-Sep-2021	28 days	13 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_GHFF_WS_GGCAMP_2021-09-09_NP	E298	09-Sep-2021	23-Sep-2021	----	----		23-Sep-2021	28 days	14 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E235.Br-L	09-Sep-2021	----	----	----		13-Sep-2021	28 days	4 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GHNF_WS_GGCAMP_2021-09-10_NP	E235.Br-L	10-Sep-2021	----	----	----		17-Sep-2021	28 days	7 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E235.Cl-L	09-Sep-2021	----	----	----		13-Sep-2021	28 days	4 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GHNF_WS_GGCAMP_2021-09-10_NP	E235.Cl-L	10-Sep-2021	----	----	----		17-Sep-2021	28 days	7 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)										
HDPE RG_GHNF_WS_GGCAMP_2021-09-10_NP	E378-U	10-Sep-2021	----	----	----		13-Sep-2021	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	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)										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E378-U	09-Sep-2021	----	----	----		13-Sep-2021	3 days	4 days	× EHT
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E235.F	09-Sep-2021	----	----	----		13-Sep-2021	28 days	4 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GHNF_WS_GGCAMP_2021-09-10_NP	E235.F	10-Sep-2021	----	----	----		17-Sep-2021	28 days	7 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E235.NO3-L	09-Sep-2021	----	----	----		13-Sep-2021	3 days	4 days	× EHT
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GHNF_WS_GGCAMP_2021-09-10_NP	E235.NO3-L	10-Sep-2021	----	----	----		17-Sep-2021	3 days	7 days	× EHT
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E235.NO2-L	09-Sep-2021	----	----	----		13-Sep-2021	3 days	4 days	× EHT
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GHNF_WS_GGCAMP_2021-09-10_NP	E235.NO2-L	10-Sep-2021	----	----	----		17-Sep-2021	3 days	7 days	× EHT
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E235.SO4	09-Sep-2021	----	----	----		13-Sep-2021	28 days	4 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GHNF_WS_GGCAMP_2021-09-10_NP	E235.SO4	10-Sep-2021	----	----	----		17-Sep-2021	28 days	7 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_GHNF_WS_GGCAMP_2021-09-10_NP	E318	10-Sep-2021	16-Sep-2021	----	----		20-Sep-2021	28 days	10 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_GHFF_WS_GGCAMP_2021-09-09_NP	E318	09-Sep-2021	16-Sep-2021	----	----		20-Sep-2021	28 days	11 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) RG_GHNF_WS_GGCAMP_2021-09-10_NP	E372-U	10-Sep-2021	15-Sep-2021	----	----		15-Sep-2021	28 days	5 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) RG_GHFF_WS_GGCAMP_2021-09-09_NP	E372-U	09-Sep-2021	15-Sep-2021	----	----		15-Sep-2021	28 days	6 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) RG_GHNF_WS_GGCAMP_2021-09-10_NP	E421.Cr-L	10-Sep-2021	15-Sep-2021	----	----		15-Sep-2021	180 days	5 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) RG_GHFF_WS_GGCAMP_2021-09-09_NP	E421.Cr-L	09-Sep-2021	15-Sep-2021	----	----		15-Sep-2021	180 days	6 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GHNF_WS_GGCAMP_2021-09-10_NP	E509	10-Sep-2021	16-Sep-2021	----	----		16-Sep-2021	28 days	6 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GHFF_WS_GGCAMP_2021-09-09_NP	E509	09-Sep-2021	16-Sep-2021	----	----		16-Sep-2021	28 days	7 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) RG_GHNF_WS_GGCAMP_2021-09-10_NP	E421	10-Sep-2021	15-Sep-2021	----	----		15-Sep-2021	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 (nitric acid) RG_GHFF_WS_GGCAMP_2021-09-09_NP	E421	09-Sep-2021	15-Sep-2021	----	----		15-Sep-2021	180 days	6 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GHNF_WS_GGCAMP_2021-09-10_NP	E358-L	10-Sep-2021	20-Sep-2021	----	----		20-Sep-2021	28 days	10 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GHFF_WS_GGCAMP_2021-09-09_NP	E358-L	09-Sep-2021	20-Sep-2021	----	----		23-Sep-2021	28 days	13 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GHNF_WS_GGCAMP_2021-09-10_NP	E355-L	10-Sep-2021	20-Sep-2021	----	----		20-Sep-2021	28 days	10 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GHFF_WS_GGCAMP_2021-09-09_NP	E355-L	09-Sep-2021	20-Sep-2021	----	----		23-Sep-2021	28 days	13 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_GHNF_WS_GGCAMP_2021-09-10_NP	E283	10-Sep-2021	----	----	----		20-Sep-2021	14 days	10 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E283	09-Sep-2021	----	----	----		20-Sep-2021	14 days	11 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_GHNF_WS_GGCAMP_2021-09-10_NP	E290	10-Sep-2021	----	----	----		21-Sep-2021	14 days	11 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E290	09-Sep-2021	----	----	----		21-Sep-2021	14 days	12 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_GHNF_WS_GGCAMP_2021-09-10_NP	E100	10-Sep-2021	----	----	----		21-Sep-2021	28 days	11 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E100	09-Sep-2021	----	----	----		21-Sep-2021	28 days	12 days	✓
Physical Tests : ORP by Electrode										
HDPE RG_GHNF_WS_GGCAMP_2021-09-10_NP	E125	10-Sep-2021	----	----	----		20-Sep-2021	0.34 hrs	241 hrs	× EHTR-FM
Physical Tests : ORP by Electrode										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E125	09-Sep-2021	----	----	----		20-Sep-2021	0.34 hrs	264 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GHNF_WS_GGCAMP_2021-09-10_NP	E108	10-Sep-2021	----	----	----		21-Sep-2021	0.25 hrs	264 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E108	09-Sep-2021	----	----	----		21-Sep-2021	0.25 hrs	287 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E162	09-Sep-2021	----	----	----		14-Sep-2021	7 days	5 days	✓
Physical Tests : TDS by Gravimetry										
HDPE RG_GHNF_WS_GGCAMP_2021-09-10_NP	E162	10-Sep-2021	----	----	----		16-Sep-2021	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE [TSS-WB] RG_GHFF_WS_GGCAMP_2021-09-09_NP	E160-L	09-Sep-2021	----	----	----		14-Sep-2021	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 : TSS by Gravimetry (Low Level)										
HDPE [TSS-WB] RG_GHNF_WS_GGCAMP_2021-09-10_NP	E160-L	10-Sep-2021	----	----	----		16-Sep-2021	7 days	6 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE RG_GHNF_WS_GGCAMP_2021-09-10_NP	E121	10-Sep-2021	----	----	----		13-Sep-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE RG_GHFF_WS_GGCAMP_2021-09-09_NP	E121	09-Sep-2021	----	----	----		13-Sep-2021	3 days	4 days	× EHT
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) RG_GHFF_WS_GGCAMP_2021-09-09_NP	E420.Cr-L	09-Sep-2021	----	----	----		16-Sep-2021	180 days	7 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) RG_GHNF_WS_GGCAMP_2021-09-10_NP	E420.Cr-L	10-Sep-2021	----	----	----		16-Sep-2021	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_GHNF_WS_GGCAMP_2021-09-10_NP	E508-L	10-Sep-2021	----	----	----		18-Sep-2021	28 days	8 days	✓
Total Metals : Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)										
Pre-cleaned amber glass - total (lab preserved) RG_GHFF_WS_GGCAMP_2021-09-09_NP	E508-L	09-Sep-2021	----	----	----		18-Sep-2021	28 days	9 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) RG_GHFF_WS_GGCAMP_2021-09-09_NP	E420	09-Sep-2021	----	----	----		16-Sep-2021	180 days	7 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) RG_GHNF_WS_GGCAMP_2021-09-10_NP	E420	10-Sep-2021	----	----	----		16-Sep-2021	180 days	7 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	297438	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	298096	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	300319	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	290681	1	2	50.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	290682	1	2	50.0	5.0	✓
Conductivity in Water	E100	298095	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	292385	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	294342	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	292384	2	20	10.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	297482	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	290452	1	2	50.0	5.0	✓
Fluoride in Water by IC	E235.F	290679	1	2	50.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	290683	1	2	50.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	290684	1	2	50.0	5.0	✓
ORP by Electrode	E125	296880	1	20	5.0	5.0	✓
pH by Meter	E108	298094	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	290680	1	2	50.0	5.0	✓
TDS by Gravimetry	E162	291257	2	40	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	292724	1	8	12.5	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	294397	1	16	6.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	296198	1	9	11.1	5.0	✓
Total Metals in Water by CRC ICPMS	E420	292723	1	19	5.2	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	297485	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	291325	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	290421	2	14	14.2	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	297438	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	298096	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	300319	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	290681	1	2	50.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	290682	1	2	50.0	5.0	✓
Conductivity in Water	E100	298095	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	292385	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	294342	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	292384	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	297482	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	290452	1	2	50.0	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	290679	1	2	50.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	290683	1	2	50.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	290684	1	2	50.0	5.0	✓
ORP by Electrode	E125	296880	1	20	5.0	5.0	✓
pH by Meter	E108	298094	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	290680	1	2	50.0	5.0	✓
TDS by Gravimetry	E162	291257	2	40	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	292724	1	8	12.5	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	294397	1	16	6.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	296198	1	9	11.1	5.0	✓
Total Metals in Water by CRC ICPMS	E420	292723	1	19	5.2	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	297485	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	291325	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	291251	2	33	6.0	5.0	✓
Turbidity by Nephelometry	E121	290421	2	14	14.2	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	297438	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	298096	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	300319	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	290681	1	2	50.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	290682	1	2	50.0	5.0	✓
Conductivity in Water	E100	298095	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	292385	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	294342	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	292384	2	20	10.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	297482	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	290452	1	2	50.0	5.0	✓
Fluoride in Water by IC	E235.F	290679	1	2	50.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	290683	1	2	50.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	290684	1	2	50.0	5.0	✓
Sulfate in Water by IC	E235.SO4	290680	1	2	50.0	5.0	✓
TDS by Gravimetry	E162	291257	2	40	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	292724	1	8	12.5	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	294397	1	16	6.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	296198	1	9	11.1	5.0	✓
Total Metals in Water by CRC ICPMS	E420	292723	2	19	10.5	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	297485	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	291325	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	291251	2	33	6.0	5.0	✓
Turbidity by Nephelometry	E121	290421	2	14	14.2	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	300319	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	290681	1	2	50.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	290682	1	2	50.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	292385	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	294342	1	18	5.5	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	292384	2	20	10.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	297482	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	290452	1	2	50.0	5.0	✓
Fluoride in Water by IC	E235.F	290679	1	2	50.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	290683	1	2	50.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	290684	1	2	50.0	5.0	✓
Sulfate in Water by IC	E235.SO4	290680	1	2	50.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	292724	1	8	12.5	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	294397	1	16	6.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	296198	1	9	11.1	5.0	✓
Total Metals in Water by CRC ICPMS	E420	292723	1	19	5.2	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	297485	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	291325	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 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 E (mod)	Dissolved Orthophosphate is determined colourimetrically on a water 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.

QUALITY CONTROL REPORT

Work Order	: **CG2104017**		
Amendment	: **1**		
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 11-Sep-2021 10:15
PO	: VPO00750546	Date Analysis Commenced	: 13-Sep-2021
C-O-C number	: September GGCAMP 2021	Issue Date	: 30-Sep-2021 17:05
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 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
Anthony Calero	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Dion Chan	Lab Assistant	Metals, Burnaby, British Columbia
Erin Sanchez		Inorganics, Calgary, Alberta
Hannah Phung	Lab Assistant	Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Ilnaz Badbezanchi	Team Leader - Metals preparation	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	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

Woochan Song	Lab Analyst	Metals, Burnaby, British Columbia

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.

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	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 290421)											
CG2104004-005	Anonymous	turbidity	----	E121	0.10	NTU	0.58	0.56	0.02	Diff <2x LOR	----
Physical Tests (QC Lot: 290541)											
CG2104017-001	RG_GHFF_WS_GGCAMP _2021-09-09_NP	turbidity	----	E121	0.10	NTU	0.24	0.26	0.01	Diff <2x LOR	----
Physical Tests (QC Lot: 291257)											
CG2104004-002	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	327	323	1.23%	20%	----
Physical Tests (QC Lot: 292794)											
CG2104004-008	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	280	265	5.69%	20%	----
Physical Tests (QC Lot: 296880)											
CG2104006-003	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	480	491	2.29%	15%	----
Physical Tests (QC Lot: 297438)											
CG2104005-001	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 298094)											
CG2104004-010	Anonymous	pH	----	E108	0.10	pH units	5.01	5.03	0.398%	4%	----
Physical Tests (QC Lot: 298095)											
CG2104004-010	Anonymous	conductivity	----	E100	2.0	µS/cm	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 298096)											
CG2104004-010	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	----
Anions and Nutrients (QC Lot: 290452)											
CG2104017-001	RG_GHFF_WS_GGCAMP _2021-09-09_NP	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0012	0.0014	0.0002	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 290679)											
CG2104017-001	RG_GHFF_WS_GGCAMP _2021-09-09_NP	fluoride	16984-48-8	E235.F	0.100	mg/L	0.148	0.139	0.009	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 290680)											
CG2104017-001	RG_GHFF_WS_GGCAMP _2021-09-09_NP	sulfate (as SO4)	14808-79-8	E235.SO4	1.50	mg/L	1040	992	5.14%	20%	----
Anions and Nutrients (QC Lot: 290681)											
CG2104017-001	RG_GHFF_WS_GGCAMP _2021-09-09_NP	bromide	24959-67-9	E235.Br-L	0.250	mg/L	<0.250	<0.250	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 290682)											

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: 290682) - continued											
CG2104017-001	RG_GHFF_WS_GGCAMP _2021-09-09_NP	chloride	16887-00-6	E235.Cl-L	0.50	mg/L	2.08	1.89	0.19	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 290683)											
CG2104017-001	RG_GHFF_WS_GGCAMP _2021-09-09_NP	nitrate (as N)	14797-55-8	E235.NO3-L	0.0250	mg/L	7.67	7.28	5.24%	20%	----
Anions and Nutrients (QC Lot: 290684)											
CG2104017-001	RG_GHFF_WS_GGCAMP _2021-09-09_NP	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: 291325)											
CG2104005-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0048	0.0050	0.0003	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 294397)											
CG2104001-003	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	TKND
Anions and Nutrients (QC Lot: 300319)											
CG2104007-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 297482)											
CG2104007-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	2.28	2.14	0.14	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 297485)											
CG2104006-002	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.36	1.39	0.02	Diff <2x LOR	----
Total Metals (QC Lot: 292723)											
CG2103999-001	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	0.00230	0.00214	6.83%	20%	----
		arsenic, total	7440-38-2	E420	0.00020	mg/L	0.00024	0.00022	0.00002	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00020	mg/L	0.0167	0.0172	2.75%	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	0.108	0.105	0.003	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0100	mg/L	2.62 µg/L	0.00275	4.86%	20%	----
		calcium, total	7440-70-2	E420	0.100	mg/L	623	606	2.88%	20%	----
		cobalt, total	7440-48-4	E420	0.20	mg/L	87.6 µg/L	0.0899	2.55%	20%	----
		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	0.144	0.145	0.002	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000100	mg/L	0.000177	0.000163	0.000014	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0020	mg/L	0.938	0.894	4.74%	20%	----
		magnesium, total	7439-95-4	E420	0.0100	mg/L	292	293	0.383%	20%	----
		manganese, total	7439-96-5	E420	0.00020	mg/L	0.751	0.751	0.0845%	20%	----
		molybdenum, total	7439-98-7	E420	0.000100	mg/L	0.00466	0.00453	2.87%	20%	----
		nickel, total	7440-02-0	E420	0.00100	mg/L	0.453	0.474	4.60%	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: 292723) - continued											
CG2103999-001	Anonymous	potassium, total	7440-09-7	E420	0.100	mg/L	16.8	17.4	3.12%	20%	----
		selenium, total	7782-49-2	E420	0.100	mg/L	98.9 µg/L	0.100	1.51%	20%	----
		silicon, total	7440-21-3	E420	0.20	mg/L	2.90	2.93	1.14%	20%	----
		silver, total	7440-22-4	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		sodium, total	17341-25-2	E420	0.100	mg/L	15.6	16.2	3.70%	20%	----
		strontium, total	7440-24-6	E420	0.00040	mg/L	1.11	1.04	6.87%	20%	----
		sulfur, total	7704-34-9	E420	1.00	mg/L	435	434	0.285%	20%	----
		thallium, total	7440-28-0	E420	0.000020	mg/L	0.000398	0.000370	7.45%	20%	----
		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	0.0428	0.0390	9.41%	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	0.191	0.193	1.09%	20%	----
Total Metals (QC Lot: 292724)											
CG2103999-001	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: 296198)											
CG2104017-001	RG_GHFF_WS_GGCAMP _2021-09-09_NP	mercury, total	7439-97-6	E508-L	0.00050	ng/L	<0.00050 µg/L	<0.50	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 292384)											
CG2103975-001	Anonymous	copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00043	0.00045	0.00003	Diff <2x LOR	----
CG2103975-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0029	0.0028	0.00006	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00231	0.00236	2.26%	20%	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00011	0.00012	0.00002	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0232	0.0239	2.65%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.020	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	0.061	0.062	0.0008	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0050	mg/L	0.307 µg/L	0.000325	5.45%	20%	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	257	263	2.43%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.10	mg/L	31.0 µg/L	0.0312	0.760%	20%	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	0.055	0.054	0.001	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	0.716	0.717	0.122%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	103	101	1.52%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.213	0.215	1.30%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00600	0.00624	3.84%	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: 292384) - continued											
CG2103975-001	Anonymous	nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.142	0.143	0.758%	20%	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	13.5	13.5	0.538%	20%	----
		selenium, dissolved	7782-49-2	E421	0.050	mg/L	3.67 µg/L	0.00363	1.12%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.69	2.65	1.70%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	17341-25-2	E421	0.050	mg/L	11.3	11.4	1.15%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.613	0.634	3.39%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	154	154	0.584%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.000148	0.000155	5.24%	20%	----
		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	0.0157	0.0160	2.18%	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	0.216	0.219	1.06%	20%	----
Dissolved Metals (QC Lot: 292385)											
CG2103975-001	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: 294342)											
CG2104004-006	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
TKND	*TKN duplication was poor due to interference from high nitrate, which causes negative bias on TKN.*

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: 290421)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 290541)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 291251)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 291257)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 292788)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 292794)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 297438)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 298095)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 298096)						
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: 290452)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 290679)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 290680)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 290681)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 290682)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 290683)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 290684)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 290684) - continued						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 291325)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 294397)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 300319)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Organic / Inorganic Carbon (QCLot: 297482)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 297485)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 292723)						
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	MBRR
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	17341-25-2	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: 292723) - 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	----
Total Metals (QCLot: 292724)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 296198)						
mercury, total	7439-97-6	E508-L	0.5	ng/L	<0.50	----
Dissolved Metals (QCLot: 292384)						
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	MBRR
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	17341-25-2	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 292384) - continued						
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	----
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: 292385)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 294342)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----

Qualifiers

Qualifier	*Description*
MBRR	*Initial MB for this submission had positive results for flagged analyte (data not shown). Low level samples were repeated with new QC (2nd MB results shown). High level results (>5x initial MB level) and non-detect results were reported and are defensible*

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: 290421)									
turbidity	----	E121	0.1	NTU	200 NTU	100.0	85.0	115	----
Physical Tests (QCLot: 290541)									
turbidity	----	E121	0.1	NTU	200 NTU	99.3	85.0	115	----
Physical Tests (QCLot: 291251)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	100	85.0	115	----
Physical Tests (QCLot: 291257)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	98.9	85.0	115	----
Physical Tests (QCLot: 292788)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	103	85.0	115	----
Physical Tests (QCLot: 292794)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	97.8	85.0	115	----
Physical Tests (QCLot: 296880)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	101	95.4	104	----
Physical Tests (QCLot: 297438)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	110	85.0	115	----
Physical Tests (QCLot: 298094)									
pH	----	E108	----	pH units	7 pH units	100	98.6	101	----
Physical Tests (QCLot: 298095)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	99.1	90.0	110	----
Physical Tests (QCLot: 298096)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	101	85.0	115	----
Anions and Nutrients (QCLot: 290452)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.1 mg/L	98.9	80.0	120	----
Anions and Nutrients (QCLot: 290679)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	98.3	90.0	110	----
Anions and Nutrients (QCLot: 290680)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 290681)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	103	85.0	115	----
Anions and Nutrients (QCLot: 290682)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 290683)									

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: 290683) - continued									
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: 290684)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 291325)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	8.32 mg/L	102	80.0	120	----
Anions and Nutrients (QCLot: 294397)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	106	75.0	125	----
Anions and Nutrients (QCLot: 300319)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	101	85.0	115	----
Organic / Inorganic Carbon (QCLot: 297482)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	10 mg/L	93.2	80.0	120	----
Organic / Inorganic Carbon (QCLot: 297485)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	10 mg/L	99.8	80.0	120	----
Total Metals (QCLot: 292723)									
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	102	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	102	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	103	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	99.4	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	95.9	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	102	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	97.3	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	102	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	97.3	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	106	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	107	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	100	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	99.8	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	96.8	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	98.2	80.0	120	----

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
Total Metals (QCLot: 292723) - continued									
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	97.4	80.0	120	----
sodium, total	17341-25-2	E420	0.05	mg/L	50 mg/L	105	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	106	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	102	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	96.0	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	101	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	103	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	104	80.0	120	----
Total Metals (QCLot: 292724)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	98.8	80.0	120	----
Total Metals (QCLot: 296198)									
mercury, total	7439-97-6	E508-L	0.5	ng/L	5 ng/L	96.2	80.0	120	----
Dissolved Metals (QCLot: 292384)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	97.7	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	98.0	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	96.7	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	98.7	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	94.1	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	100	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	100	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	98.7	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	96.3	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	98.1	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	95.0	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	96.3	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	96.3	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	97.8	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	97.1	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	99.3	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	95.7	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
					Laboratory Control Sample (LCS) Report				
Dissolved Metals (QCLot: 292384) - continued									
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	102	80.0	120	----
sodium, dissolved	17341-25-2	E421	0.05	mg/L	50 mg/L	108	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	99.8	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	88.6	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	95.1	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	100	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	96.9	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	99.4	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	100	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	103	80.0	120	----
Dissolved Metals (QCLot: 292385)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	98.9	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	97.6	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: 290452)										
CG2104017-002	RG_GHNF_WS_GGCAMP_2021-09-10_NP	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0502 mg/L	0.05 mg/L	100	70.0	130	----
Anions and Nutrients (QCLot: 290679)										
CG2104017-002	RG_GHNF_WS_GGCAMP_2021-09-10_NP	fluoride	16984-48-8	E235.F	0.827 mg/L	1 mg/L	82.7	75.0	125	----
Anions and Nutrients (QCLot: 290680)										
CG2104017-002	RG_GHNF_WS_GGCAMP_2021-09-10_NP	sulfate (as SO4)	14808-79-8	E235.SO4	ND mg/L	100 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 290681)										
CG2104017-002	RG_GHNF_WS_GGCAMP_2021-09-10_NP	bromide	24959-67-9	E235.Br-L	0.497 mg/L	0.5 mg/L	99.4	75.0	125	----
Anions and Nutrients (QCLot: 290682)										
CG2104017-002	RG_GHNF_WS_GGCAMP_2021-09-10_NP	chloride	16887-00-6	E235.Cl-L	105 mg/L	100 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 290683)										
CG2104017-002	RG_GHNF_WS_GGCAMP_2021-09-10_NP	nitrate (as N)	14797-55-8	E235.NO3-L	ND mg/L	2.5 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 290684)										
CG2104017-002	RG_GHNF_WS_GGCAMP_2021-09-10_NP	nitrite (as N)	14797-65-0	E235.NO2-L	0.528 mg/L	0.5 mg/L	106	75.0	125	----
Anions and Nutrients (QCLot: 291325)										
CG2104005-002	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0593 mg/L	0.0676 mg/L	87.7	70.0	130	----
Anions and Nutrients (QCLot: 294397)										
CG2104001-002	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.901 mg/L	2.5 mg/L	36.0	70.0	130	MSTN
Anions and Nutrients (QCLot: 300319)										
CG2104023-013	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.108 mg/L	0.1 mg/L	108	75.0	125	----
Organic / Inorganic Carbon (QCLot: 297482)										
CG2104007-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	26.5 mg/L	23.9 mg/L	111	70.0	130	----
Organic / Inorganic Carbon (QCLot: 297485)										
CG2104006-002	Anonymous	carbon, total organic [TOC]	----	E355-L	25.0 mg/L	23.9 mg/L	105	70.0	130	----
Total Metals (QCLot: 292723)										
CG2103999-002	Anonymous	aluminum, total	7429-90-5	E420	0.402 mg/L	0.4 mg/L	100	70.0	130	----

Sub-Matrix: **Water**

Matrix Spike (MS) Report

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: 292723) - continued										
CG2103999-002	Anonymous	antimony, total	7440-36-0	E420	0.0380 mg/L	0.04 mg/L	95.0	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0411 mg/L	0.04 mg/L	103	70.0	130	----
		barium, total	7440-39-3	E420	0.0379 mg/L	0.04 mg/L	94.8	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0766 mg/L	0.08 mg/L	95.7	70.0	130	----
		bismuth, total	7440-69-9	E420	0.0172 mg/L	0.02 mg/L	86.2	70.0	130	----
		boron, total	7440-42-8	E420	0.205 mg/L	0.2 mg/L	103	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00717 mg/L	0.008 mg/L	89.6	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	8 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	ND mg/L	0.04 mg/L	ND	70.0	130	----
		copper, total	7440-50-8	E420	0.0361 mg/L	0.04 mg/L	90.2	70.0	130	----
		iron, total	7439-89-6	E420	3.83 mg/L	4 mg/L	95.7	70.0	130	----
		lead, total	7439-92-1	E420	0.0350 mg/L	0.04 mg/L	87.6	70.0	130	----
		lithium, total	7439-93-2	E420	ND mg/L	0.2 mg/L	ND	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	2 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	ND mg/L	0.04 mg/L	ND	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0406 mg/L	0.04 mg/L	101	70.0	130	----
		nickel, total	7440-02-0	E420	ND mg/L	0.08 mg/L	ND	70.0	130	----
		potassium, total	7440-09-7	E420	ND mg/L	8 mg/L	ND	70.0	130	----
		selenium, total	7782-49-2	E420	0.0835 mg/L	0.08 mg/L	104	70.0	130	----
		silicon, total	7440-21-3	E420	19.1 mg/L	20 mg/L	95.7	70.0	130	----
		silver, total	7440-22-4	E420	0.00730 mg/L	0.008 mg/L	91.2	70.0	130	----
		sodium, total	17341-25-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.04 mg/L	ND	70.0	130	----
		sulfur, total	7704-34-9	E420	ND mg/L	40 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.00705 mg/L	0.008 mg/L	88.2	70.0	130	----
		tin, total	7440-31-5	E420	0.0374 mg/L	0.04 mg/L	93.6	70.0	130	----
		titanium, total	7440-32-6	E420	0.0823 mg/L	0.08 mg/L	103	70.0	130	----
		uranium, total	7440-61-1	E420	ND mg/L	0.008 mg/L	ND	70.0	130	----
		vanadium, total	7440-62-2	E420	0.207 mg/L	0.2 mg/L	104	70.0	130	----
		zinc, total	7440-66-6	E420	0.734 mg/L	0.8 mg/L	91.8	70.0	130	----
Total Metals (QCLot: 292724)										
CG2103999-002	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: 296198)										
CG2104017-002	RG_GHNF_WS_GGCAMP_2021-09-10_NP	mercury, total	7439-97-6	E508-L	4.19 ng/L	5 ng/L	83.7	70.0	130	----
Dissolved Metals (QCLot: 292384)										

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: 292384) - continued										
CG2103975-002	Anonymous	copper, dissolved	7440-50-8	E421	0.0181 mg/L	0.02 mg/L	90.4	70.0	130	----
CG2103975-002	Anonymous	aluminum, dissolved	7429-90-5	E421	0.200 mg/L	0.2 mg/L	100	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0200 mg/L	0.02 mg/L	100.0	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0198 mg/L	0.02 mg/L	99.1	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0367 mg/L	0.04 mg/L	91.8	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00842 mg/L	0.01 mg/L	84.2	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.100 mg/L	0.1 mg/L	99.8	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00374 mg/L	0.004 mg/L	93.4	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	ND mg/L	0.02 mg/L	ND	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.91 mg/L	2 mg/L	95.7	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0178 mg/L	0.02 mg/L	88.9	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	ND mg/L	0.02 mg/L	ND	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0207 mg/L	0.02 mg/L	104	70.0	130	----
		nickel, dissolved	7440-02-0	E421	ND mg/L	0.04 mg/L	ND	70.0	130	----
		potassium, dissolved	7440-09-7	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0408 mg/L	0.04 mg/L	102	70.0	130	----
		silicon, dissolved	7440-21-3	E421	8.86 mg/L	10 mg/L	88.6	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00388 mg/L	0.004 mg/L	96.9	70.0	130	----
		sodium, dissolved	17341-25-2	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	0.00360 mg/L	0.004 mg/L	90.0	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0198 mg/L	0.02 mg/L	99.1	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0410 mg/L	0.04 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	0.102 mg/L	0.1 mg/L	102	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.356 mg/L	0.4 mg/L	89.0	70.0	130	----
Dissolved Metals (QCLot: 292385)										
CG2103975-002	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.0392 mg/L	0.04 mg/L	98.0	70.0	130	----
Dissolved Metals (QCLot: 294342)										
CG2104004-007	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000981 mg/L	0.0001 mg/L	98.1	70.0	130	----

Qualifiers

Qualifier	*Description*
MSTN	*TKN Matrix Spike recovery was low due to interference from high nitrate, which causes negative bias on TKN.*

Teck

COC ID:	September GGCAMP 2021	TURNAROUND TIME:	

PROJECT/CLIENT INFO

Facility Name / Job#	REP		
Project Manager	Allie Ferguson		
Email			
Address	421 Pine Avenue		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	250-425-8202		

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	1 403 407 1794		

Excel	PDF	EDD
x	x	x
		x
x	x	x
x	x	x
x	x	x

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	TECKCOAL-ROUTINE-VA	ALS_Package-DOC	ALS_Package-TKN/TOC	HG-T-U-CVAF-VA	HG-D-CVAF-VA	TECKCOAL-MET-T-VA	TECKCOAL-MET-D-VA
Filtered								N	F	N	N	F	N	F
Preserved									H2SO4	H2SO4		HCL	HNO3	HNO3
RG_GHFF_WS_GGCAMP_2021-09-09_NP	RG_GHFF	WS	No	9/9/2021	1136	G	7	X	X	X	X	X	X	X
RG_GHNF_WS_GGCAMP_2021-09-10_NP	RG_GHNF	WS	No	9/10/2021	1045	G	7	X	X	X	X	X	X	X

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

ALS PO 750546

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	
Jennifer Ings/Minnow	################		9/11 1035

NB OF BOTTLES RETURNED/DESCRIPTION

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	Jennifer Ings	Mobile #	519-500-3444
Sampler's Signature	Jennif Ings	Date/Time	September 10, 2021

9

Environmental Division
Calgary
Work Order Reference
CG2104017

Telephone: +1 403 407 1800

CERTIFICATE OF ANALYSIS

Work Order	: **CG2104105**	Page	: 1 of 7
Amendment	: **1**		
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	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-2021 08:50
PO	: VPO00750546	Date Analysis Commenced	: 16-Sep-2021
C-O-C number	: September GGCAMP 2021	Issue Date	: 01-Dec-2021 16:17
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	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Dee Lee	Analyst	Metals, Burnaby, British Columbia
Elke Tabora		Inorganics, Calgary, Alberta
Erin Sanchez		Inorganics, Calgary, Alberta
Hannah Phung	Lab Assistant	Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Monica Ko	Lab Assistant	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia
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*
DLA	*Detection Limit adjusted for required dilution.*
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					
				Client sample ID	**RG_GHUT_WS_GGCAMP_2021-09-13_NP**	**RG_GHBP_WS_GGCAMP_2021-09-13_NP**	**RG_RIVER_WS_2021-09-13_NP**	**RG_FBLANK_WS_2021-09-13_NP**	----
				Client sampling date / time	13-Sep-2021 09:30	13-Sep-2021 15:05	13-Sep-2021 15:05	13-Sep-2021 15:05	----
					CG2104105-001	**CG2104105-002**	**CG2104105-003**	**CG2104105-004**	--------
					Result	Result	Result	Result	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	16.1	<2.0	<2.0	<2.0	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	464	210	234	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	20.6	21.6	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	464	230	256	<1.0	----
conductivity	----	E100	2.0	µS/cm	2270	1600	1590	<2.0	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	1600	989	993	<0.50	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	480	430	441	438	----
pH	----	E108	0.10	pH units	8.04	8.44	8.43	5.32	----
solids, total dissolved [TDS]	----	E162	10	mg/L	2040	1310	1300	<10	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	1.7	2.4	2.0	<1.0	----
turbidity	----	E121	0.10	NTU	1.04	1.42	0.91	<0.10	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	565	256	286	<1.0	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	<1.0	12.4	13.0	<1.0	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	0.0108	0.0091	<0.0050	----
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	1.63	1.50	1.56	<0.10	----
fluoride	16984-48-8	E235.F	0.020	mg/L	<0.100 [DLDS]	0.112	0.115	<0.020	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.443 [TKNI]	0.678	0.563	<0.050	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	10.0	4.74	4.71	<0.0050	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0050 [DLDS]	0.0064	0.0077	<0.0010	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0039	<0.0010	<0.0010	<0.0010	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0094	0.0065	0.0079	<0.0020	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	1120	787	783	<0.30	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.52	2.35	2.05	<0.50	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.54	2.24	2.18	<0.50	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

				Client sample ID	RG_GHUT_WS_GGCAMP_2021-09-13_NP	RG_GHBP_WS_GGCAMP_2021-09-13_NP	RG_RIVER_WS_2021-09-13_NP	RG_FBLANK_WS_2021-09-13_NP	----
				Client sampling date / time	13-Sep-2021 09:30	13-Sep-2021 15:05	13-Sep-2021 15:05	13-Sep-2021 15:05	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	CG2104105-001	CG2104105-002	CG2104105-003	CG2104105-004	--------
					Result	Result	Result	Result	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	33.4	21.4	21.8	<0.10	----
cation sum	----	EC101	0.10	meq/L	32.0	19.9	20.0	<0.10	----
ion balance (cations/anions ratio)	----	EC101	0.010	%	95.8	93.0	91.7	100	----
ion balance (cation-anion difference)	----	EC101	0.010	%	2.14	3.63	4.31	<0.010	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0075	0.0110	0.0072	<0.0030	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00083	0.00053	0.00053	<0.00010	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00021	0.00020	0.00020	<0.00010	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0306	0.0363	0.0386	<0.00010	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.040 DLA	<0.020	<0.020	<0.020	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000100 DLA	<0.000050	<0.000050	<0.000050	----
boron, total	7440-42-8	E420	0.010	mg/L	<0.020 DLA	0.012	0.012	<0.010	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.906	0.0128	0.0077	<0.0050	----
calcium, total	7440-70-2	E420	0.050	mg/L	328	176	184	<0.050	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	<0.00020 DLA	<0.00010	<0.00010	<0.00010	----
cobalt, total	7440-48-4	E420	0.10	µg/L	<0.20 DLA	<0.10	<0.10	<0.10	----
copper, total	7440-50-8	E420	0.00050	mg/L	<0.00100 DLA	0.00051	<0.00050	<0.00050	----
iron, total	7439-89-6	E420	0.010	mg/L	<0.020 DLA	0.010	0.012	<0.010	----
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000100 DLA	<0.000050	<0.000050	<0.000050	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0199	0.0186	0.0185	<0.0010	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	196	139	152	0.0050 RRV	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.0108	0.00183	0.00206	<0.00010	----
mercury, total	7439-97-6	E508-L	0.00050	µg/L	0.00072	0.00051	<0.00050	<0.00050	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00173	0.00394	0.00441	<0.000050	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.0321	0.00747	0.00784	<0.00050	----
potassium, total	7440-09-7	E420	0.050	mg/L	2.95	2.42	2.54	<0.050	----
selenium, total	7782-49-2	E420	0.050	µg/L	253	145	156	<0.050	----
silicon, total	7440-21-3	E420	0.10	mg/L	3.07	3.78	4.06	<0.10	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000020 DLA	<0.000010	<0.000010	<0.000010	----
sodium, total	17341-25-2	E420	0.050	mg/L	1.84	2.54	2.71	<0.050	----

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	RG_GHUT_WS_GGCAMP_2021-09-13_NP	RG_GHBP_WS_GGCAMP_2021-09-13_NP	RG_RIVER_WS_2021-09-13_NP	RG_FBLANK_WS_2021-09-13_NP	----
				Client sampling date / time	13-Sep-2021 09:30	13-Sep-2021 15:05	13-Sep-2021 15:05	13-Sep-2021 15:05	----
					CG2104105-001	CG2104105-002	CG2104105-003	CG2104105-004	--------
					Result	Result	Result	Result	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.179	0.188	0.195	<0.00020	----
sulfur, total	7704-34-9	E420	0.50	mg/L	362	265	280	<0.50	----
thallium, total	7440-28-0	E420	0.000010	mg/L	0.000025	<0.000010	<0.000010	<0.000010	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00020 DLA	<0.00010	<0.00010	<0.00010	----
titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00060 DLA	<0.00030	<0.00030	<0.00030	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.0148	0.00890	0.00891	<0.000010	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00100 DLA	<0.00050	<0.00050	<0.00050	----
zinc, total	7440-66-6	E420	0.0030	mg/L	0.0569	0.0045	<0.0030	<0.0030	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0022	<0.0010	<0.0010	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00080	0.00050	0.00048	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00023	0.00019	0.00021	<0.00010	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0313	0.0390	0.0377	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.040 DLA	<0.020	<0.020	<0.020	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000100 DLA	<0.000050	<0.000050	<0.000050	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.020 DLA	0.010	0.010	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	0.946	0.0076	0.0052	<0.0050	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	316	170	170	<0.050	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00020 DLA	<0.00010	<0.00010	<0.00010	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.20 DLA	<0.10	<0.10	<0.10	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00060	0.00045	0.00027	<0.00020	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.020 DLA	<0.010	<0.010	<0.010	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000100 DLA	<0.000050	<0.000050	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0201	0.0179	0.0178	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	196	137	138	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00982	0.00065	0.00047	<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	0.00177	0.00380	0.00431	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.0332	0.00724	0.00744	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	3.08	2.60	2.57	<0.050	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	RG_GHUT_WS_GGCAMP_2021-09-13_NP	RG_GHBP_WS_GGCAMP_2021-09-13_NP	RG_RIVER_WS_2021-09-13_NP	RG_FBLANK_WS_2021-09-13_NP	----
				Client sampling date / time	13-Sep-2021 09:30	13-Sep-2021 15:05	13-Sep-2021 15:05	13-Sep-2021 15:05	----
Analyte	CAS Number	Method	LOR	Unit	CG2104105-001	CG2104105-002	CG2104105-003	CG2104105-004	--------
					Result	Result	Result	Result	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	243	145	142	<0.050	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.43	3.85	3.90	<0.050	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000020 DLA	<0.000010	<0.000010	<0.000010	----
sodium, dissolved	17341-25-2	E421	0.050	mg/L	1.90	2.66	2.56	<0.050	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.171	0.178	0.174	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	384	260	257	<0.50	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.000023	<0.000010	<0.000010	<0.000010	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00020 DLA	<0.00010	<0.00010	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00060 DLA	<0.00030	<0.00030	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.0144	0.00831	0.00864	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00100 DLA	<0.00050	<0.00050	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0605	0.0053	<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	: **CG2104105**	Page	: 1 of 20
Amendment	: 1		
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	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-2021 08:50
PO	: VPO00750546	Issue Date	: 01-Dec-2021 16:18
C-O-C number	: September GGCAMP 2021		
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 Services number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

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_2021-09-13_NP	E298	13-Sep-2021	27-Sep-2021	----	----		27-Sep-2021	28 days	14 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_GHBP_WS_GGCAMP_2021-09-13_NP	E298	13-Sep-2021	27-Sep-2021	----	----		27-Sep-2021	28 days	14 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_GHUT_WS_GGCAMP_2021-09-13_NP	E298	13-Sep-2021	27-Sep-2021	----	----		27-Sep-2021	28 days	14 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) RG_RIVER_WS_2021-09-13_NP	E298	13-Sep-2021	27-Sep-2021	----	----		27-Sep-2021	28 days	14 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_FBLANK_WS_2021-09-13_NP	E235.Br-L	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GHBP_WS_GGCAMP_2021-09-13_NP	E235.Br-L	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GHUT_WS_GGCAMP_2021-09-13_NP	E235.Br-L	13-Sep-2021	----	----	----		16-Sep-2021	28 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
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_RIVER_WS_2021-09-13_NP	E235.Br-L	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_FBLANK_WS_2021-09-13_NP	E235.Cl-L	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GHBP_WS_GGCAMP_2021-09-13_NP	E235.Cl-L	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GHUT_WS_GGCAMP_2021-09-13_NP	E235.Cl-L	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_RIVER_WS_2021-09-13_NP	E235.Cl-L	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)										
HDPE RG_FBLANK_WS_2021-09-13_NP	E378-U	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)										
HDPE RG_GHBP_WS_GGCAMP_2021-09-13_NP	E378-U	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)										
HDPE RG_GHUT_WS_GGCAMP_2021-09-13_NP	E378-U	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)										
HDPE RG_RIVER_WS_2021-09-13_NP	E378-U	13-Sep-2021	----	----	----		16-Sep-2021	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	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 : Fluoride in Water by IC										
HDPE RG_FBLANK_WS_2021-09-13_NP	E235.F	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GHBP_WS_GGCAMP_2021-09-13_NP	E235.F	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GHUT_WS_GGCAMP_2021-09-13_NP	E235.F	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_RIVER_WS_2021-09-13_NP	E235.F	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_FBLANK_WS_2021-09-13_NP	E235.NO3-L	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GHBP_WS_GGCAMP_2021-09-13_NP	E235.NO3-L	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GHUT_WS_GGCAMP_2021-09-13_NP	E235.NO3-L	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_RIVER_WS_2021-09-13_NP	E235.NO3-L	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_FBLANK_WS_2021-09-13_NP	E235.NO2-L	13-Sep-2021	----	----	----		16-Sep-2021	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 : Nitrite in Water by IC (Low Level)										
HDPE RG_GHBP_WS_GGCAMP_2021-09-13_NP	E235.NO2-L	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GHUT_WS_GGCAMP_2021-09-13_NP	E235.NO2-L	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_RIVER_WS_2021-09-13_NP	E235.NO2-L	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_FBLANK_WS_2021-09-13_NP	E235.SO4	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GHBP_WS_GGCAMP_2021-09-13_NP	E235.SO4	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_GHUT_WS_GGCAMP_2021-09-13_NP	E235.SO4	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE RG_RIVER_WS_2021-09-13_NP	E235.SO4	13-Sep-2021	----	----	----		16-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_FBLANK_WS_2021-09-13_NP	E318	13-Sep-2021	21-Sep-2021	----	----		23-Sep-2021	28 days	10 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_GHBP_WS_GGCAMP_2021-09-13_NP	E318	13-Sep-2021	21-Sep-2021	----	----		23-Sep-2021	28 days	10 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_GHUT_WS_GGCAMP_2021-09-13_NP	E318	13-Sep-2021	21-Sep-2021	----	----		23-Sep-2021	28 days	10 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_RIVER_WS_2021-09-13_NP	E318	13-Sep-2021	21-Sep-2021	----	----		23-Sep-2021	28 days	10 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) RG_FBLANK_WS_2021-09-13_NP	E372-U	13-Sep-2021	17-Sep-2021	----	----		17-Sep-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) RG_GHBP_WS_GGCAMP_2021-09-13_NP	E372-U	13-Sep-2021	17-Sep-2021	----	----		17-Sep-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) RG_GHUT_WS_GGCAMP_2021-09-13_NP	E372-U	13-Sep-2021	17-Sep-2021	----	----		17-Sep-2021	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) RG_RIVER_WS_2021-09-13_NP	E372-U	13-Sep-2021	17-Sep-2021	----	----		17-Sep-2021	28 days	4 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) RG_FBLANK_WS_2021-09-13_NP	E421.Cr-L	13-Sep-2021	21-Sep-2021	----	----		21-Sep-2021	180 days	8 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) RG_GHBP_WS_GGCAMP_2021-09-13_NP	E421.Cr-L	13-Sep-2021	21-Sep-2021	----	----		21-Sep-2021	180 days	8 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) RG_GHUT_WS_GGCAMP_2021-09-13_NP	E421.Cr-L	13-Sep-2021	21-Sep-2021	----	----		21-Sep-2021	180 days	8 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_RIVER_WS_2021-09-13_NP	E421.Cr-L	13-Sep-2021	21-Sep-2021	----	----		21-Sep-2021	180 days	8 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_FBLANK_WS_2021-09-13_NP	E509	13-Sep-2021	22-Sep-2021	----	----		22-Sep-2021	28 days	8 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GHBP_WS_GGCAMP_2021-09-13_NP	E509	13-Sep-2021	22-Sep-2021	----	----		22-Sep-2021	28 days	8 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_RIVER_WS_2021-09-13_NP	E509	13-Sep-2021	22-Sep-2021	----	----		22-Sep-2021	28 days	8 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GHUT_WS_GGCAMP_2021-09-13_NP	E509	13-Sep-2021	22-Sep-2021	----	----		22-Sep-2021	28 days	9 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) RG_FBLANK_WS_2021-09-13_NP	E421	13-Sep-2021	21-Sep-2021	----	----		21-Sep-2021	180 days	8 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) RG_GHBP_WS_GGCAMP_2021-09-13_NP	E421	13-Sep-2021	21-Sep-2021	----	----		21-Sep-2021	180 days	8 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) RG_GHUT_WS_GGCAMP_2021-09-13_NP	E421	13-Sep-2021	21-Sep-2021	----	----		21-Sep-2021	180 days	8 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) RG_RIVER_WS_2021-09-13_NP	E421	13-Sep-2021	21-Sep-2021	----	----		21-Sep-2021	180 days	8 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_2021-09-13_NP	E358-L	13-Sep-2021	22-Sep-2021	----	----		26-Sep-2021	28 days	13 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GHBP_WS_GGCAMP_2021-09-13_NP	E358-L	13-Sep-2021	22-Sep-2021	----	----		26-Sep-2021	28 days	13 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GHUT_WS_GGCAMP_2021-09-13_NP	E358-L	13-Sep-2021	22-Sep-2021	----	----		26-Sep-2021	28 days	13 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_RIVER_WS_2021-09-13_NP	E358-L	13-Sep-2021	22-Sep-2021	----	----		26-Sep-2021	28 days	13 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_FBLANK_WS_2021-09-13_NP	E355-L	13-Sep-2021	22-Sep-2021	----	----		26-Sep-2021	28 days	13 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GHBP_WS_GGCAMP_2021-09-13_NP	E355-L	13-Sep-2021	22-Sep-2021	----	----		26-Sep-2021	28 days	13 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GHUT_WS_GGCAMP_2021-09-13_NP	E355-L	13-Sep-2021	22-Sep-2021	----	----		26-Sep-2021	28 days	13 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_RIVER_WS_2021-09-13_NP	E355-L	13-Sep-2021	22-Sep-2021	----	----		26-Sep-2021	28 days	13 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_FBLANK_WS_2021-09-13_NP	E283	13-Sep-2021	----	----	----		22-Sep-2021	14 days	9 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_GHBP_WS_GGCAMP_2021-09-13_NP	E283	13-Sep-2021	----	----	----		22-Sep-2021	14 days	9 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_GHUT_WS_GGCAMP_2021-09-13_NP	E283	13-Sep-2021	----	----	----		22-Sep-2021	14 days	9 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_RIVER_WS_2021-09-13_NP	E283	13-Sep-2021	----	----	----		22-Sep-2021	14 days	9 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_FBLANK_WS_2021-09-13_NP	E290	13-Sep-2021	----	----	----		25-Sep-2021	14 days	12 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_GHBP_WS_GGCAMP_2021-09-13_NP	E290	13-Sep-2021	----	----	----		25-Sep-2021	14 days	12 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_GHUT_WS_GGCAMP_2021-09-13_NP	E290	13-Sep-2021	----	----	----		25-Sep-2021	14 days	12 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE RG_RIVER_WS_2021-09-13_NP	E290	13-Sep-2021	----	----	----		25-Sep-2021	14 days	12 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_FBLANK_WS_2021-09-13_NP	E100	13-Sep-2021	----	----	----		25-Sep-2021	28 days	12 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_GHBP_WS_GGCAMP_2021-09-13_NP	E100	13-Sep-2021	----	----	----		25-Sep-2021	28 days	12 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_GHUT_WS_GGCAMP_2021-09-13_NP	E100	13-Sep-2021	----	----	----		25-Sep-2021	28 days	12 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_RIVER_WS_2021-09-13_NP	E100	13-Sep-2021	----	----	----		25-Sep-2021	28 days	12 days	✓
Physical Tests : ORP by Electrode										
HDPE RG_FBLANK_WS_2021-09-13_NP	E125	13-Sep-2021	----	----	----		24-Sep-2021	0.25 hrs	262 hrs	× EHTR-FM
Physical Tests : ORP by Electrode										
HDPE RG_GHBP_WS_GGCAMP_2021-09-13_NP	E125	13-Sep-2021	----	----	----		24-Sep-2021	0.25 hrs	262 hrs	× EHTR-FM
Physical Tests : ORP by Electrode										
HDPE RG_RIVER_WS_2021-09-13_NP	E125	13-Sep-2021	----	----	----		24-Sep-2021	0.25 hrs	262 hrs	× EHTR-FM
Physical Tests : ORP by Electrode										
HDPE RG_GHUT_WS_GGCAMP_2021-09-13_NP	E125	13-Sep-2021	----	----	----		24-Sep-2021	0.25 hrs	268 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_FBLANK_WS_2021-09-13_NP	E108	13-Sep-2021	----	----	----		25-Sep-2021	0.25 hrs	287 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GHBP_WS_GGCAMP_2021-09-13_NP	E108	13-Sep-2021	----	----	----		25-Sep-2021	0.25 hrs	287 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_RIVER_WS_2021-09-13_NP	E108	13-Sep-2021	----	----	----		25-Sep-2021	0.25 hrs	287 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 : pH by Meter										
HDPE RG_GHUT_WS_GGCAMP_2021-09-13_NP	E108	13-Sep-2021	----	----	----		25-Sep-2021	0.25 hrs	293 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE RG_FBLANK_WS_2021-09-13_NP	E162	13-Sep-2021	----	----	----		20-Sep-2021	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE RG_GHBP_WS_GGCAMP_2021-09-13_NP	E162	13-Sep-2021	----	----	----		20-Sep-2021	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE RG_GHUT_WS_GGCAMP_2021-09-13_NP	E162	13-Sep-2021	----	----	----		20-Sep-2021	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE RG_RIVER_WS_2021-09-13_NP	E162	13-Sep-2021	----	----	----		20-Sep-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE RG_FBLANK_WS_2021-09-13_NP	E160-L	13-Sep-2021	----	----	----		20-Sep-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE RG_GHBP_WS_GGCAMP_2021-09-13_NP	E160-L	13-Sep-2021	----	----	----		20-Sep-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE RG_GHUT_WS_GGCAMP_2021-09-13_NP	E160-L	13-Sep-2021	----	----	----		20-Sep-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE RG_RIVER_WS_2021-09-13_NP	E160-L	13-Sep-2021	----	----	----		20-Sep-2021	7 days	7 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_FBLANK_WS_2021-09-13_NP	E121	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
RG_GHBP_WS_GGCAMP_2021-09-13_NP	E121	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
RG_GHUT_WS_GGCAMP_2021-09-13_NP	E121	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
RG_RIVER_WS_2021-09-13_NP	E121	13-Sep-2021	----	----	----		16-Sep-2021	3 days	3 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid)										
RG_FBLANK_WS_2021-09-13_NP	E420.Cr-L	13-Sep-2021	----	----	----		21-Sep-2021	180 days	8 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid)										
RG_GHBP_WS_GGCAMP_2021-09-13_NP	E420.Cr-L	13-Sep-2021	----	----	----		21-Sep-2021	180 days	8 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid)										
RG_GHUT_WS_GGCAMP_2021-09-13_NP	E420.Cr-L	13-Sep-2021	----	----	----		21-Sep-2021	180 days	8 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid)										
RG_RIVER_WS_2021-09-13_NP	E420.Cr-L	13-Sep-2021	----	----	----		21-Sep-2021	180 days	8 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_2021-09-13_NP	E508-L	13-Sep-2021	----	----	----		22-Sep-2021	28 days	9 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 Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)										
Pre-cleaned amber glass - total (lab preserved) RG_GHBP_WS_GGCAMP_2021-09-13_NP	E508-L	13-Sep-2021	----	----	----		22-Sep-2021	28 days	9 days	✓
Total Metals : Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)										
Pre-cleaned amber glass - total (lab preserved) RG_GHUT_WS_GGCAMP_2021-09-13_NP	E508-L	13-Sep-2021	----	----	----		22-Sep-2021	28 days	9 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_2021-09-13_NP	E508-L	13-Sep-2021	----	----	----		22-Sep-2021	28 days	9 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) RG_FBLANK_WS_2021-09-13_NP	E420	13-Sep-2021	----	----	----		21-Sep-2021	180 days	8 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) RG_GHBP_WS_GGCAMP_2021-09-13_NP	E420	13-Sep-2021	----	----	----		21-Sep-2021	180 days	8 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) RG_GHUT_WS_GGCAMP_2021-09-13_NP	E420	13-Sep-2021	----	----	----		21-Sep-2021	180 days	8 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) RG_RIVER_WS_2021-09-13_NP	E420	13-Sep-2021	----	----	----		21-Sep-2021	180 days	8 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	299285	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	302837	1	9	11.1	5.0	✓
Ammonia by Fluorescence	E298	304087	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	293546	1	13	7.6	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	293547	1	13	7.6	5.0	✓
Conductivity in Water	E100	302836	1	9	11.1	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	298315	1	19	5.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	298918	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	298316	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	299650	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	293496	1	4	25.0	5.0	✓
Fluoride in Water by IC	E235.F	293544	1	13	7.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	293548	1	15	6.6	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	293549	1	15	6.6	5.0	✓
ORP by Electrode	E125	299552	1	20	5.0	5.0	✓
pH by Meter	E108	302835	1	11	9.0	5.0	✓
Sulfate in Water by IC	E235.SO4	293545	1	13	7.6	5.0	✓
TDS by Gravimetry	E162	296874	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	295747	1	18	5.5	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	298416	1	19	5.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	299579	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	295748	1	18	5.5	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	299658	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	293784	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	293633	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	299285	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	302837	1	9	11.1	5.0	✓
Ammonia by Fluorescence	E298	304087	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	293546	1	13	7.6	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	293547	1	13	7.6	5.0	✓
Conductivity in Water	E100	302836	1	9	11.1	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	298315	1	19	5.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	298918	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	298316	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	299650	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	293496	1	4	25.0	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	293544	1	13	7.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	293548	1	15	6.6	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	293549	1	15	6.6	5.0	✓
ORP by Electrode	E125	299552	1	20	5.0	5.0	✓
pH by Meter	E108	302835	1	11	9.0	5.0	✓
Sulfate in Water by IC	E235.SO4	293545	1	13	7.6	5.0	✓
TDS by Gravimetry	E162	296874	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	295747	1	18	5.5	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	298416	1	19	5.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	299579	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	295748	1	18	5.5	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	299658	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	293784	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	296869	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	293633	1	20	5.0	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	299285	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	302837	1	9	11.1	5.0	✓
Ammonia by Fluorescence	E298	304087	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	293546	1	13	7.6	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	293547	1	13	7.6	5.0	✓
Conductivity in Water	E100	302836	1	9	11.1	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	298315	1	19	5.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	298918	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	298316	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	299650	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	293496	1	4	25.0	5.0	✓
Fluoride in Water by IC	E235.F	293544	1	13	7.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	293548	1	15	6.6	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	293549	1	15	6.6	5.0	✓
Sulfate in Water by IC	E235.SO4	293545	1	13	7.6	5.0	✓
TDS by Gravimetry	E162	296874	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	295747	1	18	5.5	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	298416	1	19	5.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	299579	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	295748	1	18	5.5	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	299658	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	293784	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	296869	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	293633	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	304087	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	293546	1	13	7.6	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	293547	1	13	7.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	298315	1	19	5.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	298918	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	298316	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	299650	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	293496	1	4	25.0	5.0	✓
Fluoride in Water by IC	E235.F	293544	1	13	7.6	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	293548	1	15	6.6	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	293549	1	15	6.6	5.0	✓
Sulfate in Water by IC	E235.SO4	293545	1	13	7.6	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	295747	1	18	5.5	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	298416	1	19	5.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	299579	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	295748	1	18	5.5	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	299658	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	293784	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 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 flow analyzer 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	: **CG2104105**		
Amendment	: **1**		
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	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-2021 08:50
PO	: VPO00750546	Date Analysis Commenced	: 16-Sep-2021
C-O-C number	: September GGCAMP 2021	Issue Date	: 01-Dec-2021 16:17
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 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*
Anthony Calero	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Dee Lee	Analyst	Metals, Burnaby, British Columbia
Elke Tabora		Inorganics, Calgary, Alberta
Erin Sanchez		Inorganics, Calgary, Alberta
Hannah Phung	Lab Assistant	Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Monica Ko	Lab Assistant	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia

Vladka Stamenova	Analyst	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.

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: 293633)											
CG2104105-001	RG_GHUT_WS_GGCAMP _2021-09-13_NP	turbidity	----	E121	0.10	NTU	1.04	0.99	0.05	Diff <2x LOR	----
Physical Tests (QC Lot: 296874)											
CG2104061-007	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	290	289	0.346%	20%	----
Physical Tests (QC Lot: 299285)											
CG2104099-006	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	2.3	<2.0	0.3	Diff <2x LOR	----
Physical Tests (QC Lot: 299552)											
CG2104099-006	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	437	445	1.77%	15%	----
Physical Tests (QC Lot: 302835)											
CG2104099-011	Anonymous	pH	----	E108	0.10	pH units	8.27	8.31	0.482%	4%	----
Physical Tests (QC Lot: 302836)											
CG2104099-013	Anonymous	conductivity	----	E100	2.0	μS/cm	544	545	0.184%	10%	----
Physical Tests (QC Lot: 302837)											
CG2104099-013	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	323	341	5.52%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	32.2	31.4	2.52%	20%	----
		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	355	372	4.81%	20%	----
Anions and Nutrients (QC Lot: 293496)											
CG2104105-001	RG_GHUT_WS_GGCAMP _2021-09-13_NP	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0039	0.0037	0.0002	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 293544)											
CG2104092-001	Anonymous	fluoride	16984-48-8	E235.F	0.020	mg/L	0.185	0.183	0.002	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 293545)											
CG2104092-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	243	243	0.0797%	20%	----
Anions and Nutrients (QC Lot: 293546)											
CG2104092-001	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: 293547)											
CG2104092-001	Anonymous	chloride	16887-00-6	E235.Cl-L	0.10	mg/L	1.31	1.26	4.41%	20%	----
Anions and Nutrients (QC Lot: 293548)											
CG2104092-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	13.5	13.5	0.0140%	20%	----
Anions and Nutrients (QC Lot: 293549)											
CG2104092-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0243	0.0231	5.06%	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						
Anions and Nutrients (QC Lot: 293784)											
CG2104104-002	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0576	0.0545	5.51%	20%	----
Anions and Nutrients (QC Lot: 298416)											
CG2104099-004	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.164	0.169	0.005	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 304087)											
CG2104099-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0441	0.0427	0.0014	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 299650)											
CG2104099-009	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	2.77	2.90	0.13	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 299658)											
CG2104098-014	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Total Metals (QC Lot: 295747)											
CG2104087-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00018	<0.00010	0.00008	Diff <2x LOR	----
Total Metals (QC Lot: 295748)											
CG2104087-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0035	0.0034	0.0001	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	0.00028	0.00028	0.000007	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00021	0.00018	0.00002	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0540	0.0538	0.401%	20%	----
		beryllium, total	7440-41-7	E420	0.020	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	0.0004	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0050	mg/L	0.0509 µg/L	0.0000618	19.3%	20%	----
		calcium, total	7440-70-2	E420	0.050	mg/L	196	197	0.516%	20%	----
		cobalt, total	7440-48-4	E420	0.10	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	0.00070	0.00070	0.000006	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	0.0221	0.0207	6.74%	20%	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	146	147	1.14%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00054	0.00059	0.00005	Diff <2x LOR	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00123	0.00122	0.370%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	0.00138	0.00142	0.00003	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	2.58	2.63	1.72%	20%	----
		selenium, total	7782-49-2	E420	0.050	mg/L	147 µg/L	0.146	0.998%	20%	----
		silicon, total	7440-21-3	E420	0.10	mg/L	2.31	2.29	0.728%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	17341-25-2	E420	0.050	mg/L	3.60	3.62	0.420%	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: 295748) - continued											
CG2104087-001	Anonymous	strontium, total	7440-24-6	E420	0.00020	mg/L	0.191	0.186	2.59%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	249	248	0.250%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	0.000012	0.000011	0.0000003	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	0.00813	0.00801	1.51%	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: 299579)											
CG2104098-001	Anonymous	mercury, total	7439-97-6	E508-L	0.00050	ng/L	<0.00050 µg/L	<0.50	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 298315)											
CG2104087-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00013	0.00015	0.00002	Diff <2x LOR	----
Dissolved Metals (QC Lot: 298316)											
CG2104087-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0011	0.0011	0.00001	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00026	0.00026	0.000007	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00020	0.00019	0.000006	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0563	0.0567	0.739%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.020	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	0.010	0.0005	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0050	mg/L	0.0583 µg/L	0.0000598	2.47%	20%	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	175	172	1.48%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.10	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00086	0.00087	0.000008	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	0.000052	<0.000050	0.000002	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0195	0.0187	4.06%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	136	133	2.20%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00051	0.00048	0.00003	Diff <2x LOR	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00128	0.00129	0.223%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00147	0.00144	0.00002	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	2.62	2.69	2.43%	20%	----
		selenium, dissolved	7782-49-2	E421	0.050	mg/L	137 µg/L	0.135	1.58%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.21	2.17	1.84%	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: 298316) - continued											
CG2104087-001	Anonymous	sodium, dissolved	17341-25-2	E421	0.050	mg/L	3.64	3.60	0.935%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.189	0.188	0.634%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	234	232	0.864%	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	0.00770	0.00766	0.487%	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	0.0021	0.0020	0.0001	Diff <2x LOR	----
Dissolved Metals (QC Lot: 298918)											
CG2104099-005	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: 293633)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 296869)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 296874)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 299285)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 302836)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 302837)						
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: 293496)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 293544)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 293545)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 293546)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 293547)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 293548)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 293549)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 293784)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 298416)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 304087)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 304087) - continued						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Organic / Inorganic Carbon (QCLot: 299650)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 299658)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 295747)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 295748)						
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	17341-25-2	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: 295748) - 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: 299579)						
mercury, total	7439-97-6	E508-L	0.5	ng/L	<0.50	----
Dissolved Metals (QCLot: 298315)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 298316)						
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	17341-25-2	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: 298316) - 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: 298918)						
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: 293633)									
turbidity	----	E121	0.1	NTU	200 NTU	98.8	85.0	115	----
Physical Tests (QCLot: 296869)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	94.4	85.0	115	----
Physical Tests (QCLot: 296874)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	94.0	85.0	115	----
Physical Tests (QCLot: 299285)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	108	85.0	115	----
Physical Tests (QCLot: 299552)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	100	95.4	104	----
Physical Tests (QCLot: 302835)									
pH	----	E108	----	pH units	7 pH units	100	98.6	101	----
Physical Tests (QCLot: 302836)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	98.8	90.0	110	----
Physical Tests (QCLot: 302837)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	101	85.0	115	----
Anions and Nutrients (QCLot: 293496)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.02 mg/L	100	80.0	120	----
Anions and Nutrients (QCLot: 293544)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 293545)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 293546)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	101	85.0	115	----
Anions and Nutrients (QCLot: 293547)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 293548)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 293549)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 293784)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	8.32 mg/L	94.0	80.0	120	----
Anions and Nutrients (QCLot: 298416)									

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: 298416) - continued									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	111	75.0	125	----
Anions and Nutrients (QCLot: 304087)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	102	85.0	115	----
Organic / Inorganic Carbon (QCLot: 299650)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	10 mg/L	94.0	80.0	120	----
Organic / Inorganic Carbon (QCLot: 299658)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	10 mg/L	105	80.0	120	----
Total Metals (QCLot: 295747)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	99.0	80.0	120	----
Total Metals (QCLot: 295748)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	102	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	106	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	99.5	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	98.9	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	101	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	103	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	100	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	107	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	99.1	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	99.4	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	100	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	104	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	103	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	96.9	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	104	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	99.4	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	98.2	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	101	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	107	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	102	80.0	120	----
sodium, total	17341-25-2	E420	0.05	mg/L	50 mg/L	100	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	105	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	104	80.0	120	----

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
Total Metals (QCLot: 295748) - continued									
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	106	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	99.4	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	96.4	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	104	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	99.8	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	99.5	80.0	120	----
Total Metals (QCLot: 299579)									
mercury, total	7439-97-6	E508-L	0.5	ng/L	5 ng/L	108	80.0	120	----
Dissolved Metals (QCLot: 298315)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	98.3	80.0	120	----
Dissolved Metals (QCLot: 298316)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	97.3	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	98.4	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	100	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	102	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	99.2	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	106	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	98.9	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	98.1	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	98.4	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	103	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	88.1	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	99.8	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	97.2	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	98.8	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	99.7	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	98.8	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	101	80.0	120	----
sodium, dissolved	17341-25-2	E421	0.05	mg/L	50 mg/L	101	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	98.7	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	80.3	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: 298316) - continued									
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	99.6	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	98.5	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	95.0	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	101	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	100.0	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	101	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: 293496)										
CG2104105-002	RG_GHBP_WS_GGCAMP_2021-09-13_NP	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0627 mg/L	0.05 mg/L	125	70.0	130	----
Anions and Nutrients (QCLot: 293544)										
CG2104092-002	Anonymous	fluoride	16984-48-8	E235.F	0.994 mg/L	1 mg/L	99.4	75.0	125	----
Anions and Nutrients (QCLot: 293545)										
CG2104092-002	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	ND mg/L	100 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 293546)										
CG2104092-002	Anonymous	bromide	24959-67-9	E235.Br-L	0.535 mg/L	0.5 mg/L	107	75.0	125	----
Anions and Nutrients (QCLot: 293547)										
CG2104092-002	Anonymous	chloride	16887-00-6	E235.Cl-L	107 mg/L	100 mg/L	107	75.0	125	----
Anions and Nutrients (QCLot: 293548)										
CG2104092-002	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: 293549)										
CG2104092-002	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.544 mg/L	0.5 mg/L	109	75.0	125	----
Anions and Nutrients (QCLot: 293784)										
CG2104105-001	RG_GHUT_WS_GGCAMP_2021-09-13_NP	phosphorus, total	7723-14-0	E372-U	0.0598 mg/L	0.0676 mg/L	88.5	70.0	130	----
Anions and Nutrients (QCLot: 298416)										
CG2104099-005	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.77 mg/L	2.5 mg/L	111	70.0	130	----
Anions and Nutrients (QCLot: 304087)										
CG2104099-006	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0987 mg/L	0.1 mg/L	98.7	75.0	125	----
Organic / Inorganic Carbon (QCLot: 299650)										
CG2104099-009	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	27.4 mg/L	23.9 mg/L	114	70.0	130	----
Organic / Inorganic Carbon (QCLot: 299658)										
CG2104098-014	Anonymous	carbon, total organic [TOC]	----	E355-L	28.2 mg/L	23.9 mg/L	118	70.0	130	----
Total Metals (QCLot: 295747)										
CG2104087-002	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.0368 mg/L	0.04 mg/L	92.0	70.0	130	----
Total Metals (QCLot: 295748)										
CG2104087-002	Anonymous	aluminum, total	7429-90-5	E420	0.159 mg/L	0.2 mg/L	79.7	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: 295748) - continued										
CG2104087-002	Anonymous	antimony, total	7440-36-0	E420	0.0206 mg/L	0.02 mg/L	103	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0190 mg/L	0.02 mg/L	95.2	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	0.0387 mg/L	0.04 mg/L	96.7	70.0	130	----
		bismuth, total	7440-69-9	E420	0.00946 mg/L	0.01 mg/L	94.6	70.0	130	----
		boron, total	7440-42-8	E420	0.100 mg/L	0.1 mg/L	100	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00371 mg/L	0.004 mg/L	92.8	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	0.0174 mg/L	0.02 mg/L	87.2	70.0	130	----
		copper, total	7440-50-8	E420	0.0173 mg/L	0.02 mg/L	86.6	70.0	130	----
		iron, total	7439-89-6	E420	1.86 mg/L	2 mg/L	92.8	70.0	130	----
		lead, total	7439-92-1	E420	0.0189 mg/L	0.02 mg/L	94.6	70.0	130	----
		lithium, total	7439-93-2	E420	0.0968 mg/L	0.1 mg/L	96.8	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	0.0180 mg/L	0.02 mg/L	90.0	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0193 mg/L	0.02 mg/L	96.6	70.0	130	----
		nickel, total	7440-02-0	E420	0.0347 mg/L	0.04 mg/L	86.8	70.0	130	----
		potassium, total	7440-09-7	E420	3.46 mg/L	4 mg/L	86.6	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	9.18 mg/L	10 mg/L	91.8	70.0	130	----
		silver, total	7440-22-4	E420	0.00391 mg/L	0.004 mg/L	97.7	70.0	130	----
		sodium, total	17341-25-2	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	0.00370 mg/L	0.004 mg/L	92.5	70.0	130	----
		tin, total	7440-31-5	E420	0.0196 mg/L	0.02 mg/L	97.8	70.0	130	----
		titanium, total	7440-32-6	E420	0.0367 mg/L	0.04 mg/L	91.8	70.0	130	----
		uranium, total	7440-61-1	E420	ND mg/L	0.004 mg/L	ND	70.0	130	----
		vanadium, total	7440-62-2	E420	0.0946 mg/L	0.1 mg/L	94.6	70.0	130	----
		zinc, total	7440-66-6	E420	0.357 mg/L	0.4 mg/L	89.3	70.0	130	----
Total Metals (QCLot: 299579)										
CG2104098-002	Anonymous	mercury, total	7439-97-6	E508-L	5.16 ng/L	5 ng/L	103	70.0	130	----
Dissolved Metals (QCLot: 298315)										
CG2104087-002	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.0391 mg/L	0.04 mg/L	97.8	70.0	130	----
Dissolved Metals (QCLot: 298316)										
CG2104087-002	Anonymous	aluminum, dissolved	7429-90-5	E421	0.203 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
Dissolved Metals (QCLot: 298316) - continued										
CG2104087-002	Anonymous	antimony, dissolved	7440-36-0	E421	0.0202 mg/L	0.02 mg/L	101	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0221 mg/L	0.02 mg/L	110	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0369 mg/L	0.04 mg/L	92.2	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00906 mg/L	0.01 mg/L	90.6	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.096 mg/L	0.1 mg/L	95.9	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00372 mg/L	0.004 mg/L	93.1	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	0.0186 mg/L	0.02 mg/L	93.0	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0183 mg/L	0.02 mg/L	91.7	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.86 mg/L	2 mg/L	92.9	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0192 mg/L	0.02 mg/L	96.2	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.0954 mg/L	0.1 mg/L	95.4	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	0.0192 mg/L	0.02 mg/L	96.2	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0206 mg/L	0.02 mg/L	103	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0365 mg/L	0.04 mg/L	91.3	70.0	130	----
		potassium, dissolved	7440-09-7	E421	3.58 mg/L	4 mg/L	89.5	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	8.40 mg/L	10 mg/L	84.0	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00376 mg/L	0.004 mg/L	94.1	70.0	130	----
		sodium, dissolved	17341-25-2	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	0.00387 mg/L	0.004 mg/L	96.8	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0195 mg/L	0.02 mg/L	97.7	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0393 mg/L	0.04 mg/L	98.3	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	0.101 mg/L	0.1 mg/L	101	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.358 mg/L	0.4 mg/L	89.6	70.0	130	----
Dissolved Metals (QCLot: 298918)										
CG2104099-006	Anonymous	mercury, dissolved	7439-97-6	E509	0.000103 mg/L	0.0001 mg/L	103	70.0	130	----

Teck

COC ID:	September GGCAMP 2021	TURNAROUND TIME:	

PROJECT/CLIENT INFO

Facility Name / Job#	REP
Project Manager	Allie Ferguson
Email	allie.ferguson@teck.com
Address	421 Pine Avenue
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	250-425-8202

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	1 403 407 1794

Report To	Excel	PDF	EDD
allie.ferguson@teck.com	x	x	x
teckcoal@equisonline.com			x
lbowron@minnow.ca		x	x
monica.barthag@teck.com	x	x	x
awiebe@minnow.ca	x	x	x

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	TECKCOAL-ROUTINE-VA	ALS_Package-DOC	ALS_Package-TKN/TOC	HG-T-U-CVAF-VA	HG-D-CVAF-VA	TECKCOAL-MET-T-VA	TECKCOAL-MET-D-VA
Filtered								N	F	N	N	F	N	F
Preserved									H2SO4	H2SO4		HCL	HNO3	HNO3
RG_GHUT_WS_GGCAMP_2021-09-13_NP	RG_GHUT	WS	No	9/13/2021	930	G	7	X	X	X	X	X	X	X
RG_GHBP_WS_GGCAMP_2021-09-13_NP	RG_GHBP	WS	No	9/13/2021	1505	G	7	X	X	X	X	X	X	X
RG_RIVER_WS_2021-09-13_NP	RG_RIVER	WS	No	9/13/2021	1505	G	7	X	X	X	X	X	X	X
RG_FBLANK_WS_2021-09-13_NP	RG_FBLANK	WS	No	9/13/2021	1505	G	7	X	X	X	X	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

ALS PO 750546

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	
Jennifer Ings/Minnow	################	Dk	9/15 0850

NB OF BOTTLES RETURNED/DESCRIPTION

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	Jennifer Ings	Mobile #	519-500-3444
Sampler's Signature	Jennifer Ings	Date/Time	September 14, 2021

6°

Environmental Division
Calgary
Work Order Reference
CG2104105

Telephone : +1 403 407 1800

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **CG2104192**	Page	: 1 of 6
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	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-2021 10:00
PO	: VPO00750546	Date Analysis Commenced	: 18-Sep-2021
C-O-C number	: September GGCAMP 2021	Issue Date	: 06-Oct-2021 16:50
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*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Anthony Calero	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Dion Chan	Lab Assistant	Metals, Burnaby, British Columbia
Erin Sanchez		Inorganics, Calgary, Alberta
Hannah Phung	Lab Assistant	Inorganics, Calgary, Alberta
Ilnaz Badbezanchi	Team Leader - Metals preparation	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia

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.*

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	RG_GANF_WS_GGCAMP_2021-09-15_NP	----	----	----	----
				Client sampling date / time	15-Sep-2021 12:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2104192-001	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	----	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	241	----	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	26.6	----	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	267	----	----	----	----
conductivity	----	E100	2.0	µS/cm	1210	----	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	800	----	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	465	----	----	----	----
pH	----	E108	0.10	pH units	8.54	----	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	892	----	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	1.4	----	----	----	----
turbidity	----	E121	0.10	NTU	0.35	----	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	294	----	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	16.0	----	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	----	----	----	----
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	3.22	----	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.353	----	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.080	----	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.322	----	----	----	----
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	0.0027	----	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	473	----	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	2.56	----	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	2.58	----	----	----	----

Analytical Results

Sub-Matrix: Water

(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	RG_GANF_WS_GGCAMP_2021-09-15_NP	----	----	----	----
				Client sampling date / time	15-Sep-2021 12:30	----	----	----	----
					CG2104192-001	--------	--------	--------	--------
					Result	----	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	15.3	----	----	----	----
cation sum	----	EC101	0.10	meq/L	16.3	----	----	----	----
ion balance (cations/anions ratio)	----	EC101	0.010	%	106	----	----	----	----
ion balance (cation-anion difference)	----	EC101	0.010	%	3.16	----	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0043	----	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00011	----	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00016	----	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0670	----	----	----	----
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	<0.0050	----	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	124	----	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	<0.00010	----	----	----	----
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	0.0255	----	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	94.6	----	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.00080	----	----	----	----
mercury, total	7439-97-6	E508-L	0.00050	µg/L	<0.00050	----	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00126	----	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00138	----	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	2.81	----	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	5.98	----	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	3.94	----	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	----	----	----	----
sodium, total	17341-25-2	E420	0.050	mg/L	4.40	----	----	----	----

Analytical Results

Sub-Matrix: Water

(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID: RG_GANF_WS_GGCAMP_2021-09-15_NP	----	----	----	----
				Client sampling date / time	15-Sep-2021 12:30	----	----	----	----
					CG2104192-001	--------	--------	--------	--------
					Result	----	----	----	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.256	----	----	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	172	----	----	----	----
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	0.00272	----	----	----	----
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	0.00010	----	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00016	----	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0794	----	----	----	----
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	<0.0050	----	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	144	----	----	----	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00011	----	----	----	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.10	----	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00036	----	----	----	----
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	0.0275	----	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	107	----	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00085	----	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00132	----	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00136	----	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	3.17	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	RG_GANF_WS_GGCAMP_2021-09-15_NP	----	----	----	----
				Client sampling date / time	15-Sep-2021 12:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2104192-001	--------	--------	--------	--------
					Result	----	----	----	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	6.86	----	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.83	----	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	----	----	----	----
sodium, dissolved	17341-25-2	E421	0.050	mg/L	5.03	----	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.278	----	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	160	----	----	----	----
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	0.00289	----	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	----	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0029	----	----	----	----
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.

ALS Environmental

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2104192**	Page	: 1 of 12
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	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-2021 10:00
PO	: VPO00750546	Issue Date	: 06-Oct-2021 16:50
C-O-C number	: September GGCAMP 2021		
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 Services number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

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_GANF_WS_GGCAMP_2021-09-15_NP	E298	15-Sep-2021	29-Sep-2021	----	----		29-Sep-2021	28 days	14 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GANF_WS_GGCAMP_2021-09-15_NP	E235.Br-L	15-Sep-2021	----	----	----		18-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GANF_WS_GGCAMP_2021-09-15_NP	E235.Cl-L	15-Sep-2021	----	----	----		18-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)										
HDPE RG_GANF_WS_GGCAMP_2021-09-15_NP	E378-U	15-Sep-2021	----	----	----		18-Sep-2021	3 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GANF_WS_GGCAMP_2021-09-15_NP	E235.F	15-Sep-2021	----	----	----		18-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GANF_WS_GGCAMP_2021-09-15_NP	E235.NO3-L	15-Sep-2021	----	----	----		18-Sep-2021	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GANF_WS_GGCAMP_2021-09-15_NP	E235.NO2-L	15-Sep-2021	----	----	----		18-Sep-2021	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_GANF_WS_GGCAMP_2021-09-15_NP	E235.SO4	15-Sep-2021	----	----	----		18-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) RG_GANF_WS_GGCAMP_2021-09-15_NP	E318	15-Sep-2021	27-Sep-2021	----	----		27-Sep-2021	28 days	12 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid) RG_GANF_WS_GGCAMP_2021-09-15_NP	E372-U	15-Sep-2021	22-Sep-2021	----	----		22-Sep-2021	28 days	7 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) RG_GANF_WS_GGCAMP_2021-09-15_NP	E421.Cr-L	15-Sep-2021	23-Sep-2021	----	----		23-Sep-2021	180 days	8 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) RG_GANF_WS_GGCAMP_2021-09-15_NP	E509	15-Sep-2021	23-Sep-2021	----	----		23-Sep-2021	28 days	8 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) RG_GANF_WS_GGCAMP_2021-09-15_NP	E421	15-Sep-2021	23-Sep-2021	----	----		23-Sep-2021	180 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) RG_GANF_WS_GGCAMP_2021-09-15_NP	E358-L	15-Sep-2021	27-Sep-2021	----	----		29-Sep-2021	28 days	14 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) RG_GANF_WS_GGCAMP_2021-09-15_NP	E355-L	15-Sep-2021	27-Sep-2021	----	----		29-Sep-2021	28 days	14 days	✓
Physical Tests : Acidity by Titration										
HDPE RG_GANF_WS_GGCAMP_2021-09-15_NP	E283	15-Sep-2021	----	----	----		28-Sep-2021	14 days	13 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_GGCAMP_2021-09-15_NP	E290	15-Sep-2021	----	----	----		28-Sep-2021	14 days	13 days	✓
Physical Tests : Conductivity in Water										
HDPE										
RG_GANF_WS_GGCAMP_2021-09-15_NP	E100	15-Sep-2021	----	----	----		28-Sep-2021	28 days	13 days	✓
Physical Tests : ORP by Electrode										
HDPE										
RG_GANF_WS_GGCAMP_2021-09-15_NP	E125	15-Sep-2021	----	----	----		25-Sep-2021	0.34 hrs	242 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE										
RG_GANF_WS_GGCAMP_2021-09-15_NP	E108	15-Sep-2021	----	----	----		28-Sep-2021	0.25 hrs	310 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE										
RG_GANF_WS_GGCAMP_2021-09-15_NP	E162	15-Sep-2021	----	----	----		22-Sep-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE [TSS-WB]										
RG_GANF_WS_GGCAMP_2021-09-15_NP	E160-L	15-Sep-2021	----	----	----		22-Sep-2021	7 days	7 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE										
RG_GANF_WS_GGCAMP_2021-09-15_NP	E121	15-Sep-2021	----	----	----		18-Sep-2021	3 days	3 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid)										
RG_GANF_WS_GGCAMP_2021-09-15_NP	E420.Cr-L	15-Sep-2021	----	----	----		23-Sep-2021	180 days	8 days	✓
Total Metals : Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)										
Pre-cleaned amber glass - total (lab preserved)										
RG_GANF_WS_GGCAMP_2021-09-15_NP	E508-L	15-Sep-2021	----	----	----		24-Sep-2021	28 days	9 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 (nitric acid) RG_GANF_WS_GGCAMP_2021-09-15_NP	E420	15-Sep-2021	----	----	----		23-Sep-2021	180 days	8 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	304859	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	304723	1	15	6.6	5.0	✓
Ammonia by Fluorescence	E298	305706	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	296270	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	296271	1	16	6.2	5.0	✓
Conductivity in Water	E100	304722	1	15	6.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	300110	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	300938	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	300109	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	303820	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	296209	1	14	7.1	5.0	✓
Fluoride in Water by IC	E235.F	296268	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	296272	1	16	6.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	296273	1	16	6.2	5.0	✓
ORP by Electrode	E125	302476	1	20	5.0	5.0	✓
pH by Meter	E108	304721	1	18	5.5	5.0	✓
Sulfate in Water by IC	E235.SO4	296269	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	298977	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	300563	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	304121	1	19	5.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	301411	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	300562	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	303828	1	19	5.2	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	297810	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	296170	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	304859	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	304723	1	15	6.6	5.0	✓
Ammonia by Fluorescence	E298	305706	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	296270	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	296271	1	16	6.2	5.0	✓
Conductivity in Water	E100	304722	1	15	6.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	300110	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	300938	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	300109	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	303820	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	296209	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*
Laboratory Control Samples (LCS) - Continued							
Fluoride in Water by IC	E235.F	296268	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	296272	1	16	6.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	296273	1	16	6.2	5.0	✓
ORP by Electrode	E125	302476	1	20	5.0	5.0	✓
pH by Meter	E108	304721	1	18	5.5	5.0	✓
Sulfate in Water by IC	E235.SO4	296269	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	298977	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	300563	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	304121	1	19	5.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	301411	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	300562	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	303828	1	19	5.2	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	297810	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	298276	1	13	7.6	5.0	✓
Turbidity by Nephelometry	E121	296170	1	20	5.0	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	304859	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	304723	1	15	6.6	5.0	✓
Ammonia by Fluorescence	E298	305706	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	296270	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	296271	1	16	6.2	5.0	✓
Conductivity in Water	E100	304722	1	15	6.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	300110	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	300938	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	300109	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	303820	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	296209	1	14	7.1	5.0	✓
Fluoride in Water by IC	E235.F	296268	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	296272	1	16	6.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	296273	1	16	6.2	5.0	✓
Sulfate in Water by IC	E235.SO4	296269	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	298977	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	300563	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	304121	1	19	5.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	301411	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	300562	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	303828	1	19	5.2	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	297810	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	298276	1	13	7.6	5.0	✓
Turbidity by Nephelometry	E121	296170	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	305706	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	296270	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	296271	1	16	6.2	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	300110	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	300938	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	300109	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	303820	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	296209	1	14	7.1	5.0	✓
Fluoride in Water by IC	E235.F	296268	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	296272	1	16	6.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	296273	1	16	6.2	5.0	✓
Sulfate in Water by IC	E235.SO4	296269	1	16	6.2	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	300563	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	304121	1	19	5.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	301411	1	19	5.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	300562	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	303828	1	19	5.2	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	297810	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 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 E (mod)	Dissolved Orthophosphate is determined colourimetrically on a water 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.

QUALITY CONTROL REPORT

Work Order	: **CG2104192**		Page	: 1 of 18
Client	: Teck Coal Limited		Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson		Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0		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-2021 10:00
PO	: VPO00750546		Date Analysis Commenced	: 18-Sep-2021
C-O-C number	: September GGCAMP 2021		Issue Date	: 06-Oct-2021 16:50
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 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
Anthony Calero	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Dion Chan	Lab Assistant	Metals, Burnaby, British Columbia
Erin Sanchez		Inorganics, Calgary, Alberta
Hannah Phung	Lab Assistant	Inorganics, Calgary, Alberta
Ilnaz Badbezanchi	Team Leader - Metals preparation	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia

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.

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: 296170)											
CG2104162-002	Anonymous	turbidity	----	E121	0.10	NTU	0.28	0.26	0.01	Diff <2x LOR	----
Physical Tests (QC Lot: 298977)											
CG2104186-002	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	248	252	1.80%	20%	----
Physical Tests (QC Lot: 302476)											
CG2104192-001	RG_GANF_WS_GGCAMP _2021-09-15_NP	oxidation-reduction potential [ORP]	----	E125	0.10	mV	465	471	1.28%	15%	----
Physical Tests (QC Lot: 304721)											
CG2104186-002	Anonymous	pH	----	E108	0.10	pH units	8.48	8.53	0.588%	4%	----
Physical Tests (QC Lot: 304722)											
CG2104186-005	Anonymous	conductivity	----	E100	2.0	µS/cm	454	457	0.659%	10%	----
Physical Tests (QC Lot: 304723)											
CG2104186-005	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	136	136	0.0737%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	7.8	7.4	0.4	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	144	143	0.349%	20%	----
Physical Tests (QC Lot: 304859)											
CG2104186-005	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 296209)											
CG2104188-018	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0019	0.0024	0.0005	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 296268)											
CG2104186-007	Anonymous	fluoride	16984-48-8	E235.F	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 296269)											
CG2104186-007	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	<0.30	<0.30	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 296270)											
CG2104186-007	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: 296271)											
CG2104186-007	Anonymous	chloride	16887-00-6	E235.Cl-L	0.10	mg/L	<0.10	<0.10	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 296272)											
CG2104186-007	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	<0.0050	0.0061	0.0011	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 296273)											
CG2104186-007	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: 297810)											

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: 297810) - continued											
CG2104189-003	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	<0.0020	<0.0020	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 304121)											
CG2104136-003	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 305706)											
CG2104183-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0167	0.0149	0.0018	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 303820)											
CG2104186-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.23	1.35	0.12	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 303828)											
CG2104186-001	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.45	1.30	0.14	Diff <2x LOR	----
Total Metals (QC Lot: 300562)											
CG2104166-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	8.63	8.82	2.14%	20%	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	0.00174	0.00176	1.23%	20%	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.0115	0.0117	2.32%	20%	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.532	0.540	1.46%	20%	----
		beryllium, total	7440-41-7	E420	0.020	mg/L	0.818 µg/L	0.000804	1.66%	20%	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	0.000225	0.000232	0.000008	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.030	0.030	0.0004	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0050	mg/L	2.04 µg/L	0.00206	0.785%	20%	----
		calcium, total	7440-70-2	E420	0.050	mg/L	235	234	0.574%	20%	----
		cobalt, total	7440-48-4	E420	0.10	mg/L	9.70 µg/L	0.00985	1.52%	20%	----
		copper, total	7440-50-8	E420	0.00050	mg/L	0.0332	0.0330	0.376%	20%	----
		iron, total	7439-89-6	E420	0.010	mg/L	27.6	28.5	3.39%	20%	----
		lead, total	7439-92-1	E420	0.000050	mg/L	0.0126	0.0127	0.888%	20%	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	0.0328	0.0328	0.0523%	20%	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	68.3	67.8	0.792%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	1.64	1.62	1.06%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00284	0.00299	5.41%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	0.0310	0.0314	1.35%	20%	----
		potassium, total	7440-09-7	E420	0.050	mg/L	5.08	5.04	0.813%	20%	----
		selenium, total	7782-49-2	E420	0.050	mg/L	1.06 µg/L	0.00103	3.36%	20%	----
		silicon, total	7440-21-3	E420	0.10	mg/L	16.6	17.0	1.95%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	0.000748	0.000769	2.77%	20%	----
		sodium, total	17341-25-2	E420	0.050	mg/L	13.8	13.5	2.02%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.671	0.683	1.76%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	22.0	21.6	2.04%	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: 300562) - continued											
CG2104166-001	Anonymous	thallium, total	7440-28-0	E420	0.000010	mg/L	0.000489	0.000507	3.52%	20%	----
		tin, total	7440-31-5	E420	0.00010	mg/L	0.00239	0.00241	0.732%	20%	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	0.0293	0.0304	3.67%	20%	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.00499	0.00492	1.44%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	0.0328	0.0335	1.89%	20%	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	0.144	0.143	0.604%	20%	----
Total Metals (QC Lot: 300563)											
CG2104166-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.0248	0.0254	2.28%	20%	----
Total Metals (QC Lot: 301411)											
CG2104186-001	Anonymous	mercury, total	7439-97-6	E508-L	0.00050	ng/L	<0.00050 µg/L	<0.50	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 300109)											
CG2104166-004	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	<0.00010	<0.00010	0	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		beryllium, dissolved	7440-41-7	E421	0.020	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	0.0050	mg/L	<0.0050 µg/L	<0.0000050	0	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.10	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	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		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	<0.000050	<0.000050	0	Diff <2x LOR	----
		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	<0.050	<0.050	0	Diff <2x LOR	----
		selenium, dissolved	7782-49-2	E421	0.050	mg/L	<0.050 µg/L	<0.000050	0	Diff <2x LOR	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	17341-25-2	E421	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	<0.00020	<0.00020	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: 300109) - continued											
CG2104166-004	Anonymous	sulfur, dissolved	7704-34-9	E421	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
		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	<0.000010	<0.000010	0	Diff <2x LOR	----
		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: 300110)											
CG2104166-004	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: 300938)											
CG2104188-014	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: 296170)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 298276)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 298977)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 304722)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 304723)						
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: 304859)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Anions and Nutrients (QCLot: 296209)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 296268)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 296269)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 296270)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 296271)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 296272)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 296273)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 297810)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 304121)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 305706)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 305706) - continued						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Organic / Inorganic Carbon (QCLot: 303820)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 303828)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 300562)						
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	17341-25-2	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: 300562) - continued						
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 300563)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 301411)						
mercury, total	7439-97-6	E508-L	0.5	ng/L	<0.50	----
Dissolved Metals (QCLot: 300109)						
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	17341-25-2	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	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 300109) - continued						
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Dissolved Metals (QCLot: 300110)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 300938)						
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: 296170)									
turbidity	----	E121	0.1	NTU	200 NTU	97.8	85.0	115	----
Physical Tests (QCLot: 298276)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	93.8	85.0	115	----
Physical Tests (QCLot: 298977)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	99.4	85.0	115	----
Physical Tests (QCLot: 302476)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	101	95.4	104	----
Physical Tests (QCLot: 304721)									
pH	----	E108	----	pH units	7 pH units	100	98.6	101	----
Physical Tests (QCLot: 304722)									
conductivity	----	E100	1	μS/cm	146.9 μS/cm	101	90.0	110	----
Physical Tests (QCLot: 304723)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	99.6	85.0	115	----
Physical Tests (QCLot: 304859)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	100	85.0	115	----
Anions and Nutrients (QCLot: 296209)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.02 mg/L	98.6	80.0	120	----
Anions and Nutrients (QCLot: 296268)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	106	90.0	110	----
Anions and Nutrients (QCLot: 296269)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 296270)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	107	85.0	115	----
Anions and Nutrients (QCLot: 296271)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 296272)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	105	90.0	110	----
Anions and Nutrients (QCLot: 296273)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	106	90.0	110	----
Anions and Nutrients (QCLot: 297810)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	8.32 mg/L	98.8	80.0	120	----
Anions and Nutrients (QCLot: 304121)									

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: 304121) - continued									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	99.9	75.0	125	----
Anions and Nutrients (QCLot: 305706)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	108	85.0	115	----
Organic / Inorganic Carbon (QCLot: 303820)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	10 mg/L	102	80.0	120	----
Organic / Inorganic Carbon (QCLot: 303828)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	10 mg/L	106	80.0	120	----
Total Metals (QCLot: 300562)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	108	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	110	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	102	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	97.3	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	100	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	95.5	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	99.7	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	96.9	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	100	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	99.6	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	103	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	99.3	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	99.0	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	104	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	100.0	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	105	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	99.0	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	102	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	106	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	104	80.0	120	----
sodium, total	17341-25-2	E420	0.05	mg/L	50 mg/L	97.8	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	105	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	97.6	80.0	120	----

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
Total Metals (QCLot: 300562) - continued									
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	103	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	101	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	101	80.0	120	----
Total Metals (QCLot: 300563)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	100	80.0	120	----
Total Metals (QCLot: 301411)									
mercury, total	7439-97-6	E508-L	0.5	ng/L	5 ng/L	97.6	80.0	120	----
Dissolved Metals (QCLot: 300109)									
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	102	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	112	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	110	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	98.4	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	106	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	92.5	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	108	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	98.0	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	111	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	110	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	101	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	102	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	95.8	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	106	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	109	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	110	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	108	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	111	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	95.8	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	101	80.0	120	----
sodium, dissolved	17341-25-2	E421	0.05	mg/L	50 mg/L	111	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	98.8	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	103	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	103	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	100	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: 300109) - continued									
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	106	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	104	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	110	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	112	80.0	120	----
Dissolved Metals (QCLot: 300110)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	111	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	93.1	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: 296209)										
CG2104188-019	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0557 mg/L	0.05 mg/L	111	70.0	130	----
Anions and Nutrients (QCLot: 296268)										
CG2104186-007	Anonymous	fluoride	16984-48-8	E235.F	1.07 mg/L	1 mg/L	107	75.0	125	----
Anions and Nutrients (QCLot: 296269)										
CG2104186-007	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	104 mg/L	100 mg/L	104	75.0	125	----
Anions and Nutrients (QCLot: 296270)										
CG2104186-007	Anonymous	bromide	24959-67-9	E235.Br-L	0.544 mg/L	0.5 mg/L	109	75.0	125	----
Anions and Nutrients (QCLot: 296271)										
CG2104186-007	Anonymous	chloride	16887-00-6	E235.Cl-L	105 mg/L	100 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 296272)										
CG2104186-007	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	2.63 mg/L	2.5 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 296273)										
CG2104186-007	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.538 mg/L	0.5 mg/L	108	75.0	125	----
Anions and Nutrients (QCLot: 297810)										
CG2104189-004	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0520 mg/L	0.0676 mg/L	76.9	70.0	130	----
Anions and Nutrients (QCLot: 304121)										
CG2104138-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.50 mg/L	2.5 mg/L	99.8	70.0	130	----
Anions and Nutrients (QCLot: 305706)										
CG2104186-007	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.109 mg/L	0.1 mg/L	109	75.0	125	----
Organic / Inorganic Carbon (QCLot: 303820)										
CG2104186-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	28.4 mg/L	23.9 mg/L	119	70.0	130	----
Organic / Inorganic Carbon (QCLot: 303828)										
CG2104186-001	Anonymous	carbon, total organic [TOC]	----	E355-L	27.8 mg/L	23.9 mg/L	116	70.0	130	----
Total Metals (QCLot: 300562)										
CG2104166-002	Anonymous	aluminum, total	7429-90-5	E420	ND mg/L	0.2 mg/L	ND	70.0	130	----
		antimony, total	7440-36-0	E420	0.0425 mg/L	0.04 mg/L	106	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0388 mg/L	0.04 mg/L	96.9	70.0	130	----
		barium, total	7440-39-3	E420	ND mg/L	0.02 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: 300562) - continued										
CG2104166-002	Anonymous	beryllium, total	7440-41-7	E420	0.0729 mg/L	0.08 mg/L	91.1	70.0	130	----
		bismuth, total	7440-69-9	E420	0.0189 mg/L	0.02 mg/L	94.5	70.0	130	----
		boron, total	7440-42-8	E420	0.180 mg/L	0.2 mg/L	90.0	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00750 mg/L	0.008 mg/L	93.7	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	0.0357 mg/L	0.04 mg/L	89.2	70.0	130	----
		copper, total	7440-50-8	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		iron, total	7439-89-6	E420	ND mg/L	2 mg/L	ND	70.0	130	----
		lead, total	7439-92-1	E420	0.0363 mg/L	0.04 mg/L	90.8	70.0	130	----
		lithium, total	7439-93-2	E420	0.187 mg/L	0.2 mg/L	93.4	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	ND mg/L	0.02 mg/L	ND	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0434 mg/L	0.04 mg/L	108	70.0	130	----
		nickel, total	7440-02-0	E420	0.0694 mg/L	0.08 mg/L	86.8	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	0.0778 mg/L	0.08 mg/L	97.2	70.0	130	----
		silicon, total	7440-21-3	E420	ND mg/L	10 mg/L	ND	70.0	130	----
		silver, total	7440-22-4	E420	0.00836 mg/L	0.008 mg/L	104	70.0	130	----
		sodium, total	17341-25-2	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	0.00711 mg/L	0.008 mg/L	88.8	70.0	130	----
		tin, total	7440-31-5	E420	0.0395 mg/L	0.04 mg/L	98.8	70.0	130	----
		titanium, total	7440-32-6	E420	0.0794 mg/L	0.08 mg/L	99.3	70.0	130	----
		uranium, total	7440-61-1	E420	0.00756 mg/L	0.008 mg/L	94.6	70.0	130	----
		vanadium, total	7440-62-2	E420	0.197 mg/L	0.2 mg/L	98.5	70.0	130	----
		zinc, total	7440-66-6	E420	0.729 mg/L	0.8 mg/L	91.2	70.0	130	----
Total Metals (QCLot: 300563)										
CG2104166-002	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.0743 mg/L	0.08 mg/L	92.9	70.0	130	----
Total Metals (QCLot: 301411)										
CG2104186-002	Anonymous	mercury, total	7439-97-6	E508-L	4.83 ng/L	5 ng/L	96.6	70.0	130	----
Dissolved Metals (QCLot: 300109)										
CG2104171-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.209 mg/L	0.2 mg/L	105	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0204 mg/L	0.02 mg/L	102	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0229 mg/L	0.02 mg/L	114	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 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*
Dissolved Metals (QCLot: 300109) - continued										
CG2104171-001	Anonymous	beryllium, dissolved	7440-41-7	E421	0.0379 mg/L	0.04 mg/L	94.8	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00906 mg/L	0.01 mg/L	90.6	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.092 mg/L	0.1 mg/L	92.6	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00436 mg/L	0.004 mg/L	109	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	0.0216 mg/L	0.02 mg/L	108	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0214 mg/L	0.02 mg/L	107	70.0	130	----
		iron, dissolved	7439-89-6	E421	2.04 mg/L	2 mg/L	102	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0198 mg/L	0.02 mg/L	98.8	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.0921 mg/L	0.1 mg/L	92.1	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	0.0214 mg/L	0.02 mg/L	107	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0202 mg/L	0.02 mg/L	101	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0430 mg/L	0.04 mg/L	108	70.0	130	----
		potassium, dissolved	7440-09-7	E421	4.42 mg/L	4 mg/L	111	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0467 mg/L	0.04 mg/L	117	70.0	130	----
		silicon, dissolved	7440-21-3	E421	9.19 mg/L	10 mg/L	91.9	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00409 mg/L	0.004 mg/L	102	70.0	130	----
		sodium, dissolved	17341-25-2	E421	2.50 mg/L	2 mg/L	125	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	20.3 mg/L	20 mg/L	101	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00404 mg/L	0.004 mg/L	101	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0200 mg/L	0.02 mg/L	100	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0430 mg/L	0.04 mg/L	107	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.00411 mg/L	0.004 mg/L	103	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.111 mg/L	0.1 mg/L	111	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.439 mg/L	0.4 mg/L	110	70.0	130	----
Dissolved Metals (QCLot: 300110)										
CG2104171-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.0442 mg/L	0.04 mg/L	110	70.0	130	----
Dissolved Metals (QCLot: 300938)										
CG2104188-015	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000993 mg/L	0.0001 mg/L	99.3	70.0	130	----

Teck

COC ID:	September GGCAMP 2021	TURNAROUND TIME:	

PROJECT/CLIENT INFO

Facility Name / Job#	REP				
Project Manager	Allie Ferguson				
Email	allie.ferguson@teck.com				
Address	421 Pine Avenue				
City	Sparwood	Province	BC		
Postal Code	V0B 2G0	Country	Canada		
Phone Number	250-425-8202				

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	1 403 407 1794		

Report recipients	Excel	PDF	EDD
allie.ferguson@teck.com			
teckcoal@equisonline.com			
tocwrcn@minnow.ca			
monica.barthe@teck.com			
awiebe@minnow.ca			

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	TECKCOAL-ROUTINE-VA (N)	ALS_Package-DOC (F, H2SO4)	ALS_Package-TKN/TOC (N, H2SO4)	HG-T-U-CVAF-VA (N)	HG-D-CVAF-VA (F, HCL)	TECKCOAL-MET-T-VA (N, HNO3)	TECKCOAL-MET-D-VA (F, HNO3)
RG_GANF_WS_GGCAMP_2021-09-15_NP	RG_GANF	WS	No	9/15/2021	1230	G	7	X	X	X	X	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

ALS PO 750546

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	
Jennifer Ings/Minnow	################		9/17 1100

NB OF BOTTLES RETURNED/DESCRIPTION

Regular (default)	x	Sampler's Name	Jennifer Ings	Mobile #	519-500-3444
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	September 16, 2021
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

9

Environmental Division
Calgary
Work Order Reference
CG2104192

Telephone : +1 403 407 1800

CERTIFICATE OF ANALYSIS

Work Order	: **CG2104210**	Page	: 1 of 7
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 18-Sep-2021 09:05
PO	: VPO00750546	Date Analysis Commenced	: 19-Sep-2021
C-O-C number	: SEPTEMBER GGCAMP 2021	Issue Date	: 10-Oct-2021 14:56
Sampler	: JI		
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	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Erin Sanchez		Inorganics, Calgary, Alberta
Hannah Phung	Lab Assistant	Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Ilnaz Badbezanchi	Team Leader - Metals preparation	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Oscar Ruiz	Lab Assistant	Inorganics, Calgary, Alberta
Owen Cheng		Metals, Burnaby, British Columbia
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Shaneel Dayal	Analyst	Metals, Burnaby, British Columbia

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*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
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_GGCAMP_2021-09-16_NP	----	----	----	----
				Client sampling date / time	16-Sep-2021 12:00	----	----	----	----
					CG2104210-001	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	----	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	212	----	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	11.6	----	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	223	----	----	----	----
conductivity	----	E100	2.0	µS/cm	495	----	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	262	----	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	458	----	----	----	----
pH	----	E108	0.10	pH units	8.43	----	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	323	----	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	2.6	----	----	----	----
turbidity	----	E121	0.10	NTU	1.53	----	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	258	----	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	7.0	----	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	----	----	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0057	----	----	----	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	----	----	----	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	3.11	----	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.149	----	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.118	----	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	<0.0050	----	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	----	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0079 HTD	----	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0150	----	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	61.7	----	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	3.14	----	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	3.33	----	----	----	----

Analytical Results

Sub-Matrix: Water

(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	RG_GAUT_WS_GGCAMP_2021-09-16_NP	----	----	----	----
				Client sampling date / time	16-Sep-2021 12:00	----	----	----	----
					CG2104210-001	--------	--------	--------	--------
					Result	----	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	5.84	----	----	----	----
cation sum	----	EC101	0.10	meq/L	5.42	----	----	----	----
ion balance (cations/anions ratio)	----	EC101	0.010	%	92.8	----	----	----	----
ion balance (cation-anion difference)	----	EC101	0.010	%	3.73	----	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0214	----	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00022	----	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00026	----	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.104	----	----	----	----
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	0.0167	----	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	62.3	----	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	<0.00010	----	----	----	----
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	0.022	----	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	----	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0067	----	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	22.8	----	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.00369	----	----	----	----
mercury, total	7439-97-6	E508-L	0.00050	µg/L	0.00073	----	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000882	----	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00187	----	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	1.26	----	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	0.690	----	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	3.29	----	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	----	----	----	----
sodium, total	17341-25-2	E420	0.050	mg/L	3.50	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GAUT_WS_GGCAMP_2021-09-16_NP	----	----	----	----
				Client sampling date / time	16-Sep-2021 12:00	----	----	----	----
					CG2104210-001	--------	--------	--------	--------
					Result	----	----	----	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.248	----	----	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	19.6	----	----	----	----
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	<0.00090 DLM	----	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.000488	----	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	----	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	0.0032	----	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0019	----	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00016	----	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00023	----	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.116	----	----	----	----
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	0.0117	----	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	66.7	----	----	----	----
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	0.00030	----	----	----	----
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	0.0070	----	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	23.1	----	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00279	----	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000893	----	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00186	----	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	1.33	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GAUT_WS_GGCAMP_2021-09-16_NP	----	----	----	----
				Client sampling date / time	16-Sep-2021 12:00	----	----	----	----
					CG2104210-001	--------	--------	--------	--------
					Result	----	----	----	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	0.750	----	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.52	----	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	----	----	----	----
sodium, dissolved	17341-25-2	E421	0.050	mg/L	3.52	----	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.219	----	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	20.6	----	----	----	----
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	0.000502	----	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	----	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0014	----	----	----	----
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	: **CG2104210**	Page	: 1 of 13
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 18-Sep-2021 09:05
PO	: VPO00750546	Issue Date	: 10-Oct-2021 14:56
C-O-C number	: SEPTEMBER GGCAMP 2021		
Sampler	: JI		
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 Services number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Matrix Spike outliers occur.
- Laboratory Control Sample (LCS) 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
Laboratory Control Sample (LCS) Recoveries								
Total Metals	QC-MRG2-300736002	----	antimony, total	7440-36-0	E420	122 % MES	80.0-120%	Recovery greater than upper control limit
Total Metals	QC-MRG2-300736002	----	strontium, total	7440-24-6	E420	122 % MES	80.0-120%	Recovery greater than upper control limit

Result Qualifiers

Qualifier	*Description*
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

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_GAUT_WS_GGCAMP_2021-09-16_NP	E298	16-Sep-2021	29-Sep-2021	----	----		29-Sep-2021	28 days	13 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GAUT_WS_GGCAMP_2021-09-16_NP	E235.Br-L	16-Sep-2021	----	----	----		19-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GAUT_WS_GGCAMP_2021-09-16_NP	E235.Cl-L	16-Sep-2021	----	----	----		19-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)										
HDPE RG_GAUT_WS_GGCAMP_2021-09-16_NP	E378-U	16-Sep-2021	----	----	----		20-Sep-2021	3 days	4 days	✘ EHT
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GAUT_WS_GGCAMP_2021-09-16_NP	E235.F	16-Sep-2021	----	----	----		19-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GAUT_WS_GGCAMP_2021-09-16_NP	E235.NO3-L	16-Sep-2021	----	----	----		19-Sep-2021	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GAUT_WS_GGCAMP_2021-09-16_NP	E235.NO2-L	16-Sep-2021	----	----	----		19-Sep-2021	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	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_GAUT_WS_GGCAMP_2021-09-16_NP	E235.SO4	16-Sep-2021	----	----	----		19-Sep-2021	28 days	3 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid)										
RG_GAUT_WS_GGCAMP_2021-09-16_NP	E318	16-Sep-2021	28-Sep-2021	----	----		28-Sep-2021	28 days	12 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid)										
RG_GAUT_WS_GGCAMP_2021-09-16_NP	E372-U	16-Sep-2021	23-Sep-2021	----	----		23-Sep-2021	28 days	7 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid)										
RG_GAUT_WS_GGCAMP_2021-09-16_NP	E421.Cr-L	16-Sep-2021	23-Sep-2021	----	----		24-Sep-2021	180 days	7 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid)										
RG_GAUT_WS_GGCAMP_2021-09-16_NP	E509	16-Sep-2021	24-Sep-2021	----	----		24-Sep-2021	28 days	8 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
RG_GAUT_WS_GGCAMP_2021-09-16_NP	E421	16-Sep-2021	23-Sep-2021	----	----		24-Sep-2021	180 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
RG_GAUT_WS_GGCAMP_2021-09-16_NP	E358-L	16-Sep-2021	27-Sep-2021	----	----		30-Sep-2021	28 days	14 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
RG_GAUT_WS_GGCAMP_2021-09-16_NP	E355-L	16-Sep-2021	27-Sep-2021	----	----		30-Sep-2021	28 days	14 days	✓
Physical Tests : Acidity by Titration										
HDPE										
RG_GAUT_WS_GGCAMP_2021-09-16_NP	E283	16-Sep-2021	----	----	----		29-Sep-2021	14 days	13 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_GAUT_WS_GGCAMP_2021-09-16_NP	E290	16-Sep-2021	----	----	----		28-Sep-2021	14 days	12 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_GAUT_WS_GGCAMP_2021-09-16_NP	E100	16-Sep-2021	----	----	----		28-Sep-2021	28 days	12 days	✓
Physical Tests : ORP by Electrode										
HDPE RG_GAUT_WS_GGCAMP_2021-09-16_NP	E125	16-Sep-2021	----	----	----		27-Sep-2021	0.34 hrs	265 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GAUT_WS_GGCAMP_2021-09-16_NP	E108	16-Sep-2021	----	----	----		28-Sep-2021	0.25 hrs	288 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE RG_GAUT_WS_GGCAMP_2021-09-16_NP	E162	16-Sep-2021	----	----	----		23-Sep-2021	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE [TSS-WB] RG_GAUT_WS_GGCAMP_2021-09-16_NP	E160-L	16-Sep-2021	----	----	----		23-Sep-2021	7 days	7 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE RG_GAUT_WS_GGCAMP_2021-09-16_NP	E121	16-Sep-2021	----	----	----		19-Sep-2021	3 days	3 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) RG_GAUT_WS_GGCAMP_2021-09-16_NP	E420.Cr-L	16-Sep-2021	----	----	----		24-Sep-2021	180 days	8 days	✓
Total Metals : Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)										
Pre-cleaned amber glass - total (lab preserved) RG_GAUT_WS_GGCAMP_2021-09-16_NP	E508-L	16-Sep-2021	----	----	----		27-Sep-2021	28 days	11 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 (nitric acid)										
RG_GAUT_WS_GGCAMP_2021-09-16_NP	E420	16-Sep-2021	----	----	----		24-Sep-2021	180 days	8 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	306147	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	304819	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	305806	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	296824	1	5	20.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	296825	1	5	20.0	5.0	✓
Conductivity in Water	E100	304817	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	300105	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	301260	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	300106	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	303950	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	297211	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	296828	1	5	20.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	296826	1	5	20.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	296827	1	5	20.0	5.0	✓
ORP by Electrode	E125	303222	1	16	6.2	5.0	✓
pH by Meter	E108	304818	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	296823	1	5	20.0	5.0	✓
TDS by Gravimetry	E162	300153	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	300736	1	20	5.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	302113	1	19	5.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	303406	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	300737	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	303957	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	299080	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	296756	1	1	100.0	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	306147	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	304819	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	305806	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	296824	1	5	20.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	296825	1	5	20.0	5.0	✓
Conductivity in Water	E100	304817	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	300105	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	301260	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	300106	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	303950	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	297211	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	296828	1	5	20.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	296826	1	5	20.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	296827	1	5	20.0	5.0	✓
ORP by Electrode	E125	303222	1	16	6.2	5.0	✓
pH by Meter	E108	304818	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	296823	1	5	20.0	5.0	✓
TDS by Gravimetry	E162	300153	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	300736	1	20	5.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	302113	1	19	5.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	303406	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	300737	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	303957	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	299080	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	300146	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	296756	1	1	100.0	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	306147	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	304819	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	305806	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	296824	1	5	20.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	296825	1	5	20.0	5.0	✓
Conductivity in Water	E100	304817	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	300105	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	301260	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	300106	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	303950	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	297211	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	296828	1	5	20.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	296826	1	5	20.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	296827	1	5	20.0	5.0	✓
Sulfate in Water by IC	E235.SO4	296823	1	5	20.0	5.0	✓
TDS by Gravimetry	E162	300153	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	300736	1	20	5.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	302113	1	19	5.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	303406	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	300737	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	303957	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	299080	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	300146	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	296756	1	1	100.0	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	305806	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	296824	1	5	20.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	296825	1	5	20.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	300105	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	301260	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	300106	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	303950	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	297211	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	296828	1	5	20.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	296826	1	5	20.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	296827	1	5	20.0	5.0	✓
Sulfate in Water by IC	E235.SO4	296823	1	5	20.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	300736	1	20	5.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	302113	1	19	5.2	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	303406	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	300737	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	303957	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	299080	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 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 E (mod)	Dissolved Orthophosphate is determined colourimetrically on a water 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 $CaCO_3$), 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 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 HNO_3.

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.

QUALITY CONTROL REPORT

Work Order	: **CG2104210**		
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 18-Sep-2021 09:05
PO	: VPO00750546	Date Analysis Commenced	: 19-Sep-2021
C-O-C number	: SEPTEMBER GGCAMP 2021	Issue Date	: 10-Oct-2021 14:56
Sampler	: JI		
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 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*
Anthony Calero	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Erin Sanchez		Inorganics, Calgary, Alberta
Hannah Phung	Lab Assistant	Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Ilnaz Badbezanchi	Team Leader - Metals preparation	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Oscar Ruiz	Lab Assistant	Inorganics, Calgary, Alberta
Owen Cheng		Metals, Burnaby, British Columbia
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Shaneel Dayal	Analyst	Metals, Burnaby, British Columbia

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.

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: 296756)											
CG2104210-001	RG_GAUT_WS_GGCAMP _2021-09-16_NP	turbidity	----	E121	0.10	NTU	1.53	1.41	8.15%	15%	----
Physical Tests (QC Lot: 300153)											
CG2104181-010	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	1320	1340	1.43%	20%	----
Physical Tests (QC Lot: 303222)											
CG2104202-001	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	462	465	0.690%	15%	----
Physical Tests (QC Lot: 304817)											
CG2104202-002	Anonymous	conductivity	----	E100	2.0	µS/cm	1520	1520	0.329%	10%	----
Physical Tests (QC Lot: 304818)											
CG2104202-002	Anonymous	pH	----	E108	0.10	pH units	8.14	8.15	0.123%	4%	----
Physical Tests (QC Lot: 304819)											
CG2104202-002	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	354	354	0.113%	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	354	354	0.113%	20%	----
Physical Tests (QC Lot: 306147)											
CG2104202-002	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	5.4	6.1	0.7	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 296823)											
CG2104210-001	RG_GAUT_WS_GGCAMP _2021-09-16_NP	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	61.7	61.8	0.147%	20%	----
Anions and Nutrients (QC Lot: 296824)											
CG2104210-001	RG_GAUT_WS_GGCAMP _2021-09-16_NP	bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 296825)											
CG2104210-001	RG_GAUT_WS_GGCAMP _2021-09-16_NP	chloride	16887-00-6	E235.Cl-L	0.10	mg/L	3.11	3.09	0.406%	20%	----
Anions and Nutrients (QC Lot: 296826)											
CG2104210-001	RG_GAUT_WS_GGCAMP _2021-09-16_NP	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 296827)											
CG2104210-001	RG_GAUT_WS_GGCAMP _2021-09-16_NP	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: 296828)											
CG2104210-001	RG_GAUT_WS_GGCAMP _2021-09-16_NP	fluoride	16984-48-8	E235.F	0.020	mg/L	0.149	0.143	0.007	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: 297211)											
CG2104209-001	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: 299080)											
CG2104202-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	<0.0020	<0.0020	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 302113)											
CG2104196-003	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 305806)											
CG2104200-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.125	mg/L	2.80	2.81	0.535%	20%	----
Organic / Inorganic Carbon (QC Lot: 303950)											
CG2104202-002	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	0.92	0.79	0.13	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 303957)											
CG2104202-001	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	0.63	0.64	0.006	Diff <2x LOR	----
Total Metals (QC Lot: 300736)											
CG2104170-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00012	0.00013	0.000006	Diff <2x LOR	----
Total Metals (QC Lot: 300737)											
CG2104170-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	<0.0030	0.0034	0.0004	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	0.00019	0.00020	0.000005	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0668	0.0664	0.596%	20%	----
		beryllium, total	7440-41-7	E420	0.020	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	0.014	0.013	0.0001	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0050	mg/L	0.113 µg/L	0.000110	2.19%	20%	----
		calcium, total	7440-70-2	E420	0.050	mg/L	89.2	87.2	2.34%	20%	----
		cobalt, total	7440-48-4	E420	0.10	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	0.0335	0.0330	1.47%	20%	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	40.6	41.0	0.850%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00116	0.00127	9.74%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00219	0.00226	3.02%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	0.00373	0.00366	0.00007	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	1.15	1.17	1.72%	20%	----
		selenium, total	7782-49-2	E420	0.050	mg/L	26.7 µg/L	0.0271	1.66%	20%	----
		silicon, total	7440-21-3	E420	0.10	mg/L	2.16	2.13	1.11%	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: 300737) - continued											
CG2104170-001	Anonymous	silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	17341-25-2	E420	0.050	mg/L	6.25	6.29	0.640%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.224	0.227	1.06%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	64.7	66.3	2.44%	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	0.00280	0.00278	0.974%	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	0.0054	0.0057	0.0003	Diff <2x LOR	----
Total Metals (QC Lot: 303406)											
CG2104208-001	Anonymous	mercury, total	7439-97-6	E508-L	0.00050	ng/L	<0.00050 µg/L	<0.50	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 300105)											
CG2104202-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00012	0.00012	0.000006	Diff <2x LOR	----
Dissolved Metals (QC Lot: 300106)											
CG2104202-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0013	0.0011	0.0002	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	<0.00010	<0.00010	0	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0152	0.0152	0.550%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.020	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	0.0050	mg/L	0.0129 µg/L	0.0000110	0.0000019	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	43.9	44.2	0.799%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.10	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	0.0021	0.0021	0.00002	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	12.4	12.6	1.38%	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	0.00102	0.000970	5.22%	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	0.266	0.273	0.007	Diff <2x LOR	----
		selenium, dissolved	7782-49-2	E421	0.050	mg/L	1.32 µg/L	0.00134	1.93%	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: 300106) - continued											
CG2104202-001	Anonymous	silicon, dissolved	7440-21-3	E421	0.050	mg/L	1.57	1.56	0.623%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	17341-25-2	E421	0.050	mg/L	0.478	0.482	0.004	Diff <2x LOR	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.123	0.120	2.51%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	17.8	18.1	1.97%	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	0.00149	0.00147	1.75%	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	0.0034	0.0038	0.0004	Diff <2x LOR	----
Dissolved Metals (QC Lot: 301260)											
CG2104161-008	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: 296756)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 300146)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 300153)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 304817)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 304819)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	1.1	----
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: 306147)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Anions and Nutrients (QCLot: 296823)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 296824)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 296825)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 296826)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 296827)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 296828)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 297211)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 299080)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 302113)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 305806)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 305806) - continued						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Organic / Inorganic Carbon (QCLot: 303950)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 303957)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 300736)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 300737)						
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	17341-25-2	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: 300737) - 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: 303406)						
mercury, total	7439-97-6	E508-L	0.5	ng/L	<0.50	----
Dissolved Metals (QCLot: 300105)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 300106)						
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	17341-25-2	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: 300106) - 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: 301260)						
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: 296756)									
turbidity	----	E121	0.1	NTU	200 NTU	96.6	85.0	115	----
Physical Tests (QCLot: 300146)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	93.8	85.0	115	----
Physical Tests (QCLot: 300153)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	99.1	85.0	115	----
Physical Tests (QCLot: 303222)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	101	95.4	104	----
Physical Tests (QCLot: 304817)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	100	90.0	110	----
Physical Tests (QCLot: 304818)									
pH	----	E108	----	pH units	7 pH units	100	98.6	101	----
Physical Tests (QCLot: 304819)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	98.9	85.0	115	----
Physical Tests (QCLot: 306147)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	108	85.0	115	----
Anions and Nutrients (QCLot: 296823)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	106	90.0	110	----
Anions and Nutrients (QCLot: 296824)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	102	85.0	115	----
Anions and Nutrients (QCLot: 296825)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 296826)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 296827)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	105	90.0	110	----
Anions and Nutrients (QCLot: 296828)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	108	90.0	110	----
Anions and Nutrients (QCLot: 297211)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.02 mg/L	100	80.0	120	----
Anions and Nutrients (QCLot: 299080)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	8.32 mg/L	96.2	80.0	120	----
Anions and Nutrients (QCLot: 302113)									

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: 302113) - continued									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	93.2	75.0	125	----
Anions and Nutrients (QCLot: 305806)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	105	85.0	115	----
Organic / Inorganic Carbon (QCLot: 303950)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	10 mg/L	98.9	80.0	120	----
Organic / Inorganic Carbon (QCLot: 303957)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	10 mg/L	103	80.0	120	----
Total Metals (QCLot: 300736)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	107	80.0	120	----
Total Metals (QCLot: 300737)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	110	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	# 122	80.0	120	MES
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	107	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	115	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	97.0	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	115	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	94.6	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	104	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	95.7	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	107	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	104	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	99.8	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	101	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	100	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	107	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	107	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	111	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	106	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	106	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	98.4	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	107	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	109	80.0	120	----
sodium, total	17341-25-2	E420	0.05	mg/L	50 mg/L	108	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	# 122	80.0	120	MES
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	101	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
					Laboratory Control Sample (LCS) Report				
Total Metals (QCLot: 300737) - continued									
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	105	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	105	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	110	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	97.9	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	108	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	106	80.0	120	----
Total Metals (QCLot: 303406)									
mercury, total	7439-97-6	E508-L	0.5	ng/L	5 ng/L	93.2	80.0	120	----
Dissolved Metals (QCLot: 300105)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	99.0	80.0	120	----
Dissolved Metals (QCLot: 300106)									
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	103	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	99.0	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	100	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	96.4	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	93.2	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	103	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	97.6	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	98.7	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	97.4	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	102	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	95.5	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	95.8	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	96.7	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	96.2	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	101	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	105	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	106	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	97.2	80.0	120	----
sodium, dissolved	17341-25-2	E421	0.05	mg/L	50 mg/L	99.2	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	97.2	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	104	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: 300106) - continued									
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	97.0	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	93.8	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	98.4	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	99.1	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	98.0	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	92.8	80.0	120	----

Qualifiers

Qualifier	Description
MES	Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).

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: 296823)										
CG2104211-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	ND mg/L	100 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 296824)										
CG2104211-001	Anonymous	bromide	24959-67-9	E235.Br-L	0.560 mg/L	0.5 mg/L	112	75.0	125	----
Anions and Nutrients (QCLot: 296825)										
CG2104211-001	Anonymous	chloride	16887-00-6	E235.Cl-L	111 mg/L	100 mg/L	111	75.0	125	----
Anions and Nutrients (QCLot: 296826)										
CG2104211-001	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: 296827)										
CG2104211-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.576 mg/L	0.5 mg/L	115	75.0	125	----
Anions and Nutrients (QCLot: 296828)										
CG2104211-001	Anonymous	fluoride	16984-48-8	E235.F	1.00 mg/L	1 mg/L	100	75.0	125	----
Anions and Nutrients (QCLot: 297211)										
CG2104210-001	RG_GAUT_WS_GGCAMP_ 2021-09-16_NP	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0582 mg/L	0.05 mg/L	116	70.0	130	----
Anions and Nutrients (QCLot: 299080)										
CG2104202-002	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0561 mg/L	0.0676 mg/L	83.0	70.0	130	----
Anions and Nutrients (QCLot: 302113)										
CG2104196-002	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.45 mg/L	2.5 mg/L	98.1	70.0	130	----
Anions and Nutrients (QCLot: 305806)										
CG2104202-005	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.116 mg/L	0.1 mg/L	116	75.0	125	----
Organic / Inorganic Carbon (QCLot: 303950)										
CG2104202-002	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	23.0 mg/L	23.9 mg/L	96.3	70.0	130	----
Organic / Inorganic Carbon (QCLot: 303957)										
CG2104202-001	Anonymous	carbon, total organic [TOC]	----	E355-L	23.3 mg/L	23.9 mg/L	97.5	70.0	130	----
Total Metals (QCLot: 300736)										
CG2104185-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.0400 mg/L	0.04 mg/L	100	70.0	130	----
Total Metals (QCLot: 300737)										
CG2104185-001	Anonymous	aluminum, total	7429-90-5	E420	0.192 mg/L	0.2 mg/L	95.9	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: 300737) - continued										
CG2104185-001	Anonymous	antimony, total	7440-36-0	E420	0.0209 mg/L	0.02 mg/L	105	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0200 mg/L	0.02 mg/L	99.8	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	0.0358 mg/L	0.04 mg/L	89.5	70.0	130	----
		bismuth, total	7440-69-9	E420	0.00978 mg/L	0.01 mg/L	97.8	70.0	130	----
		boron, total	7440-42-8	E420	0.092 mg/L	0.1 mg/L	92.3	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00399 mg/L	0.004 mg/L	99.7	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	0.0191 mg/L	0.02 mg/L	95.5	70.0	130	----
		copper, total	7440-50-8	E420	0.0187 mg/L	0.02 mg/L	93.5	70.0	130	----
		iron, total	7439-89-6	E420	1.92 mg/L	2 mg/L	96.2	70.0	130	----
		lead, total	7439-92-1	E420	0.0187 mg/L	0.02 mg/L	93.3	70.0	130	----
		lithium, total	7439-93-2	E420	0.0878 mg/L	0.1 mg/L	87.8	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	0.0191 mg/L	0.02 mg/L	95.6	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0206 mg/L	0.02 mg/L	103	70.0	130	----
		nickel, total	7440-02-0	E420	0.0376 mg/L	0.04 mg/L	93.9	70.0	130	----
		potassium, total	7440-09-7	E420	3.83 mg/L	4 mg/L	95.8	70.0	130	----
		selenium, total	7782-49-2	E420	0.0392 mg/L	0.04 mg/L	97.9	70.0	130	----
		silicon, total	7440-21-3	E420	8.52 mg/L	10 mg/L	85.2	70.0	130	----
		silver, total	7440-22-4	E420	0.00416 mg/L	0.004 mg/L	104	70.0	130	----
		sodium, total	17341-25-2	E420	1.92 mg/L	2 mg/L	95.9	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	18.2 mg/L	20 mg/L	91.3	70.0	130	----
		thallium, total	7440-28-0	E420	0.00363 mg/L	0.004 mg/L	90.8	70.0	130	----
		tin, total	7440-31-5	E420	0.0199 mg/L	0.02 mg/L	99.7	70.0	130	----
		titanium, total	7440-32-6	E420	0.0410 mg/L	0.04 mg/L	102	70.0	130	----
		uranium, total	7440-61-1	E420	0.00392 mg/L	0.004 mg/L	97.9	70.0	130	----
		vanadium, total	7440-62-2	E420	0.102 mg/L	0.1 mg/L	102	70.0	130	----
		zinc, total	7440-66-6	E420	0.383 mg/L	0.4 mg/L	95.7	70.0	130	----
Total Metals (QCLot: 303406)										
CG2104209-001	Anonymous	mercury, total	7439-97-6	E508-L	4.51 ng/L	5 ng/L	90.1	70.0	130	----
Dissolved Metals (QCLot: 300105)										
CG2104202-002	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.0392 mg/L	0.04 mg/L	98.0	70.0	130	----
Dissolved Metals (QCLot: 300106)										
CG2104202-002	Anonymous	aluminum, dissolved	7429-90-5	E421	0.199 mg/L	0.2 mg/L	99.5	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: 300106) - continued										
CG2104202-002	Anonymous	antimony, dissolved	7440-36-0	E421	0.0198 mg/L	0.02 mg/L	99.0	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0196 mg/L	0.02 mg/L	98.0	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0366 mg/L	0.04 mg/L	91.6	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00831 mg/L	0.01 mg/L	83.1	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.093 mg/L	0.1 mg/L	93.3	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00399 mg/L	0.004 mg/L	99.7	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	0.0183 mg/L	0.02 mg/L	91.7	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0178 mg/L	0.02 mg/L	89.2	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.88 mg/L	2 mg/L	94.1	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0177 mg/L	0.02 mg/L	88.7	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	0.0188 mg/L	0.02 mg/L	94.2	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0202 mg/L	0.02 mg/L	101	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0345 mg/L	0.04 mg/L	86.3	70.0	130	----
		potassium, dissolved	7440-09-7	E421	ND mg/L	4 mg/L	ND	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	9.71 mg/L	10 mg/L	97.1	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00370 mg/L	0.004 mg/L	92.6	70.0	130	----
		sodium, dissolved	17341-25-2	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	0.00354 mg/L	0.004 mg/L	88.5	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0202 mg/L	0.02 mg/L	101	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0373 mg/L	0.04 mg/L	93.3	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	0.0996 mg/L	0.1 mg/L	99.6	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.355 mg/L	0.4 mg/L	88.6	70.0	130	----
Dissolved Metals (QCLot: 301260)										
CG2104161-009	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000943 mg/L	0.0001 mg/L	94.3	70.0	130	----

Teck

Page 1 of 1

COC ID: **September GGCAMP 2021** TURNAROUND TIME:

PROJECT/CLIENT INFO

Facility Name / Job#	REP
Project Manager	Allie Ferguson
Email	allie.ferguson@teck.com
Address	21 Pine Avenue
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	0-425-8202

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	1 403 407 1794

Email	Excel	PDF	EDD
allie.ferguson@teck.com	x		x
teckcoal@equisonline.com			x
lbowron@minnow.ca	x		x
monica.barthe@teck.com	x		
awiebe@minnow.ca	x		x

Environmental Division
Calgary
Work Order Reference
CG2104210
Telephone : +1 403 407 1800

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	TECKCOAL-ROUTINE-VA	ALS_Package-DOC	ALS_Package-TKN/TOC	HG-T-U-CVAF-VA	HG-D-CVAF-VA	TECKCOAL-MET-T-VA	TECKCOAL-MET-D-VA
Filtered								N	F	N	N	F	N	F
Preserved									H2SO4	H2SO4		HCL	HNO3	HNO3
RG_GAUT_WS_GGCAMP_2021-09-16_NP	RG_GAUT	WS	No	9/16/2021	1200	G	7	X	X	X	X	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

ALS PO 750546

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Jennifer Ings/Minnow	################		17/09 9:05

NB OF BOTTLES RETURNED/DESCRIPTION

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	Jennifer Ings	Mobile #	519-500-3444
Sampler's Signature		Date/Time	September 17, 2021

6°

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **CG2104395**	Page	: 1 of 6
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 24-Sep-2021 08:40
PO	: VPO00750546	Date Analysis Commenced	: 25-Sep-2021
C-O-C number	: SEPTEMBERGGCAMP2021	Issue Date	: 13-Oct-2021 17:01
Sampler	: JENIFER 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*
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
Maria Tuguinay	Lab Assistant	Inorganics, Calgary, Alberta
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
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia
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.*
HTD	*Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.*

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water)**

					Client sample ID				
					RG_GHP_WS_GGCAMP_2021-09-23_NP	----	----	----	----
				Client sampling date / time	23-Sep-2021 09:30	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**CG2104395-001**	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	----	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	223	----	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	16.0	----	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	239	----	----	----	----
conductivity	----	E100	2.0	µS/cm	1610	----	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	1050	----	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	483	----	----	----	----
pH	----	E108	0.10	pH units	8.39	----	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	1380	----	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	1.5	----	----	----	----
turbidity	----	E121	0.10	NTU	0.92	----	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	272	----	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	9.6	----	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	----	----	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0140	----	----	----	----
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	1.84	----	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.152	----	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.614	----	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	6.52 HTD	----	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0064 HTD	----	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0012	----	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0050	----	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	804	----	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	2.29	----	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	2.44	----	----	----	----

Analytical Results

Sub-Matrix: Water

(Matrix: Water)

				Client sample ID	RG_GHP_WS_GGCAMP_2021-09-23_NP	----	----	----	----
				Client sampling date / time	23-Sep-2021 09:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2104395-001	--------	--------	--------	--------
					Result	----	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	22.0	----	----	----	----
cation sum	----	EC101	0.10	meq/L	21.1	----	----	----	----
ion balance (cations/anions ratio)	----	EC101	0.010	%	95.9	----	----	----	----
ion balance (cation-anion difference)	----	EC101	0.010	%	2.09	----	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0063	----	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00051	----	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00023	----	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0394	----	----	----	----
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	0.0067	----	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	174	----	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00039	----	----	----	----
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	0.0168	----	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	159	----	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.00152	----	----	----	----
mercury, total	7439-97-6	E508-L	0.00050	µg/L	<0.00050	----	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00188	----	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00854	----	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	2.81	----	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	161	----	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	4.42	----	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	----	----	----	----
sodium, total	17341-25-2	E420	0.050	mg/L	2.86	----	----	----	----

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	RG_GHP_WS_GGCAMP_2021-09-23_NP	----	----	----	----
				Client sampling date / time	23-Sep-2021 09:30	----	----	----	----
					CG2104395-001	--------	--------	--------	--------
					Result	----	----	----	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.194	----	----	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	312	----	----	----	----
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	0.00876	----	----	----	----
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	0.0012	----	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00046	----	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00019	----	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0351	----	----	----	----
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	173	----	----	----	----
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	0.00025	----	----	----	----
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	0.0162	----	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	150	----	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00047	----	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00168	----	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00698	----	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	2.41	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	RG_GHP_WS_GGCAMP_2021-09-23_NP	----	----	----	----
				Client sampling date / time	23-Sep-2021 09:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2104395-001	--------	--------	--------	--------
					Result	----	----	----	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	154	----	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	4.12	----	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	----	----	----	----
sodium, dissolved	17341-25-2	E421	0.050	mg/L	2.48	----	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.184	----	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	274	----	----	----	----
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	0.00811	----	----	----	----
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.

ALS Environmental

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2104395**	Page	: 1 of 12
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 24-Sep-2021 08:40
PO	: VPO00750546	Issue Date	: 13-Oct-2021 17:01
C-O-C number	: SEPTEMBERGGCAMP2021		
Sampler	: JENIFER 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 Services number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

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_GHP_WS_GGCAMP_2021-09-23_NP	E298	23-Sep-2021	06-Oct-2021	----	----		06-Oct-2021	28 days	13 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE RG_GHP_WS_GGCAMP_2021-09-23_NP	E235.Br-L	23-Sep-2021	----	----	----		25-Sep-2021	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE RG_GHP_WS_GGCAMP_2021-09-23_NP	E235.Cl-L	23-Sep-2021	----	----	----		25-Sep-2021	28 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)										
HDPE RG_GHP_WS_GGCAMP_2021-09-23_NP	E378-U	23-Sep-2021	----	----	----		25-Sep-2021	3 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE RG_GHP_WS_GGCAMP_2021-09-23_NP	E235.F	23-Sep-2021	----	----	----		25-Sep-2021	28 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE RG_GHP_WS_GGCAMP_2021-09-23_NP	E235.NO3-L	23-Sep-2021	----	----	----		25-Sep-2021	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE RG_GHP_WS_GGCAMP_2021-09-23_NP	E235.NO2-L	23-Sep-2021	----	----	----		25-Sep-2021	3 days	2 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_GHP_WS_GGCAMP_2021-09-23_NP	E235.SO4	23-Sep-2021	----	----	----		25-Sep-2021	28 days	2 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid)										
RG_GHP_WS_GGCAMP_2021-09-23_NP	E318	23-Sep-2021	29-Sep-2021	----	----		29-Sep-2021	28 days	6 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (Ultra Trace)										
Amber glass total (sulfuric acid)										
RG_GHP_WS_GGCAMP_2021-09-23_NP	E372-U	23-Sep-2021	30-Sep-2021	----	----		30-Sep-2021	28 days	7 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid)										
RG_GHP_WS_GGCAMP_2021-09-23_NP	E421.Cr-L	23-Sep-2021	30-Sep-2021	----	----		30-Sep-2021	180 days	7 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid)										
RG_GHP_WS_GGCAMP_2021-09-23_NP	E509	23-Sep-2021	01-Oct-2021	----	----		01-Oct-2021	28 days	8 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
RG_GHP_WS_GGCAMP_2021-09-23_NP	E421	23-Sep-2021	30-Sep-2021	----	----		30-Sep-2021	180 days	7 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
RG_GHP_WS_GGCAMP_2021-09-23_NP	E358-L	23-Sep-2021	02-Oct-2021	----	----		04-Oct-2021	28 days	11 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
RG_GHP_WS_GGCAMP_2021-09-23_NP	E355-L	23-Sep-2021	02-Oct-2021	----	----		04-Oct-2021	28 days	11 days	✓
Physical Tests : Acidity by Titration										
HDPE										
RG_GHP_WS_GGCAMP_2021-09-23_NP	E283	23-Sep-2021	----	----	----		02-Oct-2021	14 days	9 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_GHP_WS_GGCAMP_2021-09-23_NP	E290	23-Sep-2021	----	----	----		02-Oct-2021	14 days	9 days	✓
Physical Tests : Conductivity in Water										
HDPE RG_GHP_WS_GGCAMP_2021-09-23_NP	E100	23-Sep-2021	----	----	----		02-Oct-2021	28 days	9 days	✓
Physical Tests : ORP by Electrode										
HDPE RG_GHP_WS_GGCAMP_2021-09-23_NP	E125	23-Sep-2021	----	----	----		01-Oct-2021	0.25 hrs	196 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE RG_GHP_WS_GGCAMP_2021-09-23_NP	E108	23-Sep-2021	----	----	----		02-Oct-2021	0.25 hrs	217 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE RG_GHP_WS_GGCAMP_2021-09-23_NP	E162	23-Sep-2021	----	----	----		29-Sep-2021	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE [TSS-WB] RG_GHP_WS_GGCAMP_2021-09-23_NP	E160-L	23-Sep-2021	----	----	----		29-Sep-2021	7 days	6 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE RG_GHP_WS_GGCAMP_2021-09-23_NP	E121	23-Sep-2021	----	----	----		26-Sep-2021	3 days	3 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) RG_GHP_WS_GGCAMP_2021-09-23_NP	E420.Cr-L	23-Sep-2021	----	----	----		01-Oct-2021	180 days	8 days	✓
Total Metals : Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)										
Pre-cleaned amber glass - total (lab preserved) RG_GHP_WS_GGCAMP_2021-09-23_NP	E508-L	23-Sep-2021	----	----	----		30-Sep-2021	28 days	7 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
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid)										
RG_GHP_WS_GGCAMP_2021-09-23_NP	E420	23-Sep-2021	----	----	----		01-Oct-2021	180 days	8 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	309212	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	309201	1	12	8.3	5.0	✓
Ammonia by Fluorescence	E298	313146	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	302762	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	302763	1	16	6.2	5.0	✓
Conductivity in Water	E100	309203	1	12	8.3	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	307271	1	11	9.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	307895	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	307270	1	13	7.6	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	309371	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	302815	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	302760	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	302764	1	16	6.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	302765	1	16	6.2	5.0	✓
ORP by Electrode	E125	308431	1	20	5.0	5.0	✓
pH by Meter	E108	309202	1	14	7.1	5.0	✓
Sulfate in Water by IC	E235.SO4	302761	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	304955	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	307698	1	9	11.1	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	305746	1	18	5.5	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	307062	1	17	5.8	5.0	✓
Total Metals in Water by CRC ICPMS	E420	307697	1	19	5.2	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	309374	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	304415	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	303018	1	6	16.6	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	309212	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	309201	1	12	8.3	5.0	✓
Ammonia by Fluorescence	E298	313146	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	302762	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	302763	1	16	6.2	5.0	✓
Conductivity in Water	E100	309203	1	12	8.3	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	307271	1	11	9.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	307895	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	307270	1	13	7.6	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	309371	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	302815	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	302760	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	302764	1	16	6.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	302765	1	16	6.2	5.0	✓
ORP by Electrode	E125	308431	1	20	5.0	5.0	✓
pH by Meter	E108	309202	1	14	7.1	5.0	✓
Sulfate in Water by IC	E235.SO4	302761	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	304955	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	307698	1	9	11.1	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	305746	1	18	5.5	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	307062	1	17	5.8	5.0	✓
Total Metals in Water by CRC ICPMS	E420	307697	1	19	5.2	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	309374	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	304415	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	304925	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	303018	1	6	16.6	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	309212	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	309201	1	12	8.3	5.0	✓
Ammonia by Fluorescence	E298	313146	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	302762	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	302763	1	16	6.2	5.0	✓
Conductivity in Water	E100	309203	1	12	8.3	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	307271	1	11	9.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	307895	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	307270	1	13	7.6	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	309371	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	302815	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	302760	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	302764	1	16	6.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	302765	1	16	6.2	5.0	✓
Sulfate in Water by IC	E235.SO4	302761	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	304955	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	307698	1	9	11.1	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	305746	1	18	5.5	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	307062	1	17	5.8	5.0	✓
Total Metals in Water by CRC ICPMS	E420	307697	1	19	5.2	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	309374	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	304415	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	304925	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	303018	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*
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	313146	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	302762	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	302763	1	16	6.2	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	307271	1	11	9.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	307895	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	307270	1	13	7.6	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	309371	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	E378-U	302815	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	302760	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	302764	1	16	6.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	302765	1	16	6.2	5.0	✓
Sulfate in Water by IC	E235.SO4	302761	1	16	6.2	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	307698	1	9	11.1	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	305746	1	18	5.5	5.0	✓
Total Mercury in Water by CVAFS (Low Level, LOR = 0.5 ppt)	E508-L	307062	1	17	5.8	5.0	✓
Total Metals in Water by CRC ICPMS	E420	307697	1	19	5.2	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	309374	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (Ultra Trace)	E372-U	304415	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 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 E (mod)	Dissolved Orthophosphate is determined colourimetrically on a water 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.

QUALITY CONTROL REPORT

Work Order	: **CG2104395**	Page	: 1 of 18
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Allie Ferguson	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: REGIONAL EFFECTS PROGRAM	Date Samples Received	: 24-Sep-2021 08:40
PO	: VPO00750546	Date Analysis Commenced	: 25-Sep-2021
C-O-C number	: SEPTEMBERGGCAMP2021	Issue Date	: 13-Oct-2021 17:01
Sampler	: JENIFER 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 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*
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
Maria Tuguinay	Lab Assistant	Inorganics, Calgary, Alberta
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
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia
Vladka Stamenova	Analyst	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.

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	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 303018)											
CG2104383-001	Anonymous	turbidity	----	E121	0.10	NTU	0.38	0.39	0.007	Diff <2x LOR	----
Physical Tests (QC Lot: 304955)											
CG2104385-002	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	178	180	2	Diff <2x LOR	----
Physical Tests (QC Lot: 308431)											
CG2104389-002	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	421	422	0.308%	15%	----
Physical Tests (QC Lot: 309201)											
CG2104390-011	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	885	869	1.85%	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	885	869	1.85%	20%	----
Physical Tests (QC Lot: 309202)											
CG2104390-011	Anonymous	pH	----	E108	0.10	pH units	8.09	8.10	0.124%	4%	----
Physical Tests (QC Lot: 309203)											
CG2104390-011	Anonymous	conductivity	----	E100	1.0	µS/cm	13700	13700	0.00%	10%	----
Physical Tests (QC Lot: 309212)											
CG2104389-002	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	2.1	<2.0	0.1	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 302760)											
CG2104389-001	Anonymous	fluoride	16984-48-8	E235.F	0.020	mg/L	0.391	0.365	6.88%	20%	----
Anions and Nutrients (QC Lot: 302761)											
CG2104389-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	29.7	26.8	10.1%	20%	----
Anions and Nutrients (QC Lot: 302762)											
CG2104389-001	Anonymous	bromide	24959-67-9	E235.Br-L	0.050	mg/L	0.108	0.098	0.010	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 302763)											
CG2104389-001	Anonymous	chloride	16887-00-6	E235.Cl-L	0.10	mg/L	20.3	19.1	6.23%	20%	----
Anions and Nutrients (QC Lot: 302764)											
CG2104389-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.0373	0.0306	0.0067	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 302765)											
CG2104389-001	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: 302815)											
CG2104363-001	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: 304415)											

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: 304415) - continued											
CG2104383-004	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	<0.0020	<0.0020	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 305746)											
CG2104381-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.500	mg/L	2.23	2.27	0.034	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 313146)											
CG2104385-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0129	0.0083	0.0046	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 309371)											
CG2104390-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	11.1	10.8	3.28%	20%	----
Organic / Inorganic Carbon (QC Lot: 309374)											
CG2104384-014	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	0.85	0.71	0.14	Diff <2x LOR	----
Total Metals (QC Lot: 307062)											
CG2104394-001	Anonymous	mercury, total	7439-97-6	E508-L	0.00050	ng/L	0.00058 µg/L	0.78	0.21	Diff <2x LOR	----
Total Metals (QC Lot: 307697)											
CG2104385-002	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0057	0.0041	0.0016	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	0.00040	0.00044	0.00004	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0599	0.0608	1.46%	20%	----
		beryllium, total	7440-41-7	E420	0.020	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	0.0050	mg/L	<0.0050 µg/L	<0.0000050	0	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	35.7	34.6	3.27%	20%	----
		cobalt, total	7440-48-4	E420	0.10	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	0.0004	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	0.0029	0.0028	0.0001	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	18.8	18.6	0.849%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00061	0.00046	0.00015	Diff <2x LOR	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00140	0.00135	3.56%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	1.07	1.08	0.860%	20%	----
		selenium, total	7782-49-2	E420	0.050	mg/L	0.297 µg/L	0.000238	0.000059	Diff <2x LOR	----
		silicon, total	7440-21-3	E420	0.10	mg/L	2.20	2.18	0.878%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	17341-25-2	E420	0.050	mg/L	1.94	1.97	1.65%	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: 307697) - continued											
CG2104385-002	Anonymous	strontium, total	7440-24-6	E420	0.00020	mg/L	0.135	0.133	1.19%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	7.98	7.90	0.983%	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	0.000858	0.000847	1.35%	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	0.0057	0.0050	0.0007	Diff <2x LOR	----
Total Metals (QC Lot: 307698)											
CG2104385-002	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: 307270)											
CG2104381-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0020	mg/L	0.0042	0.0030	0.0011	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00092	0.00091	0.000005	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00033	0.00032	0.00001	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	3.00	2.96	1.40%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.020	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	0.027	0.002	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0050	mg/L	0.0584 µg/L	0.0000631	7.78%	20%	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	87.3	82.5	5.72%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.10	mg/L	2.07 µg/L	0.00211	1.83%	20%	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00276	0.00276	0.130%	20%	----
		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	0.000063	0.000062	0.0000009	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.114	0.109	4.65%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	34.3	36.1	5.07%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.0324	0.0333	3.01%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00200	0.00194	3.23%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00808	0.00826	2.12%	20%	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	5.81	5.91	1.68%	20%	----
		selenium, dissolved	7782-49-2	E421	0.050	mg/L	0.816 µg/L	0.000775	5.20%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.30	3.31	0.194%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	17341-25-2	E421	0.050	mg/L	7.99	8.22	2.92%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	1.81	1.81	0.111%	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: 307270) - continued											
CG2104381-001	Anonymous	sulfur, dissolved	7704-34-9	E421	0.50	mg/L	3.26	3.38	0.12	Diff <2x LOR	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.000053	0.000052	0.0000009	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	0.000306	0.000303	1.07%	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	0.0067	0.0069	0.0002	Diff <2x LOR	----
Dissolved Metals (QC Lot: 307271)											
CG2104381-001	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: 307895)											
CG2104374-008	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: 303018)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 304925)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 304955)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 309201)						
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: 309203)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 309212)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Anions and Nutrients (QCLot: 302760)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 302761)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 302762)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 302763)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 302764)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 302765)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 302815)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 304415)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 305746)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 313146)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 313146) - continued						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Organic / Inorganic Carbon (QCLot: 309371)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 309374)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 307062)						
mercury, total	7439-97-6	E508-L	0.5	ng/L	<0.50	----
Total Metals (QCLot: 307697)						
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	17341-25-2	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: 307697) - 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: 307698)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 307270)						
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	17341-25-2	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	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 307270) - continued						
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Dissolved Metals (QCLot: 307271)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 307895)						
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: 303018)									
turbidity	----	E121	0.1	NTU	200 NTU	98.5	85.0	115	----
Physical Tests (QCLot: 304925)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	93.7	85.0	115	----
Physical Tests (QCLot: 304955)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	99.6	85.0	115	----
Physical Tests (QCLot: 308431)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	101	95.4	104	----
Physical Tests (QCLot: 309201)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	104	85.0	115	----
Physical Tests (QCLot: 309202)									
pH	----	E108	----	pH units	7 pH units	100	98.6	101	----
Physical Tests (QCLot: 309203)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	98.7	90.0	110	----
Physical Tests (QCLot: 309212)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	104	85.0	115	----
Anions and Nutrients (QCLot: 302760)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 302761)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	90.9	90.0	110	----
Anions and Nutrients (QCLot: 302762)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	101	85.0	115	----
Anions and Nutrients (QCLot: 302763)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	93.2	90.0	110	----
Anions and Nutrients (QCLot: 302764)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	93.1	90.0	110	----
Anions and Nutrients (QCLot: 302765)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	97.2	90.0	110	----
Anions and Nutrients (QCLot: 302815)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.02 mg/L	102	80.0	120	----
Anions and Nutrients (QCLot: 304415)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	8.32 mg/L	93.6	80.0	120	----
Anions and Nutrients (QCLot: 305746)									

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Anions and Nutrients (QCLot: 305746) - continued									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 313146)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	95.8	85.0	115	----
Organic / Inorganic Carbon (QCLot: 309371)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	10 mg/L	86.0	80.0	120	----
Organic / Inorganic Carbon (QCLot: 309374)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	10 mg/L	101	80.0	120	----
Total Metals (QCLot: 307062)									
mercury, total	7439-97-6	E508-L	0.5	ng/L	5 ng/L	102	80.0	120	----
Total Metals (QCLot: 307697)									
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	120	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	116	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	115	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	108	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	97.8	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	101	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	115	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	108	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	114	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	112	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	104	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	101	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	109	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	112	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	112	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	114	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	113	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	119	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	108	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	110	80.0	120	----
sodium, total	17341-25-2	E420	0.05	mg/L	50 mg/L	114	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	114	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	110	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: 307697) - 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	109	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	109	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	110	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	113	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	114	80.0	120	----
Total Metals (QCLot: 307698)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	111	80.0	120	----
Dissolved Metals (QCLot: 307270)									
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	106	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	105	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	106	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	93.8	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	93.0	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	90.0	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	104	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	103	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	101	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	101	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	105	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	90.5	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	98.6	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	105	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	101	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	113	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	101	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	99.1	80.0	120	----
sodium, dissolved	17341-25-2	E421	0.05	mg/L	50 mg/L	106	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	109	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	104	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	100	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
					Laboratory Control Sample (LCS) Report				
Dissolved Metals (QCLot: 307270) - continued									
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	97.2	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	106	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	99.4	80.0	120	----
Dissolved Metals (QCLot: 307271)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	99.7	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: 302760)										
CG2104389-002	Anonymous	fluoride	16984-48-8	E235.F	0.862 mg/L	1 mg/L	86.2	75.0	125	----
Anions and Nutrients (QCLot: 302761)										
CG2104389-002	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	97.9 mg/L	100 mg/L	97.9	75.0	125	----
Anions and Nutrients (QCLot: 302762)										
CG2104389-002	Anonymous	bromide	24959-67-9	E235.Br-L	0.440 mg/L	0.5 mg/L	88.0	75.0	125	----
Anions and Nutrients (QCLot: 302763)										
CG2104389-002	Anonymous	chloride	16887-00-6	E235.Cl-L	87.2 mg/L	100 mg/L	87.2	75.0	125	----
Anions and Nutrients (QCLot: 302764)										
CG2104389-002	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	2.30 mg/L	2.5 mg/L	91.9	75.0	125	----
Anions and Nutrients (QCLot: 302765)										
CG2104389-002	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.491 mg/L	0.5 mg/L	98.2	75.0	125	----
Anions and Nutrients (QCLot: 302815)										
CG2104363-009	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0525 mg/L	0.05 mg/L	105	70.0	130	----
Anions and Nutrients (QCLot: 304415)										
CG2104383-005	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0637 mg/L	0.0676 mg/L	94.3	70.0	130	----
Anions and Nutrients (QCLot: 305746)										
CG2104381-002	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	ND mg/L	2.5 mg/L	ND	70.0	130	----
Anions and Nutrients (QCLot: 313146)										
CG2104385-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.112 mg/L	0.1 mg/L	112	75.0	125	----
Organic / Inorganic Carbon (QCLot: 309371)										
CG2104390-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	20.2 mg/L	23.9 mg/L	84.8	70.0	130	----
Organic / Inorganic Carbon (QCLot: 309374)										
CG2104384-014	Anonymous	carbon, total organic [TOC]	----	E355-L	23.6 mg/L	23.9 mg/L	98.6	70.0	130	----
Total Metals (QCLot: 307062)										
CG2104394-002	Anonymous	mercury, total	7439-97-6	E508-L	4.59 ng/L	5 ng/L	91.8	70.0	130	----
Total Metals (QCLot: 307697)										
CG2104385-001	Anonymous	aluminum, total	7429-90-5	E420	0.202 mg/L	0.2 mg/L	101	70.0	130	----
		antimony, total	7440-36-0	E420	0.0216 mg/L	0.02 mg/L	108	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: 307697) - continued										
CG2104385-001	Anonymous	arsenic, total	7440-38-2	E420	0.0213 mg/L	0.02 mg/L	107	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	0.0407 mg/L	0.04 mg/L	102	70.0	130	----
		bismuth, total	7440-69-9	E420	0.0101 mg/L	0.01 mg/L	101	70.0	130	----
		boron, total	7440-42-8	E420	0.097 mg/L	0.1 mg/L	97.5	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00428 mg/L	0.004 mg/L	107	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	0.0207 mg/L	0.02 mg/L	104	70.0	130	----
		copper, total	7440-50-8	E420	0.0204 mg/L	0.02 mg/L	102	70.0	130	----
		iron, total	7439-89-6	E420	2.11 mg/L	2 mg/L	106	70.0	130	----
		lead, total	7439-92-1	E420	0.0190 mg/L	0.02 mg/L	94.8	70.0	130	----
		lithium, total	7439-93-2	E420	0.0984 mg/L	0.1 mg/L	98.4	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	0.0211 mg/L	0.02 mg/L	105	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0208 mg/L	0.02 mg/L	104	70.0	130	----
		nickel, total	7440-02-0	E420	0.0419 mg/L	0.04 mg/L	105	70.0	130	----
		potassium, total	7440-09-7	E420	4.32 mg/L	4 mg/L	108	70.0	130	----
		selenium, total	7782-49-2	E420	0.0453 mg/L	0.04 mg/L	113	70.0	130	----
		silicon, total	7440-21-3	E420	9.87 mg/L	10 mg/L	98.7	70.0	130	----
		silver, total	7440-22-4	E420	0.00420 mg/L	0.004 mg/L	105	70.0	130	----
		sodium, total	17341-25-2	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	22.3 mg/L	20 mg/L	111	70.0	130	----
		thallium, total	7440-28-0	E420	0.00370 mg/L	0.004 mg/L	92.6	70.0	130	----
		tin, total	7440-31-5	E420	0.0208 mg/L	0.02 mg/L	104	70.0	130	----
		titanium, total	7440-32-6	E420	0.0428 mg/L	0.04 mg/L	107	70.0	130	----
		uranium, total	7440-61-1	E420	0.00406 mg/L	0.004 mg/L	101	70.0	130	----
		vanadium, total	7440-62-2	E420	0.109 mg/L	0.1 mg/L	109	70.0	130	----
		zinc, total	7440-66-6	E420	0.405 mg/L	0.4 mg/L	101	70.0	130	----
Total Metals (QCLot: 307698)										
CG2104385-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.0415 mg/L	0.04 mg/L	104	70.0	130	----
Dissolved Metals (QCLot: 307270)										
CG2104392-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.400 mg/L	0.4 mg/L	100	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0407 mg/L	0.04 mg/L	102	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0422 mg/L	0.04 mg/L	106	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.04 mg/L	ND	70.0	130	----

Sub-Matrix: **Water**

Matrix Spike (MS) Report

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Spike Concentration	Spike Target	Recovery (%) MS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Dissolved Metals (QCLot: 307270) - continued										
CG2104392-001	Anonymous	beryllium, dissolved	7440-41-7	E421	0.0747 mg/L	0.08 mg/L	93.4	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0177 mg/L	0.02 mg/L	88.4	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.176 mg/L	0.2 mg/L	88.0	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00784 mg/L	0.008 mg/L	98.0	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	8 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0374 mg/L	0.04 mg/L	93.4	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0365 mg/L	0.04 mg/L	91.4	70.0	130	----
		iron, dissolved	7439-89-6	E421	3.82 mg/L	4 mg/L	95.5	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0383 mg/L	0.04 mg/L	95.7	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.199 mg/L	0.2 mg/L	99.4	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	2 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.0402 mg/L	0.04 mg/L	100	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0404 mg/L	0.04 mg/L	101	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0737 mg/L	0.08 mg/L	92.1	70.0	130	----
		potassium, dissolved	7440-09-7	E421	8.06 mg/L	8 mg/L	101	70.0	130	----
		selenium, dissolved	7782-49-2	E421	ND mg/L	0.08 mg/L	ND	70.0	130	----
		silicon, dissolved	7440-21-3	E421	19.1 mg/L	20 mg/L	95.5	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00727 mg/L	0.008 mg/L	90.9	70.0	130	----
		sodium, dissolved	17341-25-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.04 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00747 mg/L	0.008 mg/L	93.4	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0396 mg/L	0.04 mg/L	98.9	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0803 mg/L	0.08 mg/L	100	70.0	130	----
		uranium, dissolved	7440-61-1	E421	ND mg/L	0.008 mg/L	ND	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.206 mg/L	0.2 mg/L	103	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.701 mg/L	0.8 mg/L	87.6	70.0	130	----
Dissolved Metals (QCLot: 307271)										
CG2104392-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.0370 mg/L	0.04 mg/L	92.5	70.0	130	----
Dissolved Metals (QCLot: 307895)										
CG2104374-009	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000947 mg/L	0.0001 mg/L	94.7	70.0	130	----

Teck

COC ID:	September GGCAMP 2021	TURNAROUND TIME:	

PROJECT/CLIENT INFO

Facility Name / Job#	REP
Project Manager	Allie Ferguson
Email	allie.ferguson@teck.com
Address	421 Pine Avenue
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	250-425-8202

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	1 403 407 1794

	Excel	PDF	EDD
allie.ferguson@teck.com	x	x	x
teckcoal@equisonline.com			x
tbowron@minnow.ca	x	x	x
monica.barcha@teck.com	x	x	x
[illegible]@minnow.ca	x	x	x

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	TECKCOAL-ROUTINE-VA	ALS_Package-DOC	ALS_Package-TKN/TOC	HG-T-U-CVAF-VA	HG-D-CVAF-VA	TECKCOAL-MET-T-VA	TECKCOAL-MET-D-VA
Filtered								N	F	N	N	F	N	F
Preservative									H2SO4	H2SO4		HCL	HNO3	HNO3
RG_GHP_WS_GGCAMP_2021-09-23_NP	RG_GHP	WS	No	9/23/2021	930	G	7	X	X	X	X	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

ALS PO 750546

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Jennifer Ings/Minnow	################	[signature]	9/24 8:[illegible]

NO OF BOTTLES RETURNED/DESCRIPTION

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	Jennifer Ings	Mobile #	519-500-3444
Sampler's Signature	[signature]	Date/Time	September 23, 2021

5

Environmental Division
Calgary
Work Order Reference
CG2104395

Telephone : +1 403 407 1800

Teck Coal Ltd.
ATTN: Allie Ferguson
421 Pine Avenue
Sparwood BC V0B 2G0

Date Received: 19-FEB-21
Report Date: 27-FEB-21 12:18 (MT)
Version: FINAL

Client Phone: 250-425-8202

Certificate of Analysis

Lab Work Order #: L2559277

Project P.O. #: VPO00689999
Job Reference: REGIONAL EFFECTS PROGRAM
C of C Numbers: GHO CALCITE FEB 2021
Legal Site Desc:

Lyudmyla Shvets, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2559277-1	L2559277-2	L2559277-3	L2559277-4	L2559277-5
	Description	WS	WS	WS	WS	WS
	Sampled Date	17-FEB-21	18-FEB-21	18-FEB-21	18-FEB-21	18-FEB-21
	Sampled Time	10:00	14:00	14:00	14:00	14:00
	Client ID	RG_GHUT_WS_CALCITE_GHO_2021-02_NP	RG_GHBP_WS_LAEMP_GHO_2021-21_NP	RG_RIVER_WS_LAEMP_GHO_2021-21_NP	RG_FBLANK_WS_LAEMP_GHO_2021-21_NP	RG_TRIP_WS_LAEMP_GHO_2021-21_NP
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (@ 25C) (uS/cm)	2380	1690	1700	<2.0	<2.0
	Hardness (as CaCO3) (mg/L)	1800	1180	1170	<0.50	
	pH (pH)	8.12	8.22	8.21	5.59	5.62
	ORP (mV)	316	311	314	391	434
	Total Suspended Solids (mg/L)	15.6	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	2310 DLHC	1540 DLHC	1560 DLHC	<10	<10
	Turbidity (NTU)	3.78	0.24	0.20	<0.10	<0.10
Anions and Nutrients	Acidity (as CaCO3) (mg/L)	9.2	1.6	1.6	1.1	<1.0
	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	487	294	293	<1.0	<1.0
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	487	294	293	<1.0	<1.0
	Ammonia as N (mg/L)	<0.0050	0.0227	0.0268	0.0064 RRV	<0.0050
	Bromide (Br) (mg/L)	<0.25 DLHC	<0.25 DLHC	<0.25 DLHC	<0.050	<0.050
	Chloride (Cl) (mg/L)	1.70 DLHC	1.88 DLHC	2.60 DLHC	<0.10	<0.10
	Fluoride (F) (mg/L)	<0.10 DLHC	0.16 DLHC	0.16 DLHC	<0.020	<0.020
	Ion Balance (%)	95.2	94.0	94.1	0.0	0.0
	Nitrate (as N) (mg/L)	10.5 DLHC	5.87 DLHC	5.83 DLHC	<0.0050	<0.0050
	Nitrite (as N) (mg/L)	<0.0050 DLHC	0.0064 DLHC	0.0080 DLHC	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	<0.25	<0.25	<0.050	<0.050	<0.050
	Orthophosphate-Dissolved (as P) (mg/L)	0.0076	0.0037	0.0045	<0.0010	<0.0010
	Phosphorus (P)-Total (mg/L)	0.0070	0.0034	0.0052	<0.0020	<0.0020
	Sulfate (SO4) (mg/L)	1320 DLHC	910 DLHC	898 DLHC	<0.30	<0.30
	Anion Sum (meq/L)	37.9	25.3	25.1	<0.10	<0.10
	Cation Sum (meq/L)	36.1	23.8	23.6	<0.10	<0.10
	Cation - Anion Balance (%)	-2.5	-3.1	-3.0	0.0	0.0
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.20	1.51	1.58	<0.50	
	Total Organic Carbon (mg/L)	1.27	1.43	1.58	<0.50	<0.50
Total Metals	Aluminum (Al)-Total (mg/L)	0.0061	<0.0030	<0.0030	<0.0030	<0.0030
	Antimony (Sb)-Total (mg/L)	0.00087	0.00047	0.00047	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00038	0.00028	0.00031	<0.00010	<0.00010
	Barium (Ba)-Total (mg/L)	0.0270	0.0525	0.0493	<0.00010	<0.00010
	Beryllium (Be)-Total (ug/L)	<0.040 DLA	<0.020	<0.020	<0.020	<0.020
	Bismuth (Bi)-Total (mg/L)	<0.00010 DLA	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.020 DLA	0.010	0.013	<0.010	<0.010
	Cadmium (Cd)-Total (ug/L)	0.549	0.0098	0.0099	<0.0050	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2559277-1	L2559277-2	L2559277-3	L2559277-4	L2559277-5
	Description	WS	WS	WS	WS	WS
	Sampled Date	17-FEB-21	18-FEB-21	18-FEB-21	18-FEB-21	18-FEB-21
	Sampled Time	10:00	14:00	14:00	14:00	14:00
	Client ID	RG_GHUT_WS_CALCITE_GHO_2021-02_NP	RG_GHBP_WS_LAEMP_GHO_2021-21_NP	RG_RIVER_WS_LAEMP_GHO_2021-21_NP	RG_FBLANK_WS_LAEMP_GHO_2021-21_NP	RG_TRIP_WS_LAEMP_GHO_2021-21_NP
Grouping	**Analyte**					
WATER						
Total Metals	Calcium (Ca)-Total (mg/L)	399	224	231	<0.050	<0.050
	Chromium (Cr)-Total (mg/L)	<0.00020 DLA	0.00010	0.00011	<0.00010	<0.00010
	Cobalt (Co)-Total (ug/L)	<0.20 DLA	<0.10	<0.10	<0.10	<0.10
	Copper (Cu)-Total (mg/L)	<0.0010 DLA	<0.00050	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	<0.020 DLA	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Total (mg/L)	<0.00010 DLA	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	0.0198	0.0166	0.0171	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	251	175	176	<0.10	<0.10
	Manganese (Mn)-Total (mg/L)	0.0141	0.00172	0.00180	<0.00010	<0.00010
	Mercury (Hg)-Total (ug/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Molybdenum (Mo)-Total (mg/L)	0.00227	0.00403	0.00399	<0.000050	<0.000050
	Nickel (Ni)-Total (mg/L)	0.0366	0.0106	0.0106	<0.00050	<0.00050
	Potassium (K)-Total (mg/L)	3.08	2.45	2.50	<0.050	<0.050
	Selenium (Se)-Total (ug/L)	297	177	180	<0.050	<0.050
	Silicon (Si)-Total (mg/L)	3.38	4.14	4.27	<0.10	<0.10
	Silver (Ag)-Total (mg/L)	<0.000020 DLA	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	2.04	3.02	2.94	<0.050	<0.050
	Strontium (Sr)-Total (mg/L)	0.211	0.230	0.236	<0.00020	<0.00020
	Sulfur (S)-Total (mg/L)	487	325	332	<0.50	<0.50
	Thallium (Tl)-Total (mg/L)	0.000023	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00020 DLA	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.0146	0.00924	0.00913	<0.000010	<0.000010
	Vanadium (V)-Total (mg/L)	<0.0010 DLA	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	0.0380	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	LAB
	Aluminum (Al)-Dissolved (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	
	Antimony (Sb)-Dissolved (mg/L)	0.00076	0.00043	0.00045	<0.00010	
	Arsenic (As)-Dissolved (mg/L)	0.00024	0.00019	0.00019	<0.00010	
	Barium (Ba)-Dissolved (mg/L)	0.0249	0.0471	0.0477	<0.00010	
	Beryllium (Be)-Dissolved (ug/L)	<0.040 DLA	<0.020	<0.020	<0.020	
	Bismuth (Bi)-Dissolved (mg/L)	<0.00010 DLA	<0.000050	<0.000050	<0.000050	
	Boron (B)-Dissolved (mg/L)	<0.020 DLA	0.010	<0.010	<0.010	
	Cadmium (Cd)-Dissolved (ug/L)	0.463	0.0089	0.0089	<0.0050	
	Calcium (Ca)-Dissolved (mg/L)	329	202	203	<0.050	<0.050
	Chromium (Cr)-Dissolved (mg/L)	<0.00020 DLA	0.00010	<0.00010	<0.00010	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2559277-1	L2559277-2	L2559277-3	L2559277-4	L2559277-5
	Description	WS	WS	WS	WS	WS
	Sampled Date	17-FEB-21	18-FEB-21	18-FEB-21	18-FEB-21	18-FEB-21
	Sampled Time	10:00	14:00	14:00	14:00	14:00
	Client ID	RG_GHUT_WS_CALCITE_GHO_2021-02_NP	RG_GHBP_WS_LAEMP_GHO_2021-21_NP	RG_RIVER_WS_LAEMP_GHO_2021-21_NP	RG_FBLANK_WS_LAEMP_GHO_2021-21_NP	RG_TRIP_WS_LAEMP_GHO_2021-21_NP
Grouping	**Analyte**					
WATER						
Dissolved Metals	Cobalt (Co)-Dissolved (ug/L)	DLA <0.20	<0.10	<0.10	<0.10	
	Copper (Cu)-Dissolved (mg/L)	DLA <0.00040	<0.00020	<0.00020	<0.00020	
	Iron (Fe)-Dissolved (mg/L)	DLA <0.020	<0.010	<0.010	<0.010	
	Lead (Pb)-Dissolved (mg/L)	DLA <0.00010	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Dissolved (mg/L)	0.0179	0.0172	0.0167	<0.0010	
	Magnesium (Mg)-Dissolved (mg/L)	237	164	161	<0.10	<0.0050
	Manganese (Mn)-Dissolved (mg/L)	0.0126	0.00081	0.00084	<0.00010	
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	
	Molybdenum (Mo)-Dissolved (mg/L)	0.00190	0.00386	0.00392	<0.000050	
	Nickel (Ni)-Dissolved (mg/L)	0.0337	0.00991	0.00988	<0.00050	
	Potassium (K)-Dissolved (mg/L)	2.98	2.53	2.49	<0.050	<0.050
	Selenium (Se)-Dissolved (ug/L)	293	167	180	<0.050	
	Silicon (Si)-Dissolved (mg/L)	3.20	3.99	4.04	<0.050	
	Silver (Ag)-Dissolved (mg/L)	DLA <0.000020	<0.000010	<0.000010	<0.000010	
	Sodium (Na)-Dissolved (mg/L)	1.97	3.08	3.03	<0.050	<0.050
	Strontium (Sr)-Dissolved (mg/L)	0.183	0.223	0.228	<0.00020	
	Sulfur (S)-Dissolved (mg/L)	457	305	313	<0.50	
	Thallium (Tl)-Dissolved (mg/L)	DLA <0.000020	<0.000010	<0.000010	<0.000010	
	Tin (Sn)-Dissolved (mg/L)	DLA <0.00020	<0.00010	<0.00010	<0.00010	
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	
	Uranium (U)-Dissolved (mg/L)	0.0123	0.00785	0.00802	<0.000010	
	Vanadium (V)-Dissolved (mg/L)	DLA <0.0010	<0.00050	<0.00050	<0.00050	
	Zinc (Zn)-Dissolved (mg/L)	0.0366	<0.0010	0.0012	<0.0010	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2559277-2, -3, -4
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2559277-1
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2559277-2, -3, -4
Matrix Spike	Cobalt (Co)-Dissolved	MS-B	L2559277-1
Matrix Spike	Lithium (Li)-Dissolved	MS-B	L2559277-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2559277-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2559277-2, -3, -4
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2559277-1
Matrix Spike	Nickel (Ni)-Dissolved	MS-B	L2559277-1
Matrix Spike	Potassium (K)-Dissolved	MS-B	L2559277-1
Matrix Spike	Selenium (Se)-Dissolved	MS-B	L2559277-2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2559277-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2559277-2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2559277-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2559277-2, -3, -4
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L2559277-1
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L2559277-2, -3, -4
Matrix Spike	Uranium (U)-Dissolved	MS-B	L2559277-1
Matrix Spike	Uranium (U)-Dissolved	MS-B	L2559277-2, -3, -4
Matrix Spike	Barium (Ba)-Total	MS-B	L2559277-1, -2, -3, -4, -5
Matrix Spike	Calcium (Ca)-Total	MS-B	L2559277-1, -2, -3, -4, -5
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2559277-1, -2, -3, -4, -5
Matrix Spike	Selenium (Se)-Total	MS-B	L2559277-1, -2, -3, -4, -5
Matrix Spike	Sodium (Na)-Total	MS-B	L2559277-1, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Total	MS-B	L2559277-1, -2, -3, -4, -5
Matrix Spike	Sulfur (S)-Total	MS-B	L2559277-1, -2, -3, -4, -5
Matrix Spike	Uranium (U)-Total	MS-B	L2559277-1, -2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ACIDITY-PCT-CL	Water	Acidity by Automatic Titration	APHA 2310 Acidity

This analysis is carried out using procedures adapted from APHA Method 2310 "Acidity". Acidity is determined by potentiometric titration to a specified endpoint.

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-MAN-CL	Water	Alkalinity (Species) by Manual Titration	APHA 2320 ALKALINITY

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". 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.

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

ALS Test Code	Matrix	Test Description	Method Reference**
BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

ALS Test Code	Matrix	Test Description	Method Reference**
BR-L-IC-N-CL	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Reference Information

C-DIS-ORG-LOW-CL Water Dissolved Organic Carbon APHA 5310 B-Instrumental

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.
TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

C-TOT-ORG-LOW-CL Water Total Organic Carbon APHA 5310 TOTAL ORGANIC CARBON (TOC)

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.
TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

CL-L-IC-N-CL Water Chloride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

EC-L-PCT-CL Water Electrical Conductivity (EC) APHA 2510B

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 25C.

F-IC-N-CL Water Fluoride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-U-CVAF-VA Water Total Mercury in Water by CVAFS (Ultra) EPA 1631 REV. E

This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.

IONBALANCE-BC-CL Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-D-CCMS-CL Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Reference Information

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-L-F-CL Water Ammonia, Total (as N) J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-CL Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-CL Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ORP-CL Water Oxidation redution potential by elect. ASTM D1498

This analysis is carried out in accordance with the procedure described in the "ASTM" method D1498 "Oxidation-Reduction Potential of Water" published by the American Society for Testing and Materials (ASTM). Results are reported as observed oxidation-reduction potential of the platinum metal-reference electrode employed, in mV.

It is recommended that this analysis be conducted in the field.

P-T-L-COL-CL Water Phosphorus (P)-Total APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH-CL Water pH APHA 4500 H-Electrode

pH is determined in the laboratory using a pH electrode. All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

PO4-DO-L-COL-CL Water Orthophosphate-Dissolved (as P) APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SO4-IC-N-CL Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TDS-CL Water Total Dissolved Solids APHA 2540 C

A well-mixed sample is filtered through a glass fibre filter paper. The filtrate is then evaporated to dryness in a pre-weighed vial and dried at 180 – 2 °C. The increase in vial weight represents the total dissolved solids (TDS).

TECKCOAL-IONBAL-CL Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

TKN-L-F-CL Water Total Kjeldahl Nitrogen APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-L-CL Water Total Suspended Solids APHA 2540 D-Gravimetric

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, and by drying the filter at 104 deg. C.

TURBIDITY-CL Water Turbidity APHA 2130 B-Nephelometer

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Reference Information

Chain of Custody Numbers:

GHO CALCITE FEB 2021

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour 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.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: Teck Coal Ltd.
421 Pine Avenue
Sparwood BC V0B 2G0

Contact: Allie Ferguson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ACIDITY-PCT-CL	**Water**							
Batch R5386203								
WG3491809-5 LCS								
Acidity (as CaCO3)			99.5		%		85-115	20-FEB-21
WG3491809-4 MB								
Acidity (as CaCO3)			1.2		mg/L		2	20-FEB-21
ALK-MAN-CL	**Water**							
Batch R5386192								
WG3491803-5 LCS								
Alkalinity, Total (as CaCO3)			102.4		%		85-115	20-FEB-21
WG3491803-4 MB								
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	20-FEB-21
BE-D-L-CCMS-VA	**Water**							
Batch R5384757								
WG3490784-3 DUP		**L2559277-2**						
Beryllium (Be)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	22-FEB-21
WG3490783-2 LCS								
Beryllium (Be)-Dissolved			101.4		%		80-120	22-FEB-21
WG3490784-2 LCS								
Beryllium (Be)-Dissolved			104.5		%		80-120	22-FEB-21
WG3490783-1 MB		**NP**						
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	22-FEB-21
WG3490784-1 MB		**NP**						
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	22-FEB-21
WG3490784-4 MS		**L2559277-3**						
Beryllium (Be)-Dissolved			98.3		%		70-130	22-FEB-21
BE-T-L-CCMS-VA	**Water**							
Batch R5385392								
WG3490785-2 LCS								
Beryllium (Be)-Total			106.4		%		80-120	22-FEB-21
WG3490785-1 MB								
Beryllium (Be)-Total			<0.000020		mg/L		0.00002	22-FEB-21
BR-L-IC-N-CL	**Water**							
Batch R5386321								
WG3491822-3 DUP		**L2559277-5**						
Bromide (Br)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	19-FEB-21
WG3491822-2 LCS								
Bromide (Br)			98.2		%		85-115	19-FEB-21
WG3491822-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BR-L-IC-N-CL	**Water**							
Batch R5386321								
WG3491822-1 MB								
Bromide (Br)			<0.050		mg/L		0.05	19-FEB-21
WG3491822-4 MS		**L2559277-5**						
Bromide (Br)			98.5		%		75-125	19-FEB-21
C-DIS-ORG-LOW-CL	**Water**							
Batch R5393071								
WG3494285-3 DUP		**L2559277-4**						
Dissolved Organic Carbon		<0.50	<0.50	RPD-NA	mg/L	N/A	20	26-FEB-21
WG3494285-2 LCS								
Dissolved Organic Carbon			85.7		%		80-120	26-FEB-21
WG3494285-1 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	26-FEB-21
WG3494285-4 MS		**L2559277-4**						
Dissolved Organic Carbon			107.0		%		70-130	26-FEB-21
C-TOT-ORG-LOW-CL	**Water**							
Batch R5393071								
WG3494285-3 DUP		**L2559277-4**						
Total Organic Carbon		<0.50	<0.50	RPD-NA	mg/L	N/A	20	26-FEB-21
WG3494285-2 LCS								
Total Organic Carbon			88.9		%		80-120	26-FEB-21
WG3494285-1 MB								
Total Organic Carbon			<0.50		mg/L		0.5	26-FEB-21
WG3494285-4 MS		**L2559277-4**						
Total Organic Carbon			108.3		%		70-130	26-FEB-21
CL-L-IC-N-CL	**Water**							
Batch R5386321								
WG3491822-3 DUP		**L2559277-5**						
Chloride (Cl)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	19-FEB-21
WG3491822-2 LCS								
Chloride (Cl)			99.9		%		85-115	19-FEB-21
WG3491822-1 MB								
Chloride (Cl)			<0.10		mg/L		0.1	19-FEB-21
WG3491822-4 MS		**L2559277-5**						
Chloride (Cl)			102.4		%		75-125	19-FEB-21
EC-L-PCT-CL	**Water**							

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-L-PCT-CL	**Water**							
Batch R5386192								
WG3491803-5 LCS								
Conductivity (@ 25C)			98.1		%		90-110	20-FEB-21
WG3491803-4 MB								
Conductivity (@ 25C)			<2.0		uS/cm		2	20-FEB-21
F-IC-N-CL	**Water**							
Batch R5386321								
WG3491822-3 DUP		**L2559277-5**						
Fluoride (F)		<0.020	<0.020	RPD-NA	mg/L	N/A	20	19-FEB-21
WG3491822-2 LCS								
Fluoride (F)			100.4		%		90-110	19-FEB-21
WG3491822-1 MB								
Fluoride (F)			<0.020		mg/L		0.02	19-FEB-21
WG3491822-4 MS		**L2559277-5**						
Fluoride (F)			102.7		%		75-125	19-FEB-21
HG-D-CVAA-VA	**Water**							
Batch R5387478								
WG3492188-6 LCS								
Mercury (Hg)-Dissolved			99.5		%		80-120	24-FEB-21
WG3492188-5 MB		**NP**						
Mercury (Hg)-Dissolved			<0.0000050		mg/L		0.000005	24-FEB-21
HG-T-U-CVAF-VA	**Water**							
Batch R5387176								
WG3492091-2 LCS								
Mercury (Hg)-Total			92.4		%		80-120	23-FEB-21
WG3492091-1 MB								
Mercury (Hg)-Total			<0.00050		ug/L		0.0005	23-FEB-21
WG3492091-4 MS		**L2559277-5**						
Mercury (Hg)-Total			81.0		%		70-130	23-FEB-21
MET-D-CCMS-CL	**Water**							
Batch R5384647								
WG3491797-3 DUP		**L2559277-5**						
Calcium (Ca)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	22-FEB-21
Magnesium (Mg)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	22-FEB-21
Potassium (K)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	22-FEB-21
Sodium (Na)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	22-FEB-21
WG3491797-2 LCS		**TMRM**						
Calcium (Ca)-Dissolved			91.4		%		80-120	22-FEB-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	**Water**							
Batch R5384647								
WG3491797-2 LCS		**TMRM**						
Magnesium (Mg)-Dissolved			99.1		%		80-120	22-FEB-21
Potassium (K)-Dissolved			95.5		%		80-120	22-FEB-21
Sodium (Na)-Dissolved			93.2		%		80-120	22-FEB-21
WG3491797-1 MB								
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	22-FEB-21
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	22-FEB-21
Potassium (K)-Dissolved			<0.050		mg/L		0.05	22-FEB-21
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	22-FEB-21
WG3491797-4 MS		**L2559277-5**						
Calcium (Ca)-Dissolved			117.9		%		70-130	22-FEB-21
Magnesium (Mg)-Dissolved			117.3		%		70-130	22-FEB-21
Potassium (K)-Dissolved			119.2		%		70-130	22-FEB-21
Sodium (Na)-Dissolved			119.5		%		70-130	22-FEB-21
MET-D-CCMS-VA	**Water**							
Batch R5384757								
WG3490784-3 DUP		**L2559277-2**						
Aluminum (Al)-Dissolved		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	22-FEB-21
Antimony (Sb)-Dissolved		0.00043	0.00043		mg/L	0.9	20	22-FEB-21
Arsenic (As)-Dissolved		0.00019	0.00019		mg/L	1.8	20	22-FEB-21
Barium (Ba)-Dissolved		0.0471	0.0485		mg/L	2.9	20	22-FEB-21
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	22-FEB-21
Boron (B)-Dissolved		0.010	<0.010	RPD-NA	mg/L	N/A	20	22-FEB-21
Cadmium (Cd)-Dissolved		0.0000089	0.0000088		mg/L	1.5	20	22-FEB-21
Calcium (Ca)-Dissolved		202	204		mg/L	1.0	20	22-FEB-21
Chromium (Cr)-Dissolved		0.00010	<0.00010	RPD-NA	mg/L	N/A	20	22-FEB-21
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	22-FEB-21
Copper (Cu)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	22-FEB-21
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	22-FEB-21
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	22-FEB-21
Lithium (Li)-Dissolved		0.0172	0.0168		mg/L	2.2	20	22-FEB-21
Magnesium (Mg)-Dissolved		164	162		mg/L	1.1	20	22-FEB-21
Manganese (Mn)-Dissolved		0.00081	0.00080		mg/L	1.0	20	22-FEB-21
Molybdenum (Mo)-Dissolved		0.00386	0.00374		mg/L	3.2	20	22-FEB-21
Nickel (Ni)-Dissolved		0.00991	0.0100		mg/L	1.1	20	22-FEB-21
Potassium (K)-Dissolved		2.53	2.54		mg/L	0.6	20	22-FEB-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5384757								
WG3490784-3 DUP		**L2559277-2**						
Selenium (Se)-Dissolved		0.167	0.173		mg/L	3.3	20	22-FEB-21
Silicon (Si)-Dissolved		3.99	3.97		mg/L	0.5	20	22-FEB-21
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	22-FEB-21
Sodium (Na)-Dissolved		3.08	3.05		mg/L	0.7	20	22-FEB-21
Strontium (Sr)-Dissolved		0.223	0.223		mg/L	0.0	20	22-FEB-21
Sulfur (S)-Dissolved		305	300		mg/L	1.5	20	22-FEB-21
Thallium (Tl)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	22-FEB-21
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	22-FEB-21
Titanium (Ti)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	22-FEB-21
Uranium (U)-Dissolved		0.00785	0.00798		mg/L	1.6	20	22-FEB-21
Vanadium (V)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	22-FEB-21
Zinc (Zn)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	22-FEB-21
WG3490783-2 LCS								
Aluminum (Al)-Dissolved			104.1		%		80-120	22-FEB-21
Antimony (Sb)-Dissolved			111.0		%		80-120	22-FEB-21
Arsenic (As)-Dissolved			105.4		%		80-120	22-FEB-21
Barium (Ba)-Dissolved			105.6		%		80-120	22-FEB-21
Bismuth (Bi)-Dissolved			103.5		%		80-120	22-FEB-21
Boron (B)-Dissolved			94.5		%		80-120	22-FEB-21
Cadmium (Cd)-Dissolved			103.8		%		80-120	22-FEB-21
Calcium (Ca)-Dissolved			100.6		%		80-120	22-FEB-21
Chromium (Cr)-Dissolved			105.2		%		80-120	22-FEB-21
Cobalt (Co)-Dissolved			105.7		%		80-120	22-FEB-21
Copper (Cu)-Dissolved			102.6		%		80-120	22-FEB-21
Iron (Fe)-Dissolved			102.8		%		80-120	22-FEB-21
Lead (Pb)-Dissolved			106.6		%		80-120	22-FEB-21
Lithium (Li)-Dissolved			96.6		%		80-120	22-FEB-21
Magnesium (Mg)-Dissolved			110.7		%		80-120	22-FEB-21
Manganese (Mn)-Dissolved			104.6		%		80-120	22-FEB-21
Molybdenum (Mo)-Dissolved			103.0		%		80-120	22-FEB-21
Nickel (Ni)-Dissolved			103.5		%		80-120	22-FEB-21
Potassium (K)-Dissolved			102.8		%		80-120	22-FEB-21
Selenium (Se)-Dissolved			105.7		%		80-120	22-FEB-21
Silicon (Si)-Dissolved			104.8		%		60-140	22-FEB-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5384757								
WG3490783-2 LCS								
Silver (Ag)-Dissolved			96.5		%		80-120	22-FEB-21
Sodium (Na)-Dissolved			109.7		%		80-120	22-FEB-21
Strontium (Sr)-Dissolved			113.4		%		80-120	22-FEB-21
Sulfur (S)-Dissolved			103.5		%		80-120	22-FEB-21
Thallium (Tl)-Dissolved			104.4		%		80-120	22-FEB-21
Tin (Sn)-Dissolved			96.9		%		80-120	22-FEB-21
Titanium (Ti)-Dissolved			101.0		%		80-120	22-FEB-21
Uranium (U)-Dissolved			101.7		%		80-120	22-FEB-21
Vanadium (V)-Dissolved			106.0		%		80-120	22-FEB-21
Zinc (Zn)-Dissolved			102.0		%		80-120	22-FEB-21
WG3490784-2 LCS								
Aluminum (Al)-Dissolved			103.2		%		80-120	22-FEB-21
Antimony (Sb)-Dissolved			109.5		%		80-120	22-FEB-21
Arsenic (As)-Dissolved			104.0		%		80-120	22-FEB-21
Barium (Ba)-Dissolved			104.7		%		80-120	22-FEB-21
Bismuth (Bi)-Dissolved			104.3		%		80-120	22-FEB-21
Boron (B)-Dissolved			96.1		%		80-120	22-FEB-21
Cadmium (Cd)-Dissolved			99.4		%		80-120	22-FEB-21
Calcium (Ca)-Dissolved			104.4		%		80-120	22-FEB-21
Chromium (Cr)-Dissolved			105.3		%		80-120	22-FEB-21
Cobalt (Co)-Dissolved			104.5		%		80-120	22-FEB-21
Copper (Cu)-Dissolved			102.0		%		80-120	22-FEB-21
Iron (Fe)-Dissolved			102.0		%		80-120	22-FEB-21
Lead (Pb)-Dissolved			106.7		%		80-120	22-FEB-21
Lithium (Li)-Dissolved			100.9		%		80-120	22-FEB-21
Magnesium (Mg)-Dissolved			109.4		%		80-120	22-FEB-21
Manganese (Mn)-Dissolved			101.2		%		80-120	22-FEB-21
Molybdenum (Mo)-Dissolved			103.5		%		80-120	22-FEB-21
Nickel (Ni)-Dissolved			101.6		%		80-120	22-FEB-21
Potassium (K)-Dissolved			102.1		%		80-120	22-FEB-21
Selenium (Se)-Dissolved			103.6		%		80-120	22-FEB-21
Silicon (Si)-Dissolved			101.7		%		60-140	22-FEB-21
Silver (Ag)-Dissolved			96.7		%		80-120	22-FEB-21
Sodium (Na)-Dissolved			109.7		%		80-120	22-FEB-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5384757								
WG3490784-2 LCS								
Strontium (Sr)-Dissolved			107.5		%		80-120	22-FEB-21
Sulfur (S)-Dissolved			96.1		%		80-120	22-FEB-21
Thallium (Tl)-Dissolved			105.8		%		80-120	22-FEB-21
Tin (Sn)-Dissolved			97.8		%		80-120	22-FEB-21
Titanium (Ti)-Dissolved			101.0		%		80-120	22-FEB-21
Uranium (U)-Dissolved			90.6		%		80-120	22-FEB-21
Vanadium (V)-Dissolved			103.1		%		80-120	22-FEB-21
Zinc (Zn)-Dissolved			101.0		%		80-120	22-FEB-21
WG3490783-1 MB		**NP**						
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	22-FEB-21
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	22-FEB-21
Boron (B)-Dissolved			<0.010		mg/L		0.01	22-FEB-21
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	22-FEB-21
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	22-FEB-21
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	22-FEB-21
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	22-FEB-21
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	22-FEB-21
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	22-FEB-21
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	22-FEB-21
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	22-FEB-21
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	22-FEB-21
Potassium (K)-Dissolved			<0.050		mg/L		0.05	22-FEB-21
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	22-FEB-21
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	22-FEB-21
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	22-FEB-21
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	22-FEB-21
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	22-FEB-21
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	22-FEB-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5384757								
WG3490783-1 MB		**NP**						
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	22-FEB-21
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	22-FEB-21
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	22-FEB-21
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	22-FEB-21
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	22-FEB-21
WG3490784-1 MB		**NP**						
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	22-FEB-21
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	22-FEB-21
Boron (B)-Dissolved			<0.010		mg/L		0.01	22-FEB-21
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	22-FEB-21
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	22-FEB-21
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	22-FEB-21
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	22-FEB-21
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	22-FEB-21
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	22-FEB-21
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	22-FEB-21
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	22-FEB-21
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	22-FEB-21
Potassium (K)-Dissolved			<0.050		mg/L		0.05	22-FEB-21
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	22-FEB-21
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	22-FEB-21
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	22-FEB-21
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	22-FEB-21
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	22-FEB-21
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	22-FEB-21
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	22-FEB-21
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	22-FEB-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5384757								
WG3490784-1 MB		**NP**						
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	22-FEB-21
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	22-FEB-21
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	22-FEB-21
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	22-FEB-21
WG3490784-4 MS		**L2559277-3**						
Aluminum (Al)-Dissolved			101.9		%		70-130	22-FEB-21
Antimony (Sb)-Dissolved			102.0		%		70-130	22-FEB-21
Arsenic (As)-Dissolved			107.3		%		70-130	22-FEB-21
Barium (Ba)-Dissolved			N/A	MS-B	%		-	22-FEB-21
Bismuth (Bi)-Dissolved			82.0		%		70-130	22-FEB-21
Boron (B)-Dissolved			94.1		%		70-130	22-FEB-21
Cadmium (Cd)-Dissolved			95.1		%		70-130	22-FEB-21
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	22-FEB-21
Chromium (Cr)-Dissolved			103.5		%		70-130	22-FEB-21
Cobalt (Co)-Dissolved			95.2		%		70-130	22-FEB-21
Copper (Cu)-Dissolved			93.7		%		70-130	22-FEB-21
Iron (Fe)-Dissolved			99.5		%		70-130	22-FEB-21
Lead (Pb)-Dissolved			92.3		%		70-130	22-FEB-21
Lithium (Li)-Dissolved			97.5		%		70-130	22-FEB-21
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	22-FEB-21
Manganese (Mn)-Dissolved			96.4		%		70-130	22-FEB-21
Molybdenum (Mo)-Dissolved			105.1		%		70-130	22-FEB-21
Nickel (Ni)-Dissolved			93.3		%		70-130	22-FEB-21
Potassium (K)-Dissolved			107.8		%		70-130	22-FEB-21
Selenium (Se)-Dissolved			N/A	MS-B	%		-	22-FEB-21
Silicon (Si)-Dissolved			92.4		%		70-130	22-FEB-21
Silver (Ag)-Dissolved			93.3		%		70-130	22-FEB-21
Sodium (Na)-Dissolved			N/A	MS-B	%		-	22-FEB-21
Strontium (Sr)-Dissolved			N/A	MS-B	%		-	22-FEB-21
Sulfur (S)-Dissolved			N/A	MS-B	%		-	22-FEB-21
Thallium (Tl)-Dissolved			93.0		%		70-130	22-FEB-21
Tin (Sn)-Dissolved			98.7		%		70-130	22-FEB-21
Titanium (Ti)-Dissolved			104.6		%		70-130	22-FEB-21
Uranium (U)-Dissolved			N/A	MS-B	%		-	22-FEB-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-VA	**Water**							
Batch R5384757								
WG3490784-4 MS		**L2559277-3**						
Vanadium (V)-Dissolved			103.4		%		70-130	22-FEB-21
Zinc (Zn)-Dissolved			93.6		%		70-130	22-FEB-21
MET-T-CCMS-VA	**Water**							
Batch R5385392								
WG3490785-2 LCS								
Aluminum (Al)-Total			111.6		%		80-120	22-FEB-21
Antimony (Sb)-Total			111.5		%		80-120	22-FEB-21
Arsenic (As)-Total			111.5		%		80-120	22-FEB-21
Barium (Ba)-Total			112.7		%		80-120	22-FEB-21
Bismuth (Bi)-Total			117.9		%		80-120	22-FEB-21
Boron (B)-Total			100.1		%		80-120	22-FEB-21
Cadmium (Cd)-Total			110.6		%		80-120	22-FEB-21
Calcium (Ca)-Total			112.6		%		80-120	22-FEB-21
Chromium (Cr)-Total			109.8		%		80-120	22-FEB-21
Cobalt (Co)-Total			112.3		%		80-120	22-FEB-21
Copper (Cu)-Total			110.0		%		80-120	22-FEB-21
Iron (Fe)-Total			101.9		%		80-120	22-FEB-21
Lead (Pb)-Total			112.4		%		80-120	22-FEB-21
Lithium (Li)-Total			103.8		%		80-120	22-FEB-21
Magnesium (Mg)-Total			108.5		%		80-120	22-FEB-21
Manganese (Mn)-Total			110.1		%		80-120	22-FEB-21
Molybdenum (Mo)-Total			109.6		%		80-120	22-FEB-21
Nickel (Ni)-Total			109.8		%		80-120	22-FEB-21
Potassium (K)-Total			104.8		%		80-120	22-FEB-21
Selenium (Se)-Total			115.3		%		80-120	22-FEB-21
Silicon (Si)-Total			111.9		%		80-120	22-FEB-21
Silver (Ag)-Total			110.2		%		80-120	22-FEB-21
Sodium (Na)-Total			108.2		%		80-120	22-FEB-21
Strontium (Sr)-Total			112.4		%		80-120	22-FEB-21
Sulfur (S)-Total			107.5		%		80-120	22-FEB-21
Thallium (Tl)-Total			111.5		%		80-120	22-FEB-21
Tin (Sn)-Total			107.2		%		80-120	22-FEB-21
Titanium (Ti)-Total			112.3		%		80-120	22-FEB-21
Uranium (U)-Total			110.3		%		80-120	22-FEB-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R5385392								
WG3490785-2 LCS								
Vanadium (V)-Total			113.6		%		80-120	22-FEB-21
Zinc (Zn)-Total			105.3		%		80-120	22-FEB-21
WG3490785-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	22-FEB-21
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	22-FEB-21
Arsenic (As)-Total			<0.00010		mg/L		0.0001	22-FEB-21
Barium (Ba)-Total			<0.00010		mg/L		0.0001	22-FEB-21
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	22-FEB-21
Boron (B)-Total			<0.010		mg/L		0.01	22-FEB-21
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	22-FEB-21
Calcium (Ca)-Total			<0.050		mg/L		0.05	22-FEB-21
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	22-FEB-21
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	22-FEB-21
Copper (Cu)-Total			<0.00050		mg/L		0.0005	22-FEB-21
Iron (Fe)-Total			<0.010		mg/L		0.01	22-FEB-21
Lead (Pb)-Total			<0.000050		mg/L		0.00005	22-FEB-21
Lithium (Li)-Total			<0.0010		mg/L		0.001	22-FEB-21
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	22-FEB-21
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	22-FEB-21
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	22-FEB-21
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	22-FEB-21
Potassium (K)-Total			<0.050		mg/L		0.05	22-FEB-21
Selenium (Se)-Total			<0.000050		mg/L		0.00005	22-FEB-21
Silicon (Si)-Total			<0.10		mg/L		0.1	22-FEB-21
Silver (Ag)-Total			<0.000010		mg/L		0.00001	22-FEB-21
Sodium (Na)-Total			<0.050		mg/L		0.05	22-FEB-21
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	22-FEB-21
Sulfur (S)-Total			<0.50		mg/L		0.5	22-FEB-21
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	22-FEB-21
Tin (Sn)-Total			<0.00010		mg/L		0.0001	22-FEB-21
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	22-FEB-21
Uranium (U)-Total			<0.000010		mg/L		0.00001	22-FEB-21
Vanadium (V)-Total			<0.00050		mg/L		0.0005	22-FEB-21
Zinc (Zn)-Total			<0.0030		mg/L		0.003	22-FEB-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-L-F-CL	**Water**							
Batch R5386882								
WG3491477-18 LCS								
Ammonia as N			99.5		%		85-115	22-FEB-21
WG3491477-17 MB								
Ammonia as N			<0.0050		mg/L		0.005	22-FEB-21
NO2-L-IC-N-CL	**Water**							
Batch R5386321								
WG3491822-3 DUP		**L2559277-5**						
Nitrite (as N)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	19-FEB-21
WG3491822-2 LCS								
Nitrite (as N)			101.1		%		90-110	19-FEB-21
WG3491822-1 MB								
Nitrite (as N)			<0.0010		mg/L		0.001	19-FEB-21
WG3491822-4 MS		**L2559277-5**						
Nitrite (as N)			105.3		%		75-125	19-FEB-21
NO3-L-IC-N-CL	**Water**							
Batch R5386321								
WG3491822-3 DUP		**L2559277-5**						
Nitrate (as N)		<0.0050	0.0097	RPD-NA	mg/L	N/A	20	19-FEB-21
WG3491822-2 LCS								
Nitrate (as N)			101.3		%		90-110	19-FEB-21
WG3491822-1 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	19-FEB-21
WG3491822-4 MS		**L2559277-5**						
Nitrate (as N)			103.8		%		75-125	19-FEB-21
ORP-CL	**Water**							
Batch R5388780								
WG3492639-9 CRM		**CL-ORP**						
ORP			225		mV		210-230	24-FEB-21
P-T-L-COL-CL	**Water**							
Batch R5386117								
WG3491736-6 LCS								
Phosphorus (P)-Total			87.6		%		80-120	23-FEB-21
WG3491736-5 MB								
Phosphorus (P)-Total			<0.0020		mg/L		0.002	23-FEB-21
PH-CL	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-CL	**Water**							
Batch R5386192								
WG3491803-5 LCS								
pH			7.02		pH		6.9-7.1	20-FEB-21
PO4-DO-L-COL-CL	**Water**							
Batch R5382596								
WG3490429-6 LCS								
Orthophosphate-Dissolved (as P)			92.7		%		80-120	19-FEB-21
WG3490429-5 MB								
Orthophosphate-Dissolved (as P)			<0.0010		mg/L		0.001	19-FEB-21
SO4-IC-N-CL	**Water**							
Batch R5386321								
WG3491822-3 DUP		**L2559277-5**						
Sulfate (SO4)		<0.30	<0.30	RPD-NA	mg/L	N/A	20	19-FEB-21
WG3491822-2 LCS								
Sulfate (SO4)			109.4		%		90-110	19-FEB-21
WG3491822-1 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	19-FEB-21
WG3491822-4 MS		**L2559277-5**						
Sulfate (SO4)			112.2		%		75-125	19-FEB-21
SOLIDS-TDS-CL	**Water**							
Batch R5386017								
WG3491102-6 DUP		**L2559277-2**						
Total Dissolved Solids		1540	1590		mg/L	3.5	20	22-FEB-21
WG3491102-11 LCS								
Total Dissolved Solids			102.0		%		85-115	22-FEB-21
WG3491102-5 LCS								
Total Dissolved Solids			96.0		%		85-115	22-FEB-21
WG3491102-8 LCS								
Total Dissolved Solids			100.5		%		85-115	22-FEB-21
WG3491102-10 MB								
Total Dissolved Solids			<10		mg/L		10	22-FEB-21
WG3491102-4 MB								
Total Dissolved Solids			<10		mg/L		10	22-FEB-21
WG3491102-7 MB								
Total Dissolved Solids			<10		mg/L		10	22-FEB-21
TKN-L-F-CL	**Water**							

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-L-F-CL	**Water**							
Batch R5390882								
WG3492958-2 LCS								
Total Kjeldahl Nitrogen			90.0		%		75-125	25-FEB-21
WG3492958-6 LCS								
Total Kjeldahl Nitrogen			90.0		%		75-125	25-FEB-21
WG3492958-1 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	25-FEB-21
WG3492958-5 MB								
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	25-FEB-21
TSS-L-CL	**Water**							
Batch R5385736								
WG3491101-6 LCS								
Total Suspended Solids			104.6		%		85-115	22-FEB-21
WG3491101-5 MB								
Total Suspended Solids			<1.0		mg/L		1	22-FEB-21
TURBIDITY-CL	**Water**							
Batch R5382598								
WG3490586-5 LCS								
Turbidity			103.0		%		85-115	19-FEB-21
WG3490586-4 MB								
Turbidity			<0.10		NTU		0.1	19-FEB-21

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Oxidation redution potential by elect.							
	1	17-FEB-21 10:00	24-FEB-21 11:30	0.25	169	hours	EHTR-FM
	2	18-FEB-21 14:00	24-FEB-21 11:30	0.25	142	hours	EHTR-FM
	3	18-FEB-21 14:00	24-FEB-21 11:30	0.25	142	hours	EHTR-FM
	4	18-FEB-21 14:00	24-FEB-21 11:30	0.25	142	hours	EHTR-FM
	5	18-FEB-21 14:00	24-FEB-21 11:30	0.25	142	hours	EHTR-FM
pH							
	1	17-FEB-21 10:00	20-FEB-21 12:00	0.25	74	hours	EHTR-FM
	2	18-FEB-21 14:00	20-FEB-21 12:00	0.25	46	hours	EHTR-FM
	3	18-FEB-21 14:00	20-FEB-21 12:00	0.25	46	hours	EHTR-FM
	4	18-FEB-21 14:00	20-FEB-21 12:00	0.25	46	hours	EHTR-FM
	5	18-FEB-21 14:00	20-FEB-21 12:00	0.25	46	hours	EHTR-FM

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.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2559277 were received on 19-FEB-21 09:30.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes 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 pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Teck

COC ID:	GHO CALCITE FEB 2020	TURNAROUND TIME:	

PROJECT/CLIENT INFO

Facility Name	REP		
Project Manager	Allie Ferguson		
Email	allie.ferguson@teck.com		
Address	421 Pine Avenue		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	250-425-8202		

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	1 403 407 1794		

	Excel	PDF	EDD
[illegible]	x	x	x
teckcoal@equisonline.com			x
[illegible]@minnow.ca	x	x	x
carlie.meyer@teck.com	x	x	x
[illegible]	x	x	x

SAMPLE DETAILS

L2559277-COFC

ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	TECKCOAL-ROUTINE-VA	ALS_Package-DOC	ALS_Package-TKN/TOC	HG-T-U-CVAF-VA	HG-D-CVAF-VA	TECKCOAL-MET-T-VA	TECKCOAL-MET-D-VA				
FILTERED								N	F	N	N	F	N	F				
PRESERVED									H2SO4	H2SO4		HCL	HNO3	HNO3				
RG_GHUT_WS_CALCITE_GHO_2021-02_NP	RG_GHUT	WS	No	2/17/2021	10:00	G	7	1	1	1	1	1	1	1				
RG_GHBP_WS_LAEMP_GHO_2021-21_NP	RG_GHBP	WS	No	2/18/2021	14:00	G	7	1	1	1	1	1	1	1				
RG_RIVER_WS_LAEMP_GHO_2021-21_NP	RG_RIVER	WS	No	2/18/2021	14:00	G	7	1	1	1	1	1	1	1				
RG_FBLANK_WS_LAEMP_GHO_2021-21_NP	RG_FBLANK	WS	No	2/18/2021	14:00	G	7	1	1	1	1	1	1	1				
RG_TRIP_WS_LAEMP_GHO_2021-21_NP	RG_TRIP (Lab pre-filled)	WS	No	2/18/2021	14:00	G	4	1		1	1		1					

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	
			ZH	19/02 9:30

NB OF BOTTLES RETURNED/DESCRIPTION

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 #	647-522-0672
Sampler's Signature		Date/Time	18-Feb-2021 / 15:30

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 24, 2021

Teck Resources Limited - Vancouver
Allie Ferguson
421 Pine Avenue
Sparwood, B.C. CANADA V0B2G0
allie.ferguson@teck.com

Re: REP

Dear Allie Ferguson,

On March 11, 2021, Brooks Applied Labs (BAL) received six (6) aqueous samples.

A hard copy chain-of-custody (COC) form describing the samples in this work order was not received with the sample shipment. The client was contacted and later provided a COC form via email. This is the COC form that was used for this work order.

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 logged in for Se speciation and dissolved Se had been field-filtered prior to receipt at BAL; sample fractions for total recoverable and dissolved Se had also been preserved by the client prior to receipt. 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.

Se Speciation
Each aqueous sample was analyzed for Se 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, Se 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 Se species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting Se 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 method detection limits (MDLs), MRLs, and other details.

In instances when 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 RPD of the MS/MSD set was not calculated (**N/C**).

All data were reported without qualification, aside from concentration qualifiers. Except for items noted above, 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 met 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
Brooks Applied Labs
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 27, 2020; Valid to: June 30, 2021
Certificate Number: E87982-35

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	Ag, As, 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-4200	Non-Potable Waters	Se(IV), Se(VI)
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), and DoD/DOE (3)

Issued by: ANAB

Issued on: November 20, 2020; Valid to: March 20, 2022

Method	Matrix	ISO and Non-Gov. TNI Accredited Analyte(s)	DoD/DOE Accredited Analytes
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	Ag, Al, As, Ba, Ca, Cd, Cr, Cu, Fe, Pb, Mg, Mn, Ni, Sb, Se, 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)	Not Accredited
EPA 1640 Mod	Non-Potable Waters	Ag, As, Cd, Cu, Pb, Ni, Zn Cr, Co, Se, Tl, V (ISO Only)	Not Accredited
EPA 1631E Mod BAL-3100 (waters)	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury	Methyl Mercury (excluding Solids/Chemicals)
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic, As(III) (ISO Only)	Not Accredited
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)	Not Accredited
AOAC 2015.01 Mod BAL-5000 by BAL-5040	Food	As, Cd, Hg, Pb	Not Accredited
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs	Not Accredited
	Biological by BAL-4115	Inorganic Arsenic, DMAs, MMAs (ISO Only)	Not Accredited
BAL-4101	Food by BAL-4116	Inorganic Arsenic, DMAs, MMAs (ISO Only)	Not Accredited
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet	Not Accredited
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)	Not Accredited
SM2340B	Non-Potable Waters	Hardness	Hardness
SM 2540G EPA 160.3 BAL-0501	Solids/Chemicals & Biological	% Dry Weight	% Dry Weight

(1) ISO/IEC 17025:2017 – Certificate Number ADE-1447.2

(2) Non-Governmental NELAC Institute 2016 Standard – Certificate Number ADE-1447.1

(3) Department of Defense/Energy Consolidated Quality Systems Manual v. 5.3 – Certificate Numbers ADE-1447 for DoD, ADE-1447.3 for DOE.

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
RG_GHUT_WS_CALCITE_2021_02_NP	2103140-01	WS	Sample	02/17/2021	03/11/2021
RG_GHUT_WS_CALCITE_2021_02_NP_NAL	2103140-02	WS	Sample	02/17/2021	03/11/2021
RG_GHUT_WS_CALCITE_2021_02_NP_NAL	2103140-03	WS	Sample	02/17/2021	03/11/2021
RG_GHBP_WS_CALCITE_2021_02_NP	2103140-04	WS	Sample	02/18/2021	03/11/2021
RG_GHBP_WS_CALCITE_2021_02_NP_NAL	2103140-05	WS	Sample	02/18/2021	03/11/2021
RG_GHBP_WS_CALCITE_2021_02_NP_NAL	2103140-06	WS	Sample	02/18/2021	03/11/2021
RG_RIVER_WS_CALCITE_2021_02_NP	2103140-07	WS	Sample	02/18/2021	03/11/2021
RG_RIVER_WS_CALCITE_2021_02_NP_NAL	2103140-08	WS	Sample	02/18/2021	03/11/2021
RG_RIVER_WS_CALCITE_2021_02_NP_NAL	2103140-09	WS	Sample	02/18/2021	03/11/2021

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201	03/10/2021	03/13/2021	B210611	S210275
MeSe(IV)	Water	SOP BAL-4201	03/10/2021	03/13/2021	B210611	S210275
MeSe(VI)	Water	SOP BAL-4201	03/10/2021	03/13/2021	B210611	S210275
Se	Water	EPA 1638 Mod	03/15/2021	03/17/2021	B210649	S210298
Se(IV)	Water	SOP BAL-4201	03/10/2021	03/13/2021	B210611	S210275
Se(VI)	Water	SOP BAL-4201	03/10/2021	03/13/2021	B210611	S210275
SeCN	Water	SOP BAL-4201	03/10/2021	03/13/2021	B210611	S210275
SeMet	Water	SOP BAL-4201	03/10/2021	03/13/2021	B210611	S210275
SeSO3	Water	SOP BAL-4201	03/10/2021	03/13/2021	B210611	S210275
Unk Se Sp	Water	SOP BAL-4201	03/10/2021	03/13/2021	B210611	S210275

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_GHUT_WS_CALCITE_2021_02_NP										
2103140-01	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210611	S210275
2103140-01	MeSe(IV)	WS	D	0.013	J	0.010	0.025	µg/L	B210611	S210275
2103140-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210611	S210275
2103140-01	Se(IV)	WS	D	0.373		0.010	0.075	µg/L	B210611	S210275
2103140-01	Se(VI)	WS	D	238		0.010	0.055	µg/L	B210611	S210275
2103140-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B210611	S210275
2103140-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210611	S210275
2103140-01	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B210611	S210275
2103140-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B210611	S210275
RG_GHUT_WS_CALCITE_2021_02_NP_NAL										
2103140-02	Se	WS	TR	251		0.132	0.528	µg/L	B210649	S210298
RG_GHUT_WS_CALCITE_2021_02_NP_NAL										
2103140-03	Se	WS	D	254		0.132	0.528	µg/L	B210649	S210298
RG_GHBP_WS_CALCITE_2021_02_NP										
2103140-04	DMSeO	WS	D	0.066		0.010	0.025	µg/L	B210611	S210275
2103140-04	MeSe(IV)	WS	D	0.032		0.010	0.025	µg/L	B210611	S210275
2103140-04	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210611	S210275
2103140-04	Se(IV)	WS	D	1.46		0.010	0.075	µg/L	B210611	S210275
2103140-04	Se(VI)	WS	D	120		0.010	0.055	µg/L	B210611	S210275
2103140-04	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B210611	S210275
2103140-04	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210611	S210275
2103140-04	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B210611	S210275
2103140-04	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B210611	S210275
RG_GHBP_WS_CALCITE_2021_02_NP_NAL										
2103140-05	Se	WS	TR	142		0.132	0.528	µg/L	B210649	S210298
RG_GHBP_WS_CALCITE_2021_02_NP_NAL										
2103140-06	Se	WS	D	148		0.132	0.528	µg/L	B210649	S210298

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_RIVER_WS_CALCITE_2021_02_NP										
2103140-07	DMSeO	WS	D	0.068		0.010	0.025	µg/L	B210611	S210275
2103140-07	MeSe(IV)	WS	D	0.034		0.010	0.025	µg/L	B210611	S210275
2103140-07	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210611	S210275
2103140-07	Se(IV)	WS	D	1.64		0.010	0.075	µg/L	B210611	S210275
2103140-07	Se(VI)	WS	D	131		0.010	0.055	µg/L	B210611	S210275
2103140-07	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B210611	S210275
2103140-07	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B210611	S210275
2103140-07	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B210611	S210275
2103140-07	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B210611	S210275
RG_RIVER_WS_CALCITE_2021_02_NP_NAL										
2103140-08	Se	WS	TR	146		0.132	0.528	µg/L	B210649	S210298
RG_RIVER_WS_CALCITE_2021_02_NP_NAL										
2103140-09	Se	WS	D	149		0.132	0.528	µg/L	B210649	S210298

Accuracy & Precision Summary

Batch: B210611
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC	REC Limits	RPD	RPD Limits
B210611-BS1	**Blank Spike, (1923027)**								
	MeSe(IV)		5.095	4.920	µg/L	97%	75-125		
	Se(IV)		5.000	4.968	µg/L	99%	75-125		
	Se(VI)		5.000	4.752	µg/L	95%	75-125		
	SeCN		5.015	4.798	µg/L	96%	75-125		
	SeMet		4.932	4.340	µg/L	88%	75-125		
B210611-DUP6	**Duplicate, (2103140-07)**								
	DMSeO	0.068		0.058	µg/L			17%	25
	MeSe(IV)	0.034		0.033	µg/L			3%	25
	MeSe(VI)	ND		ND	µg/L			N/C	25
	Se(IV)	1.641		1.704	µg/L			4%	25
	Se(VI)	131.3		134.7	µg/L			3%	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
B210611-MS6	**Matrix Spike, (2103140-07)**								
	Se(IV)	1.641	4.900	6.345	µg/L	96%	75-125		
	Se(VI)	131.3	5.100	140.3	µg/L	NR	75-125		
	SeCN	ND	1.962	1.904	µg/L	97%	75-125		
	SeMet	ND	1.977	1.898	µg/L	96%	75-125		
B210611-MSD6	**Matrix Spike Duplicate, (2103140-07)**								
	Se(IV)	1.641	4.900	6.364	µg/L	96%	75-125	0.3%	25
	Se(VI)	131.3	5.100	139.6	µg/L	NR	75-125	N/C	25
	SeCN	ND	1.962	1.904	µg/L	97%	75-125	0.02%	25
	SeMet	ND	1.977	1.888	µg/L	95%	75-125	0.5%	25

Accuracy & Precision Summary

Batch: B210649
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B210649-BS1	**Blank Spike, (2035013)**								
	Se		200.0	186.2	µg/L	93%	75-125		
B210649-BS2	**Blank Spike, (2035013)**								
	Se		200.0	188.2	µg/L	94%	75-125		
B210649-BS3	**Blank Spike, (2035013)**								
	Se		200.0	186.3	µg/L	93%	75-125		
B210649-SRM1	**Reference Material (2041019, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**								
	Se		14.30	13.65	µg/L	95%	75-125		
B210649-SRM2	**Reference Material (2041019, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**								
	Se		14.30	12.77	µg/L	89%	75-125		
B210649-SRM3	**Reference Material (2041019, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**								
	Se		14.30	12.72	µg/L	89%	75-125		
B210649-DUP6	**Duplicate, (2103140-02)**								
	Se	250.6		247.9	µg/L			1%	20
B210649-MS6	**Matrix Spike, (2103140-02)**								
	Se	250.6	220.0	462.4	µg/L	96%	75-125		
B210649-MSD6	**Matrix Spike Duplicate, (2103140-02)**								
	Se	250.6	220.0	472.5	µg/L	101%	75-125	2%	20

Method Blanks & Reporting Limits

Batch: B210611
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B210611-BLK1	0.00	µg/L
B210611-BLK2	0.00	µg/L
B210611-BLK3	0.00	µg/L
B210611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B210611-BLK1	0.00	µg/L
B210611-BLK2	0.00	µg/L
B210611-BLK3	0.00	µg/L
B210611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B210611-BLK1	0.00	µg/L
B210611-BLK2	0.00	µg/L
B210611-BLK3	0.00	µg/L
B210611-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
B210611-BLK1	0.00	µg/L
B210611-BLK2	0.00	µg/L
B210611-BLK3	0.00	µg/L
B210611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B210611-BLK1	0.00	µg/L
B210611-BLK2	0.00	µg/L
B210611-BLK3	0.00	µg/L
B210611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B210611-BLK1	0.00	µg/L
B210611-BLK2	0.00	µg/L
B210611-BLK3	0.00	µg/L
B210611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B210611-BLK1	0.00	µg/L
B210611-BLK2	0.00	µg/L
B210611-BLK3	0.00	µg/L
B210611-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

18804 North Creek Parkway, Suite 100, Bothell, WA 98011 · P(206) 632-6206 · F(206) 632-6017 · info@brooksapplied.com · www.brooksapplied.com

Method Blanks & Reporting Limits

Analyte: SeSO3

Sample	Result	Units		
B210611-BLK1	0.00	µg/L		
B210611-BLK2	0.00	µg/L		
B210611-BLK3	0.00	µg/L		
B210611-BLK4	0.00	µg/L		
	Average: 0.000		**MDL:**	0.002
	Limit: 0.011		**MRL:**	0.011

Analyte: Unk Se Sp

Sample	Result	Units		
B210611-BLK1	0.00	µg/L		
B210611-BLK2	0.00	µg/L		
B210611-BLK3	0.00	µg/L		
B210611-BLK4	0.00	µg/L		
	Average: 0.000		**MDL:**	0.002
	Limit: 0.015		**MRL:**	0.015

Method Blanks & Reporting Limits

Batch: B210649
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B210649-BLK1	0.070	µg/L
B210649-BLK2	-0.0006	µg/L
B210649-BLK3	0.011	µg/L
B210649-BLK4	0.014	µg/L
Average:	0.024	
Limit:	0.480	

MDL: 0.120
MRL: 0.480

Sample Containers

Lab ID: 2103140-01
Sample: RG_GHUT_WS_CALCITE_2021_02_NP
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/17/2021
Received: 03/11/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Styrofoam Cooler #4 - 2103140
B	XTRA_VOL	15 mL	na	none	na	na	Styrofoam Cooler #4 - 2103140
C	XTRA_VOL	120 mL	na	none	na	na	Styrofoam Cooler #4 - 2103140

Lab ID: 2103140-02
Sample: RG_GHUT_WS_CALCITE_2021_02_NP_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/17/2021
Received: 03/11/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	120 mL	na	10% HNO3 (BAL)	2037003	<2	Styrofoam Cooler #3 - 2103140

Lab ID: 2103140-03
Sample: RG_GHUT_WS_CALCITE_2021_02_NP_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/17/2021
Received: 03/11/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	120 mL	na	10% HNO3 (BAL)	2037003	<2	Styrofoam Cooler #3 - 2103140

Lab ID: 2103140-04
Sample: RG_GHBP_WS_CALCITE_2021_02_NP
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/18/2021
Received: 03/11/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Styrofoam Cooler #4 - 2103140
B	XTRA_VOL	15 mL	na	none	na	na	Styrofoam Cooler #4 - 2103140
C	XTRA_VOL	120 mL	na	none	na	na	Styrofoam Cooler #4 - 2103140

Sample Containers

Lab ID: 2103140-05
Sample: RG_GHBP_WS_CALCITE_2021_02_NP_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/18/2021
Received: 03/11/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	120 mL	na	10% HNO3 (BAL)	2037003	<2	Styrofoam Cooler #3 - 2103140

Lab ID: 2103140-06
Sample: RG_GHBP_WS_CALCITE_2021_02_NP_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/18/2021
Received: 03/11/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	120 mL	na	10% HNO3 (BAL)	2037003	<2	Styrofoam Cooler #3 - 2103140

Lab ID: 2103140-07
Sample: RG_RIVER_WS_CALCITE_2021_02_NP
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/18/2021
Received: 03/11/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Styrofoam Cooler #4 - 2103140
B	XTRA_VOL	15 mL	na	none	na	na	Styrofoam Cooler #4 - 2103140
C	XTRA_VOL	120 mL	na	none	na	na	Styrofoam Cooler #4 - 2103140

Lab ID: 2103140-08
Sample: RG_RIVER_WS_CALCITE_2021_02_NP_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/18/2021
Received: 03/11/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	120 mL	na	10% HNO3 (BAL)	2037003	<2	Styrofoam Cooler #3 - 2103140

Sample Containers

Lab ID: 2103140-09
Sample: RG_RIVER_WS_CALCITE_2021_02_NP_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 02/18/2021
Received: 03/11/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	120 mL	na	10% HNO3 (BAL)	2037003	<2	Styrofoam Cooler #3 - 2103140

Shipping Containers

Styrofoam Cooler #3 - 2103140

Received: March 11, 2021 6:30
Tracking No: 54126 via Courier
Coolant Type: Blue Ice
Temperature: 1.7 °C
Description: Styrofoam Cooler #3
Damaged in transit? No
Returned to client? No
Comments: IR #31
Custody seals present? No
Custody seals intact? No
COC present? No

Styrofoam Cooler #4 - 2103140

Received: March 11, 2021 6:30
Tracking No: 54126 via Courier
Coolant Type: Blue Ice
Temperature: 1.1 °C
Description: Styrofoam Cooler #4
Damaged in transit? No
Returned to client? No
Comments: IR #31
Custody seals present? No
Custody seals intact? No
COC present? No

Teck

Page 1 of 1

Print COC
Ver 6.4.0.1

COC ID: Calcite Feb 2021

TURNAROUND TIME: Regular

PROJECT/CLIENT INFO			
Facility Name / Job#	REP		
Project Manager	Allie Ferguson		
Email	[illegible]		
Address	421 Pine Avenue		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	250.425.8257		

LABORATORY			
Lab Name	Brooks Applied Labs		
Lab Contact	Ben Wozniak		
Email	ben@brooksapplied.com		
Address	18804 North Creek Parkway		
City	Bothell	Province	WA
Postal Code	98011	Country	USA
Phone Number	206-632-6206		

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	carlie.meyer@teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	allie.ferguson@teck.com	X	X	X
Email 4:	awiebe@minnow.ca	X	X	X
Email 5:		X	X	X
Email 5:		X	X	X
PO number	625683			

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.	Total Selenium (FIL.: HNO3; PRESERV.: P)	Dissolved Selenium (FIL.: HNO3; PRESERV.: F/P)	Selenium Speciation (PRESERV.: F)
RG_GHUT_WS_CALCITE_2021_02_NP	RG_GHUT	WS	No	17-Feb-2021	10:00	G	1			1
RG_GHUT_WS_CALCITE_2021_02_NP_NAL	RG_GHUT	WS	No	17-Feb-2021	10:00	G	2	1	1	
RG_GHBP_WS_CALCITE_2021_02_NP	RG_GHBP	WS	No	18-Feb-2021	14:00	G	1			1
RG_GHBP_WS_CALCITE_2021_02_NP_NAL	RG_GHBP	WS	No	18-Feb-2021	14:00	G	2	1	1	
RG_RIVER_WS_CALCITE_2021_02_NP	RG_RIVER	WS	No	18-Feb-2021	14:00	G	1			1
RG_RIVER_WS_CALCITE_2021_02_NP_NAL	RG_RIVER	WS	No	18-Feb-2021	14:00	G	2	1	1	

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Samples for total selenium have been preserved in the field. Dissolve selenium have been filtered and preserved. Speciation samples have been filtered and frozen.				

SERVICE REQUEST (rush - subject to availability)				
Regular (default) X	**Sampler's Name**	**Maddy Stokes**	**Mobile #**	**647-522-0672**
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	**Sampler's Signature**		**Date/Time**	**March 8 2021**
For Emergency <1 Day, ASAP or Weekend - Contact ALS				

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

RW Hot Shot Service Inc.
24 Hour Hot Shot Service
P.O. BOX 276, SPARWOOD, BC V0B 2G0
PHONE: (250) 425-7447
FAX: (250) 425-7450

54126

INVOICE TO

DATE March 10/21

BILL OF LADING #

PURCHASE ORDER NUMBER

SHIPPER (FROM) Teck Coal Ltd.

STREET West Line Creek Treatment

CITY/PROVINCE Sparwood BC

POSTAL CODE

CONSIGNEE (TO) Brooks Applied Labs

STREET 18804 N. Creek Parkway

CITY PROVINCE Bothell WA

POSTAL CODE 98011

INTERLINE CARRIER

WAY BILL #

SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
5	Coolers - Water Samples	200 LBS

PAPS# RWHV54126

FREIGHT CHARGES

SHIPPER TO CHECK
☐PREPAID ☐COLLECT
If not indicated, shipping will automatically move collect

WAITING

XPU

CHARGES

FSC

SUB TOTAL

GST

TOTAL $

IF AT OWNER'S RISK, WRITE ORD HERE

UNIT #

PERMIT #

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 Curtis

DRIVER'S SIGNATURE - DELIVERY BY

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 conditions.

SHIPPER PRINT

CONSIGNEE PRINT Julian Reynolds

SHIPPER SIGN

CONSIGNEE SIGN

DATE 3-11-21

TIME 0630

NUMBER OF PIECES RECEIVED 5

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROD: Shipper GST # 864540398RT0001

Cooler ID: Styrocooler 3 **COC** (Y/N) **Temperature:** 1.7 **IR:** 31

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations: WLC

		2103127		2103128 29		RG			
Sample Types: T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types: 40	125		120		120	120			

Opened By: DKN **Date:** 3/11/21

Effective 7/29/20

Revision 004

R.W. Hot Shot Service Inc.
24 Hour Hot Shot Service
P.O. BOX 276, SPARWOOD, BC V0B 2G0
PHONE: (250) 425-7447
FAX: (250) 425-7450

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

54126

INVOICE TO

BILL OF LADING #

DATE March 10/21

PURCHASE ORDER NUMBER

SHIPPER (FROM) Teck Coal Ltd.

STREET West Line Creek Treatment

CITY/PROVINCE Sparwood BC

POSTAL CODE

CONSIGNEE (TO) Brooks Applied Labs

STREET 18804 N. Creek Parkway

CITY PROVINCE Bothell WA

POSTAL CODE 98011

INTERLINE CARRIER

WAY BILL #

SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
5	Coolers - Water Samples	200 LBS

PAPS# RWHV54126

FREIGHT CHARGES

SHIPPER TO CHECK
☐ PREPAID ☐ COLLECT
If not indicated, shipping will automatically move collect.

WAITING

XPU

CHARGES

FSC

SUB TOTAL

GST

TOTAL $

IF AT OWNER'S RISK, WRITE ORD HERE

UNIT #

PERMIT #

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 Curtis

DRIVER'S SIGNATURE - DELIVERY BY

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. 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 freight bill including conditions set aside by the standard Bill of Lading, in power at the date of issuing. 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

SHIPPER SIGN

CONSIGNEE PRINT Yalen Reynolds

CONSIGNEE SIGN

DATE 3-11-21

TIME 0630

NUMBER OF PIECES RECEIVED 5

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROD: Shipper

GST# 864540398RT0001

Cooler ID: StyroCooler 4 **COC (Y/N)** **Temperature:** 1.1 **IR:** 31

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations:	203126 -25		RG							
Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:	40	120		120						

Opened By: DJR **Date:** 3/11/21

Effective 7/29/20 Revision 004

BROOKS APPLIED LABS
18804 North Creek Parkway, Ste 100, Bothell, WA 98011 • USA • T: 206 632 6206 F: 206 632 6017 • info@brooksapplied.com

October 14, 2021

Teck Resources Limited - Vancouver
Allie Ferguson
421 Pine Avenue
Sparwood, B.C. CANADA V0B2G0
allie.ferguson@teck.com

Re: REP

Dear Allie Ferguson,

On September 16, 2021, Brooks Applied Labs (BAL) received ten (10) aqueous samples. The samples were logged-in for total recoverable selenium [*Se*], dissolved Se, and Se speciation analyses, according to the chain-of-custody (COC) forms.

Sample ID values listed on the chain-of-custody (COC) forms did not exactly match the corresponding **Sample ID** values listed on container labels several samples in this work order. The discrepancies are described in the table below.

Laboratory ID	**Sample ID** ***(From COC form)***	**Sample ID** ***(Listed on container label)***
2109237-05	RG_GHNF_WS_GGCAMP_2021-09-10_N_NAL	RG_GHNF_WS_GGCAMP_2021-09-NP_N_NAL
2109237-06	RG_GHNF_WS_GGCAMP_2021-09-10_N_NAL	RG_GHNF_WS_GGCAMP_2021-09-NP_N_NAL
2109237-08	RG_GHUT_WS_GGCAMP_2021-09-13_N_NAL	RG_GHUT_WS_GGCAMP_2021-09-NP_N_NAL
2109237-09	RG_GHUT_WS_GGCAMP_2021-09-13_N_NAL	RG_GHUT_WS_GGCAMP_2021-09-NP_N_NAL
2109237-11	RG_RIVER_WS_2021-09-13_N_NAL	RG_RIVER_WS_2021-09-NP_N_NAL
2109237-12	RG_RIVER_WS_2021-09-13_N_NAL	RG_RIVER_WS_2021-09-NP_N_NAL
2109237-14	RG_GHBP_WS_GGCAMP_2021-09-13_N_NAL	RG_GHBP_WS_GGCAMP_2021-09-NP_N_NAL
2109237-15	RG_GHBP_WS_GGCAMP_2021-09-13_N_NAL	RG_GHBP_WS_GGCAMP_2021-09-NP_N_NAL

Per client request, the samples described the table above were logged and reported in using the **Sample IDs** listed on the COC forms.

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.

Se Speciation

Each aqueous sample was analyzed for Se 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 Se species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting Se 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 when 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 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 met 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
Brooks Applied Labs
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), and DoD/DOE (3)

Issued by: ANAB

Issued on: September 21, 2021; Valid to: March 30, 2024

Method	Matrix	ISO and Non-Gov. TNI Accredited Analyte(s)	DoD/DOE Accredited Analytes
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	Ag, Al, As, Ba, Ca, Cd, Cr, Cu, Fe, Pb, Mg, Mn, Ni, Sb, Se, 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)	Not Accredited
EPA 1640 Mod	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn Ag, As, Cr, Co, Se, Tl, V (ISO Only)	Not Accredited
EPA 1631E Mod BAL-3100	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury	Methyl Mercury (excluding Solids/Chemicals)
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic (ISO Only)	Not Accredited
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)	Not Accredited
AOAC 2015.01 Mod BAL-5000	Food	As, Cd, Hg, Pb	Not Accredited
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs	Not Accredited
	Biological by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)	Not Accredited
BAL-4101	Food by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)	Not Accredited
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet	Not Accredited
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)	Not Accredited
SM2340B	Non-Potable Waters	Hardness	Hardness
SM 2540G BAL-0501	Solids/Chemicals & Biological	% Dry Weight	% Dry Weight

(1) ISO/IEC 17025:2017 – Certificate Number ADE-1447.02

(2) Non-Governmental NELAC Institute 2016 Standard – Certificate Number ADE-1447.01

(3) Department of Defense/Energy Consolidated Quality Systems Manual v. 5.3 – Certificate Numbers ADE-1447 for DoD, ADE-1447.03 for DOE.

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
RG_GHFF_WS_GGCAMP_2021-09-09_N	2109237-01	WS	Sample	09/09/2021	09/16/2021
RG_GHFF_WS_GGCAMP_2021-09-09_N_NAL	2109237-02	WS	Sample	09/09/2021	09/16/2021
RG_GHFF_WS_GGCAMP_2021-09-09_N_NAL	2109237-03	WS	Sample	09/09/2021	09/16/2021
RG_GHNF_WS_GGCAMP_2021-09-10_N	2109237-04	WS	Sample	09/10/2021	09/16/2021
RG_GHNF_WS_GGCAMP_2021-09-10_N_NAL	2109237-05	WS	Sample	09/10/2021	09/16/2021
RG_GHNF_WS_GGCAMP_2021-09-10_N_NAL	2109237-06	WS	Sample	09/10/2021	09/16/2021
RG_GHUT_WS_GGCAMP_2021-09-13_N	2109237-07	WS	Sample	09/13/2021	09/16/2021
RG_GHUT_WS_GGCAMP_2021-09-13_N_NAL	2109237-08	WS	Sample	09/13/2021	09/16/2021
RG_GHUT_WS_GGCAMP_2021-09-13_N_NAL	2109237-09	WS	Sample	09/13/2021	09/16/2021
RG_RIVER_WS_2021-09-13_N	2109237-10	WS	Sample	09/13/2021	09/16/2021
RG_RIVER_WS_2021-09-13_N_NAL	2109237-11	WS	Sample	09/13/2021	09/16/2021
RG_RIVER_WS_2021-09-13_N_NAL	2109237-12	WS	Sample	09/13/2021	09/16/2021
RG_GHBP_WS_GGCAMP_2021-09-13_N	2109237-13	WS	Sample	09/13/2021	09/16/2021
RG_GHBP_WS_GGCAMP_2021-09-13_N_NAL	2109237-14	WS	Sample	09/13/2021	09/16/2021
RG_GHBP_WS_GGCAMP_2021-09-13_N_NAL	2109237-15	WS	Sample	09/13/2021	09/16/2021

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201	09/16/2021	09/18/2021	B212603	S211070
MeSe(IV)	Water	SOP BAL-4201	09/16/2021	09/18/2021	B212603	S211070
MeSe(VI)	Water	SOP BAL-4201	09/16/2021	09/18/2021	B212603	S211070
Se	Water	EPA 1638 Mod	09/21/2021	09/22/2021	B212615	S211084
Se(IV)	Water	SOP BAL-4201	09/16/2021	09/18/2021	B212603	S211070
Se(VI)	Water	SOP BAL-4201	09/16/2021	09/18/2021	B212603	S211070
SeCN	Water	SOP BAL-4201	09/16/2021	09/18/2021	B212603	S211070
SeMet	Water	SOP BAL-4201	09/16/2021	09/18/2021	B212603	S211070
SeSO3	Water	SOP BAL-4201	09/16/2021	09/18/2021	B212603	S211070
Unk Se Sp	Water	SOP BAL-4201	09/16/2021	09/18/2021	B212603	S211070

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_GHFF_WS_GGCAMP_2021-09-09_N										
2109237-01	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-01	MeSe(IV)	WS	D	0.029		0.010	0.025	µg/L	B212603	S211070
2109237-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-01	Se(IV)	WS	D	1.08		0.010	0.075	µg/L	B212603	S211070
2109237-01	Se(VI)	WS	D	167		0.010	0.055	µg/L	B212603	S211070
2109237-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B212603	S211070
2109237-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-01	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B212603	S211070
2109237-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B212603	S211070
RG_GHFF_WS_GGCAMP_2021-09-09_N_NAL										
2109237-02	Se	WS	TR	139		0.165	0.528	µg/L	B212615	S211084
RG_GHFF_WS_GGCAMP_2021-09-09_N_NAL										
2109237-03	Se	WS	D	143		0.165	0.528	µg/L	B212615	S211084
RG_GHNF_WS_GGCAMP_2021-09-10_N										
2109237-04	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-04	MeSe(IV)	WS	D	0.017	J	0.010	0.025	µg/L	B212603	S211070
2109237-04	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-04	Se(IV)	WS	D	1.10		0.010	0.075	µg/L	B212603	S211070
2109237-04	Se(VI)	WS	D	189		0.010	0.055	µg/L	B212603	S211070
2109237-04	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B212603	S211070
2109237-04	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-04	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B212603	S211070
2109237-04	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B212603	S211070
RG_GHNF_WS_GGCAMP_2021-09-10_N_NAL										
2109237-05	Se	WS	TR	211		0.165	0.528	µg/L	B212615	S211084
RG_GHNF_WS_GGCAMP_2021-09-10_N_NAL										
2109237-06	Se	WS	D	206		0.165	0.528	µg/L	B212615	S211084

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_GHUT_WS_GGCAMP_2021-09-13_N										
2109237-07	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-07	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-07	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-07	Se(IV)	WS	D	0.363		0.010	0.075	µg/L	B212603	S211070
2109237-07	Se(VI)	WS	D	230		0.010	0.055	µg/L	B212603	S211070
2109237-07	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B212603	S211070
2109237-07	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-07	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B212603	S211070
2109237-07	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B212603	S211070
RG_GHUT_WS_GGCAMP_2021-09-13_N_NAL										
2109237-08	Se	WS	TR	216		0.165	0.528	µg/L	B212615	S211084
RG_GHUT_WS_GGCAMP_2021-09-13_N_NAL										
2109237-09	Se	WS	D	224		0.165	0.528	µg/L	B212615	S211084
RG_RIVER_WS_2021-09-13_N										
2109237-10	DMSeO	WS	D	0.255		0.010	0.025	µg/L	B212603	S211070
2109237-10	MeSe(IV)	WS	D	0.113		0.010	0.025	µg/L	B212603	S211070
2109237-10	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-10	Se(IV)	WS	D	4.06		0.010	0.075	µg/L	B212603	S211070
2109237-10	Se(VI)	WS	D	131		0.010	0.055	µg/L	B212603	S211070
2109237-10	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B212603	S211070
2109237-10	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-10	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B212603	S211070
2109237-10	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B212603	S211070
RG_RIVER_WS_2021-09-13_N_NAL										
2109237-11	Se	WS	TR	121		0.165	0.528	µg/L	B212615	S211084
RG_RIVER_WS_2021-09-13_N_NAL										
2109237-12	Se	WS	D	129		0.165	0.528	µg/L	B212615	S211084

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_GHBP_WS_GGCAMP_2021-09-13_N										
2109237-13	DMSeO	WS	D	0.250		0.010	0.025	µg/L	B212603	S211070
2109237-13	MeSe(IV)	WS	D	0.099		0.010	0.025	µg/L	B212603	S211070
2109237-13	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-13	Se(IV)	WS	D	4.23		0.010	0.075	µg/L	B212603	S211070
2109237-13	Se(VI)	WS	D	132		0.010	0.055	µg/L	B212603	S211070
2109237-13	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B212603	S211070
2109237-13	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212603	S211070
2109237-13	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B212603	S211070
2109237-13	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B212603	S211070
RG_GHBP_WS_GGCAMP_2021-09-13_N_NAL										
2109237-14	Se	WS	TR	128		0.165	0.528	µg/L	B212615	S211084
RG_GHBP_WS_GGCAMP_2021-09-13_N_NAL										
2109237-15	Se	WS	D	122		0.165	0.528	µg/L	B212615	S211084

Accuracy & Precision Summary

Batch: B212603
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B212603-BS1	**Blank Spike, (2124033)**								
	MeSe(IV)		5.095	5.395	µg/L	106%	75-125		
	Se(IV)		5.000	4.902	µg/L	98%	75-125		
	Se(VI)		5.000	4.701	µg/L	94%	75-125		
	SeCN		5.015	4.811	µg/L	96%	75-125		
	SeMet		4.932	4.724	µg/L	96%	75-125		
B212603-DUP5	**Duplicate, (2109237-04)**								
	DMSeO	ND		0.011	µg/L			N/C	25
	MeSe(IV)	0.017		0.021	µg/L			21%	25
	MeSe(VI)	ND		ND	µg/L			N/C	25
	Se(IV)	1.103		1.093	µg/L			0.9%	25
	Se(VI)	188.6		193.0	µg/L			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
B212603-MS5	**Matrix Spike, (2109237-04)**								
	Se(IV)	1.103	4.900	5.744	µg/L	95%	75-125		
	Se(VI)	188.6	5.100	198.4	µg/L	NR	75-125		
	SeCN	ND	1.962	1.960	µg/L	100%	75-125		
	SeMet	ND	1.977	2.046	µg/L	103%	75-125		
B212603-MSD5	**Matrix Spike Duplicate, (2109237-04)**								
	Se(IV)	1.103	4.900	5.688	µg/L	94%	75-125	1%	25
	Se(VI)	188.6	5.100	198.8	µg/L	NR	75-125	N/C	25
	SeCN	ND	1.962	2.015	µg/L	103%	75-125	3%	25
	SeMet	ND	1.977	2.140	µg/L	108%	75-125	4%	25

Accuracy & Precision Summary

Batch: B212615
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits
B212615-BS1	**Blank Spike, (2104075)**							
	Se		200.0	190.9	µg/L	95%	75-125	
B212615-BS2	**Blank Spike, (2104075)**							
	Se		200.0	193.3	µg/L	97%	75-125	
B212615-BS3	**Blank Spike, (2104075)**							
	Se		200.0	188.6	µg/L	94%	75-125	
B212615-BS4	**Blank Spike, (2104075)**							
	Se		200.0	191.9	µg/L	96%	75-125	
B212615-BS5	**Blank Spike, (2104075)**							
	Se		200.0	188.0	µg/L	94%	75-125	
B212615-BS6	**Blank Spike, (2104075)**							
	Se		200.0	186.7	µg/L	93%	75-125	
B212615-BS7	**Blank Spike, (2104075)**							
	Se		200.0	188.4	µg/L	94%	75-125	
B212615-SRM1	**Reference Material (2110006, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**							
	Se		14.30	15.15	µg/L	106%	75-125	
B212615-SRM2	**Reference Material (2110006, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**							
	Se		14.30	14.39	µg/L	101%	75-125	
B212615-SRM3	**Reference Material (2110006, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**							
	Se		14.30	14.63	µg/L	102%	75-125	
B212615-SRM4	**Reference Material (2110006, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**							
	Se		14.30	13.99	µg/L	98%	75-125	

Accuracy & Precision Summary

Batch: B212615
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B212615-SRM5	**Reference Material (2110006, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**								
	Se		14.30	14.00	µg/L	98%	75-125		
B212615-SRM6	**Reference Material (2110006, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**								
	Se		14.30	14.15	µg/L	99%	75-125		
B212615-SRM7	**Reference Material (2110006, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**								
	Se		14.30	13.77	µg/L	96%	75-125		
B212615-DUP8	**Duplicate, (2109237-11)**								
	Se	121.4		121.7	µg/L			0.3%	20
B212615-MS8	**Matrix Spike, (2109237-11)**								
	Se	121.4	220.0	318.4	µg/L	90%	75-125		
B212615-MSD8	**Matrix Spike Duplicate, (2109237-11)**								
	Se	121.4	220.0	320.1	µg/L	90%	75-125	0.5%	20

Method Blanks & Reporting Limits

Batch: B212603
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B212603-BLK1	0.00	µg/L
B212603-BLK2	0.00	µg/L
B212603-BLK3	0.00	µg/L
B212603-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B212603-BLK1	0.00	µg/L
B212603-BLK2	0.00	µg/L
B212603-BLK3	0.00	µg/L
B212603-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B212603-BLK1	0.00	µg/L
B212603-BLK2	0.00	µg/L
B212603-BLK3	0.00	µg/L
B212603-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
B212603-BLK1	0.00	µg/L
B212603-BLK2	0.00	µg/L
B212603-BLK3	0.00	µg/L
B212603-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B212603-BLK1	0.00	µg/L
B212603-BLK2	0.00	µg/L
B212603-BLK3	0.00	µg/L
B212603-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B212603-BLK1	0.00	µg/L
B212603-BLK2	0.00	µg/L
B212603-BLK3	0.00	µg/L
B212603-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B212603-BLK1	0.00	µg/L
B212603-BLK2	0.00	µg/L
B212603-BLK3	0.00	µg/L
B212603-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
B212603-BLK1	0.00	µg/L
B212603-BLK2	0.00	µg/L
B212603-BLK3	0.00	µg/L
B212603-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: Unk Se Sp

Sample	Result	Units
B212603-BLK1	0.00	µg/L
B212603-BLK2	0.00	µg/L
B212603-BLK3	0.00	µg/L
B212603-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Method Blanks & Reporting Limits

Batch: B212615
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B212615-BLK1	0.130	µg/L
B212615-BLK2	0.191	µg/L
B212615-BLK3	0.098	µg/L
B212615-BLK4	0.107	µg/L
B212615-BLK5	0.157	µg/L
B212615-BLK6	0.136	µg/L
B212615-BLK7	0.192	µg/L

Average: 0.144 **MDL:** 0.150
Limit: 0.480 **MRL:** 0.480

Sample Containers

Lab ID: 2109237-01
Sample: RG_GHFF_WS_GGCAMP_2021-09-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/09/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237
B	XTRA_VOL	15 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237
C	XTRA_VOL	60 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237

Lab ID: 2109237-02
Sample: RG_GHFF_WS_GGCAMP_2021-09-09_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/09/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109237

Lab ID: 2109237-03
Sample: RG_GHFF_WS_GGCAMP_2021-09-09_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/09/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109237

Lab ID: 2109237-04
Sample: RG_GHNF_WS_GGCAMP_2021-09-10_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/10/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237
B	XTRA_VOL	15 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237
C	XTRA_VOL	60 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237

Sample Containers

Lab ID: 2109237-05
Sample: RG_GHNF_WS_GGCAMP_2021-09-10_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/10/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109237

Lab ID: 2109237-06
Sample: RG_GHNF_WS_GGCAMP_2021-09-10_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/10/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109237

Lab ID: 2109237-07
Sample: RG_GHUT_WS_GGCAMP_2021-09-13_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/13/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237
B	XTRA_VOL	15 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237
C	XTRA_VOL	60 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237

Lab ID: 2109237-08
Sample: RG_GHUT_WS_GGCAMP_2021-09-13_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/13/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109237

Sample Containers

Lab ID: 2109237-09
Sample: RG_GHUT_WS_GGCAMP_2021-09-13_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/13/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109237

Lab ID: 2109237-10
Sample: RG_RIVER_WS_2021-09-13_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/13/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237
B	XTRA_VOL	15 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237
C	XTRA_VOL	60 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237

Lab ID: 2109237-11
Sample: RG_RIVER_WS_2021-09-13_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/13/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109237

Lab ID: 2109237-12
Sample: RG_RIVER_WS_2021-09-13_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/13/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109237

Sample Containers

Lab ID: 2109237-13
Sample: RG_GHBP_WS_GGCAMP_2021-09-13_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/13/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237
B	XTRA_VOL	15 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237
C	XTRA_VOL	60 mL	na	none	na	na	Styrofoam Cooler #1 - 2109237

Lab ID: 2109237-14
Sample: RG_GHBP_WS_GGCAMP_2021-09-13_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/13/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109237

Lab ID: 2109237-15
Sample: RG_GHBP_WS_GGCAMP_2021-09-13_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/13/2021
Received: 09/16/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109237

Shipping Containers

Styrofoam Cooler #1 - 2109237

Received: September 16, 2021 6:41
Tracking No: PAPS#RWHV87364 via Courier
Coolant Type: Ice
Temperature: 0.8 °C

Description: Styrofoam Cooler
Damaged in transit? No
Returned to client? No
Comments: IR#30

Custody seals present? No
Custody seals intact? No
COC present? No

Teck Confidential

COC ID: September GGCAMP | TURNAROUND TIME: Regular

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	REP			Lab Name	Brooks Applied Labs			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Allie Ferguson			Lab Contact	Ben Wozniak			Email 1:	allie.ferguson@teck.com	X	X	X
Email	allie.ferguson@teck.com			Email	ben@brooksapplied.com			Email 2:	teckcoal@equisonline.com			X
Address	421 Pine Avenue			Address	18804 North Creek Parkway			Email 3:	monica.bartha@teck.com	X	X	X
								Email 4:	lbowron@minnow.ca	X	X	X
City	Sparwood	Province	BC	City	Bothell	Province	WA	Email 5:	awiebe@minnow.ca	X	X	X
Postal Code	V0B 2G0	Country	Canada	Postal Code	98011	Country	USA	Email 5:				
Phone Number	250-910-8755			Phone Number	206-632-6206			PO number	VPO00748540			

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.	Total Selenium	Dissolved Selenium (F)	Selenium Speciation (F)
RG_GHFF_WS_GGCAMP_2021-09-09_N	RG_GHFF	WS	No	09/09/2021	1136	G	1			1
RG_GHFF_WS_GGCAMP_2021-09-09_N_NAL	RG_GHFF	WS	No	09/09/2021	1136	G	2	1	1	
RG_GHNF_WS_GGCAMP_2021-09-10_N	RG_GHNF	WS	No	09/10/2021	1045	G	1			1
RG_GHNF_WS_GGCAMP_2021-09-10_N_NAL	RG_GHNF	WS	No	09/10/2021	1045	G	2	1	1	
RG_GHUT_WS_GGCAMP_2021-09-13_N	RG_GHUT	WS	No	09/13/2021	0930	G	1			1
RG_GHUT_WS_GGCAMP_2021-09-13_N_NAL	RG_GHUT	WS	No	09/13/2021	0930	G	2	1	1	
RG_RIVER_WS_2021-09-13_N	RG_RIVER	WS	No	09/13/2021	1505	G	1			1
RG_RIVER_WS_2021-09-13_N_NAL	RG_RIVER	WS	No	09/13/2021	1505	G	2	1	1	
RG_GHBP_WS_GGCAMP_2021-09-13_N	RG_GHBP	WS	No	09/13/2021	1505	G	1			1
RG_GHBP_WS_GGCAMP_2021-09-13_N_NAL	RG_GHBP	WS	No	09/13/2021	1505	G	2	1	1	

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

Total and dissolved selenium samples have NOT been preserved. Dissolved selenium have been filtered. Speciation samples have been filtered and frozen.

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Jennifer Ings/Minnow	September 14, 2021	Sheila Prisiak	9/16/21 6:41

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	Jennifer Ings	Mobile #	519-500-3444
Sampler's Signature	Jennifer Ings	Date/Time	September 14, 2021

8 19

RW HOT SHOT SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

No. 87364

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: Sept 15-21

INVOICE TO

PURCHASE ORDER NUMBER

BILL OF LADING #

CONSIGNEE (TO): Brooks Applied Labs

SHIPPER (FROM): Teck Coal Ltd

STREET: 18804 N. Creek Parkway

POSTAL CODE: 98011

STREET: West Line Creek Treatment

POSTAL CODE

CITY/PROVINCE: Bothell, WA

CITY/PROVINCE: Sparwood, BC

SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
5	Coolers - Water Samples	100 LBS

PAPS# RWHV87364

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
DATE
TIME

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 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: Jason Zurek

CONSIGNEE PRINT: Zach (BAL)

9/16/21

SHIPPER SIGN

CONSIGNEE SIGN

NUMBER OF PIECES RECEIVED: 7

GST # 864540398RT0001

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROAD: Shipper

ABACUS PRINTING

Cooler ID: Styrofoam Cooler #1 COC (Y/N) Temperature: 0.8 IR: 30

Coolant Type: Ice Blue Ice Ambient

Notes:

2109237

Sampling Locations:	BG		EV		GH	
Sample Types:	T/D	SP	T/D	SP	T/D	SP
Container Types:	40mL	60ml		60ml	40mL	60mL

Opened By: CVL Date: 9/16/21

COPY

From: Tyler Mehler
To: Chelsea Van Landeghen; allie.ferguson@teck.com; jessica.ritz@teck.com; Lisa Bowron
Cc: Jeremy Maute
Subject: RE: Received - WO (2109233, 2109235, 2109237), REP - Privileged and Confidential
Date: Wednesday, September 22, 2021 1:25:20 PM

Hi Chelsea -- Please use the sample ID from the COC in this situation. Thanks.

From: Chelsea Van Landeghen <chelsea@brooksapplied.com>
Sent: Wednesday, September 22, 2021 10:47 AM
To: allie.ferguson@teck.com; jessica.ritz@teck.com; Lisa Bowron <LBowron@minnow.ca>; Tyler Mehler <tyler.mehler@minnow.ca>
Cc: Jeremy Maute <Jeremy@brooksapplied.com>
Subject: Received - WO (2109233, 2109235, 2109237), REP - Privileged and Confidential

Good morning!

This is confirmation that samples from the REP project were received at Brooks Applied Labs on September 16, 2021. The samples were logged in for the following turnaround times (TATs):

WO 2109233 – (5-9 business day) TAT
WO 2109235 – (5-9 business day) TAT
WO 2109237 – (5-9 business day) TAT

The **Sample ID** value listed on the chain-of-custody (COC) form did not exactly match the corresponding **Sample ID** terms listed on container labels for samples in WO *2109233*, *2109235*, and *2109237*. The discrepancies are described in the table below.

Laboratory ID	**Sample ID** *(From COC form)*	**Sample ID** *(listed on container label)*	**Analytical Parameter**
2109233-01	RG_ALUSM_WS_LAEMP_EVO_2021-09-12_N	RG_ALUSM_WS_2021-09-12_N	Se Speciation
2109233-02	RG_ALUSM_WS_LAEMP_EVO_2021-09-12_N_NAL	RG_ALUSM_WS_2021-09-12_N_NAL	Total Recoverable Se
2109233-03	RG_ALUSM_WS_LAEMP_EVO_2021-09-12_N_NAL	RG_ALUSM_WS_2021-09-12_N_NAL	Dissolved Se
2109233-04	RG_ERCK_WS_LAEMP_EVO_2021-09-10_N	RG_ERCK_WS_2021-09-10-1130_N	Se Speciation
2109233-05	RG_ERCK_WS_LAEMP_EVO_2021-09-10_N_NAL	RG_ERCK_WS_2021-09-10-1130_N_NAL	Total Recoverable Se
2109233-06	RG_ERCK_WS_LAEMP_EVO_2021-09-10_N_NAL	RG_ERCK_WS_2021-09-10-1130_N_NAL	Dissolved Se
2109233-07	RG_M13_WS_LAEMP_EVO_2021-09-10_N	RG_M13_WS_2021-09-10-1600	Se Speciation
2109233-08	RG_M13_WS_LAEMP_EVO_2021-09-10_N_NAL	RG_M13_WS_2021-09-10-1600	Total Recoverable Se
2109233-09	RG_M13_WS_LAEMP_EVO_2021-09-10_N_NAL	RG_M13_WS_2021-09-10-1600	Dissolved Se

2109233-10	RG_MIDER_WS_LAEMP_EVO_2021-09-09_N	RG_MIDER_WS_2021-09-09-1435_N	Se Speciation
2109233-11	RG_MIDER_WS_LAEMP_EVO_2021-09-09_N_NAL	RG_MIDER_WS_2021-09-09-1435_N_NAL	Total Recoverable Se
2109233-12	RG_MIDER_WS_LAEMP_EVO_2021-09-09_N_NAL	RG_MIDER_WS_2021-09-09-1435_N_NAL	Dissolved Se
2109233-13	RG_MIDGA_WS_LAEMP_EVO_2021-09-11_N	RG_MIDGA_WS_2021-09-11-1530	Se Speciation
2109233-14	RG_MIDGA_WS_LAEMP_EVO_2021-09-11_N_NAL	RG_MIDGA_WS_2021-09-11-1530	Total Recoverable Se
2109233-15	RG_MIDGA_WS_LAEMP_EVO_2021-09-11_N_NAL	RG_MIDGA_WS_2021-09-11-1530	Dissolved Se
2109233-16	RG_RIVER_WS_2021-09-11_N	RG_RIVER_WS_2021-09-11-1530	Se Speciation
2109233-17	RG_RIVER_WS_2021-09-11_N_NAL	RG_RIVER_WS_2021-09-11-1530	Total Recoverable Se
2109233-18	RG_RIVER_WS_2021-09-11_N_NAL	RG_RIVER_WS_2021-09-11-1530	Dissolved Se
2109233-19	RG_MIDBO_WS_LAEMP_EVO_2021-09-11_N	RG_MIDBO_WS_2021-09-11-1130	Se Speciation
2109233-20	RG_MIDBO_WS_LAEMP_EVO_2021-09-11_N_NAL	RG_MIDBO_WS_2021-09-11-1130	Total Recoverable Se
2109233-21	RG_MIDBO_WS_LAEMP_EVO_2021-09-11_N_NAL	RG_MIDBO_WS_2021-09-11-1130	Dissolved Se
2109233-22	RG_MICOMP_WS_LAEMP_EVO_2021-09-13_N	RG_MICOMP_WS_LAEMP_EVO_2021-09-13-1600_N	Se Speciation
2109233-23	RG_MICOMP_WS_LAEMP_EVO_2021-09-13_N_NAL	RG_MICOMP_WS_LAEMP_EVO_2021-09-13-1600_N_NAL	Total Recoverable Se
2109233-24	RG_MICOMP_WS_LAEMP_EVO_2021-09-13_N_NAL	RG_MICOMP_WS_LAEMP_EVO_2021-09-13-1600_N_NAL	Dissolved Se
2109235-04	RG_RIVER_WS_2021-09-09_N	RG_RIVER_WS_RAEM_2021-09-09_N	Se Speciation
2109235-06	RG_RIVER_WS_2021-09-09_N_NAL	RG_RIVER_WS_RAEM_2021-09-09_N_NAL	Dissolved Se
2109235-20	RG_GHCKD_WS_RAEMP_2021-09-11_N_NAL	RG_GHCKD_WS_RAEMP_2021-09-NP_N_NAL	Total Recoverable Se
2109235-21	RG_GHCKD_WS_RAEMP_2021-09-11_N_NAL	RG_GHCKD_WS_RAEMP_2021-09-NP_N_NAL	Dissolved Se
2109235-26	RG_BACK_WS_RAEMP_2021-09-13_NAL	RG_BACK_WS_RAEMP_2021-09-NP_NAL	Total Recoverable Se
2109235-27	RG_BACK_WS_RAEMP_2021-09-13_NAL	RG_BACK_WS_RAEMP_2021-09-NP_NAL	Dissolved Se
2109237-05	RG_GHNF_WS_GGCAMP_2021-09-10_N_NAL	RG_GHNF_WS_GGCAMP_2021-09-NP_N_NAL	Total Recoverable Se
2109237-06	RG_GHNF_WS_GGCAMP_2021-09-10_N_NAL	RG_GHNF_WS_GGCAMP_2021-09-NP_N_NAL	Dissolved Se
2109237-08	RG_GHUT_WS_GGCAMP_2021-09-13_N_NAL	RG_GHUT_WS_GGCAMP_2021-09-NP_N_NAL	Total Recoverable Se
2109237-09	RG_GHUT_WS_GGCAMP_2021-09-13_N_NAL	RG_GHUT_WS_GGCAMP_2021-09-NP_N_NAL	Dissolved Se
2109237-11	RG_RIVER_WS_2021-09-13_N_NAL	RG_RIVER_WS_2021-09-NP_N_NAL	Total Recoverable Se
2109237-12	RG_RIVER_WS_2021-09-13_N_NAL	RG_RIVER_WS_2021-09-NP_N_NAL	Dissolved Se
	RG_GHBP_WS_GGCAMP_2021-	RG_GHBP_WS_GGCAMP_2021-	Total

2109237-14	09-13_N_NAL	09-NP_N_NAL	Recoverable Se
2109237-15	RG_GHBP_WS_GGCAMP_2021-09-13_N_NAL	RG_GHBP_WS_GGCAMP_2021-09-NP_N_NAL	Dissolved Se

The samples described the table above were logged in using the **Sample ID** terms listed on the COC form. Please let us know if you would have us report any of these samples in a different manner.

Unfortunately, a recent storm has damaged our server and the lab has not had access to the server this week. Do not worry; no data was lost. We just do not have access to the server currently. This has delayed many processes, including analysis and reporting. The board we needed was obtained today and access to the server should be restored by this evening. We are making every effort to get the work orders reported within the requested time frame. I apologize for any inconvenience this may cause.

I've attached copies of the COC forms. If you have any questions, please contact the project manager, Jeremy Maute.

Best,
Chelsea

Chelsea Van Landeghen
Group Lead - Sample Control

email: chelsea@brooksapplied.com

BROOKS APPLIED LABS
Meaningful Metals Data and Advanced Speciation Solutions
P: 206-632-6206 | F: 206-632-6017 | **18804 North Creek Parkway, Suite 100, Bothell, WA 98011, USA**

BROOKS APPLIED LABS
18804 North Creek Parkway, Ste 100, Bothell, WA 98011 • USA • T: 206 632 6206 F: 206 632 6017 • info@brooksapplied.com

October 22, 2021

Teck Resources Limited - Vancouver
Allie Ferguson
421 Pine Avenue
Sparwood, B.C. CANADA V0B2G0
allie.ferguson@teck.com

Re: REP

Dear Allie Ferguson,

On September 16, 2021, Brooks Applied Labs (BAL) received ten (10) aqueous samples. The samples were logged-in for total recoverable selenium [*Se*], dissolved Se, and Se speciation analyses, according to the chain-of-custody (COC) forms.

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.

B212656-SRM1 was mis-prepped in the digest. Consequently, results are not reported for B212656-SRM1. The remaining blank spike samples and reference material samples in batch B212656 are used to demonstrate acceptable digest performance.

The client sample 2109307-05 was received with limited volume, and BAL was able to use only 1 milliliter (mL) of sample in the B212656 digest. With the lower volume used for 2109307-05, MDL/MRLs were adjusted accordingly. Consequently, the total recoverable Se result for 2109307-05 is reported with elevated MDL/MRLs.

Se Speciation

Each aqueous sample was analyzed for Se 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 Se species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting Se 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 when 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 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 met 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
Brooks Applied Labs
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), and DoD/DOE (3)

Issued by: ANAB

Issued on: September 21, 2021; Valid to: March 30, 2024

Method	Matrix	ISO and Non-Gov. TNI Accredited Analyte(s)	DoD/DOE Accredited Analytes
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	Ag, Al, As, Ba, Ca, Cd, Cr, Cu, Fe, Pb, Mg, Mn, Ni, Sb, Se, 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)	Not Accredited
EPA 1640 Mod	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn Ag, As, Cr, Co, Se, Tl, V (ISO Only)	Not Accredited
EPA 1631E Mod BAL-3100	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury	Methyl Mercury (excluding Solids/Chemicals)
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic (ISO Only)	Not Accredited
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)	Not Accredited
AOAC 2015.01 Mod BAL-5000	Food	As, Cd, Hg, Pb	Not Accredited
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs	Not Accredited
	Biological by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)	Not Accredited
BAL-4101	Food by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)	Not Accredited
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet	Not Accredited
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)	Not Accredited
SM2340B	Non-Potable Waters	Hardness	Hardness
SM 2540G BAL-0501	Solids/Chemicals & Biological	% Dry Weight	% Dry Weight

(1) ISO/IEC 17025:2017 – Certificate Number ADE-1447.02

(2) Non-Governmental NELAC Institute 2016 Standard – Certificate Number ADE-1447.01

(3) Department of Defense/Energy Consolidated Quality Systems Manual v. 5.3 – Certificate Numbers ADE-1447 for DoD, ADE-1447.03 for DOE.

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
RG_GANF_WS_GGCAMP_2021-09-15_N	2109307-01	WS	Sample	09/15/2021	09/23/2021
RG_GANF_WS_GGCAMP_2021-09-15_N_NAL	2109307-02	WS	Sample	09/15/2021	09/23/2021
RG_GANF_WS_GGCAMP_2021-09-15_N_NAL	2109307-03	WS	Sample	09/15/2021	09/23/2021
RG_GAUT_WS_GGCAMP_2021-09-16_N	2109307-04	WS	Sample	09/16/2021	09/23/2021
RG_GAUT_WS_GGCAMP_2021-09-16_N+_NAF	2109307-05	WS	Sample	09/16/2021	09/23/2021
RG_GAUT_WS_GGCAMP_2021-09-16_N+_NAF	2109307-06	WS	Sample	09/16/2021	09/23/2021

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201	09/22/2021	09/24/2021	B212622	S211081
MeSe(IV)	Water	SOP BAL-4201	09/22/2021	09/24/2021	B212622	S211081
MeSe(VI)	Water	SOP BAL-4201	09/22/2021	09/24/2021	B212622	S211081
Se	Water	EPA 1638 Mod	09/28/2021	09/30/2021	B212656	S211116
Se(IV)	Water	SOP BAL-4201	09/22/2021	09/24/2021	B212622	S211081
Se(VI)	Water	SOP BAL-4201	09/22/2021	09/24/2021	B212622	S211081
SeCN	Water	SOP BAL-4201	09/22/2021	09/24/2021	B212622	S211081
SeMet	Water	SOP BAL-4201	09/22/2021	09/24/2021	B212622	S211081
SeSO3	Water	SOP BAL-4201	09/22/2021	09/24/2021	B212622	S211081
Unk Se Sp	Water	SOP BAL-4201	09/22/2021	09/24/2021	B212622	S211081

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_GANF_WS_GGCAMP_2021-09-15_N										
2109307-01	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212622	S211081
2109307-01	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212622	S211081
2109307-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212622	S211081
2109307-01	Se(IV)	WS	D	0.112		0.010	0.075	µg/L	B212622	S211081
2109307-01	Se(VI)	WS	D	5.39		0.010	0.055	µg/L	B212622	S211081
2109307-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B212622	S211081
2109307-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212622	S211081
2109307-01	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B212622	S211081
2109307-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B212622	S211081
RG_GANF_WS_GGCAMP_2021-09-15_N_NAL										
2109307-02	Se	WS	TR	5.95		0.165	0.528	µg/L	B212656	S211116
RG_GANF_WS_GGCAMP_2021-09-15_N_NAL										
2109307-03	Se	WS	D	5.61		0.165	0.528	µg/L	B212656	S211116
RG_GAUT_WS_GGCAMP_2021-09-16_N										
2109307-04	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212622	S211081
2109307-04	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212622	S211081
2109307-04	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212622	S211081
2109307-04	Se(IV)	WS	D	0.108		0.010	0.075	µg/L	B212622	S211081
2109307-04	Se(VI)	WS	D	0.437		0.010	0.055	µg/L	B212622	S211081
2109307-04	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B212622	S211081
2109307-04	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212622	S211081
2109307-04	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B212622	S211081
2109307-04	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B212622	S211081
RG_GAUT_WS_GGCAMP_2021-09-16_N+_NAF										
2109307-05	Se	WS	TR	≤ 0.825	U	0.825	2.64	µg/L	B212656	S211116
RG_GAUT_WS_GGCAMP_2021-09-16_N+_NAF										
2109307-06	Se	WS	D	0.784		0.165	0.528	µg/L	B212656	S211116

Accuracy & Precision Summary

Batch: B212622
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B212622-BS1	**Blank Spike, (2124033)**								
	MeSe(IV)		5.095	5.615	µg/L	110%	75-125		
	Se(IV)		5.000	4.997	µg/L	100%	75-125		
	Se(VI)		5.000	5.149	µg/L	103%	75-125		
	SeCN		5.015	5.067	µg/L	101%	75-125		
	SeMet		4.932	5.109	µg/L	104%	75-125		
B212622-DUP6	**Duplicate, (2109306-42)**								
	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)	0.375		0.375	µg/L			0.1%	25
	Se(VI)	40.70		40.58	µg/L			0.3%	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
B212622-MS6	**Matrix Spike, (2109306-42)**								
	Se(IV)	0.375	4.900	5.126	µg/L	97%	75-125		
	Se(VI)	40.70	5.100	47.06	µg/L	NR	75-125		
	SeCN	ND	1.962	1.902	µg/L	97%	75-125		
	SeMet	ND	1.977	1.909	µg/L	97%	75-125		
B212622-MSD6	**Matrix Spike Duplicate, (2109306-42)**								
	Se(IV)	0.375	4.900	5.143	µg/L	97%	75-125	0.3%	25
	Se(VI)	40.70	5.100	46.88	µg/L	NR	75-125	N/C	25
	SeCN	ND	1.962	1.870	µg/L	95%	75-125	2%	25
	SeMet	ND	1.977	1.920	µg/L	97%	75-125	0.6%	25

Accuracy & Precision Summary

Batch: B212656
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B212656-BS1	**Blank Spike, (2104075)**								
	Se		200.0	200.6	µg/L	100%	75-125		
B212656-BS2	**Blank Spike, (2104075)**								
	Se		200.0	196.2	µg/L	98%	75-125		
B212656-BS3	**Blank Spike, (2104075)**								
	Se		200.0	201.0	µg/L	100%	75-125		
B212656-BS4	**Blank Spike, (2104075)**								
	Se		200.0	197.1	µg/L	99%	75-125		
B212656-SRM2	**Reference Material (2110008, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	13.20	µg/L	92%	75-125		
B212656-SRM3	**Reference Material (2110008, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	13.91	µg/L	97%	75-125		
B212656-SRM4	**Reference Material (2110008, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	13.70	µg/L	96%	75-125		
B212656-DUP4	**Duplicate, (2109307-02)**								
	Se	5.947		6.345	µg/L			6%	20
B212656-MS4	**Matrix Spike, (2109307-02)**								
	Se	5.947	220.0	229.8	µg/L	102%	75-125		
B212656-MSD4	**Matrix Spike Duplicate, (2109307-02)**								
	Se	5.947	220.0	226.8	µg/L	100%	75-125	1%	20

Method Blanks & Reporting Limits

Batch: B212622
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B212622-BLK1	0.00	µg/L
B212622-BLK2	0.00	µg/L
B212622-BLK3	0.00	µg/L
B212622-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B212622-BLK1	0.00	µg/L
B212622-BLK2	0.00	µg/L
B212622-BLK3	0.00	µg/L
B212622-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B212622-BLK1	0.00	µg/L
B212622-BLK2	0.00	µg/L
B212622-BLK3	0.00	µg/L
B212622-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
B212622-BLK1	0.00	µg/L
B212622-BLK2	0.00	µg/L
B212622-BLK3	0.00	µg/L
B212622-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B212622-BLK1	0.00	µg/L
B212622-BLK2	0.00	µg/L
B212622-BLK3	0.00	µg/L
B212622-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B212622-BLK1	0.00	µg/L
B212622-BLK2	0.00	µg/L
B212622-BLK3	0.00	µg/L
B212622-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B212622-BLK1	0.00	µg/L
B212622-BLK2	0.00	µg/L
B212622-BLK3	0.00	µg/L
B212622-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
B212622-BLK1	0.00	µg/L
B212622-BLK2	0.00	µg/L
B212622-BLK3	0.00	µg/L
B212622-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: Unk Se Sp

Sample	Result	Units
B212622-BLK1	0.00	µg/L
B212622-BLK2	0.00	µg/L
B212622-BLK3	0.00	µg/L
B212622-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Method Blanks & Reporting Limits

Batch: B212656
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B212656-BLK1	0.077	µg/L
B212656-BLK2	0.095	µg/L
B212656-BLK3	0.154	µg/L
B212656-BLK4	0.153	µg/L

Average: 0.120
Limit: 0.480

MDL: 0.150
MRL: 0.480

Sample Containers

Lab ID: 2109307-01
Sample: RG_GANF_WS_GGCAMP_2021-09-15_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/15/2021
Received: 09/23/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Styrofoam Cooler #4 - 2109307
B	XTRA_VOL	15 mL	na	none	na	na	Styrofoam Cooler #4 - 2109307
C	XTRA_VOL	60 mL	na	none	na	na	Styrofoam Cooler #4 - 2109307

Lab ID: 2109307-02
Sample: RG_GANF_WS_GGCAMP_2021-09-15_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/15/2021
Received: 09/23/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109307

Lab ID: 2109307-03
Sample: RG_GANF_WS_GGCAMP_2021-09-15_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/15/2021
Received: 09/23/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109307

Lab ID: 2109307-04
Sample: RG_GAUT_WS_GGCAMP_2021-09-16_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/16/2021
Received: 09/23/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Styrofoam Cooler #4 - 2109307
B	XTRA_VOL	15 mL	na	none	na	na	Styrofoam Cooler #4 - 2109307
C	XTRA_VOL	60 mL	na	none	na	na	Styrofoam Cooler #4 - 2109307

Sample Containers

Lab ID: 2109307-05
Sample: RG_GAUT_WS_GGCAMP_2021-09-16_N+_NAF
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/16/2021
Received: 09/23/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109307

Lab ID: 2109307-06
Sample: RG_GAUT_WS_GGCAMP_2021-09-16_N+_NAF
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/16/2021
Received: 09/23/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Styrofoam Cooler #1 - 2109307

Shipping Containers

Styrofoam Cooler #1 - 2109307

Received: September 23, 2021 7:15
Tracking No: PAPS#RWHV87409 via Courier
Coolant Type: Blue Ice
Temperature: 2.0 °C
Description: Styrofoam Cooler
Damaged in transit? No
Returned to client? No
Comments: IR#30
Custody seals present? No
Custody seals intact? No
COC present? Yes

Styrofoam Cooler #4 - 2109307

Received: September 23, 2021 7:15
Tracking No: PAPS#RWHV87409 via Courier
Coolant Type: Blue Ice
Temperature: 0.5 °C
Description: Styrofoam Cooler
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 1

COC ID:	September GGCAMP	TURNAROUND TIME:	Regular

PROJECT/CLIENT INFO

Facility Name / Job#	REP		
Project Manager	Allie Ferguson		
Email	allie.ferguson@teck.com		
Address	421 Pine Avenue		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	250-910-8755		

LABORATORY

Lab Name	Brooks Applied Labs		
Lab Contact	Ben Wozniak		
Email	ben@brooksapplied.com		
Address	18804 North Creek Parkway		
City	Bothell	Province	WA
Postal Code	98011	Country	USA
Phone Number	206-632-6206		

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	allie.ferguson@teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	monica.barthe@teck.com	X	X	X
Email 4:	lbowron@minnow.ca	X	X	X
Email 5:	awiebe@minnow.ca	X	X	X
Email 5:				
PO number	VPO00748540			

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.	Total Selenium	Dissolved Selenium (F)	Selenium Speciation (F)
RG_GANF_WS_GGCAMP_2021-09-15_N	RG_GANF	WS	No	September 15, 2021	1230	G	1			1
RG_GANF_WS_GGCAMP_2021-09-15_N_NAL	RG_GANF	WS	No	September 15, 2021	1230	G	2	1	1	
RG_GAUT_WS_GGCAMP_2021-09-16_N	RG_GAUT	WS	No	September 16, 2021	1200	G	1			1
RG_GAUT_WS_GGCAMP_2021-09-16_N+_NAF	RG_GAUT	WS	No	September 16, 2021	1200	G	2	1	1	

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

Total and dissolved selenium samples have NOT been preserved. Dissolved selenium have been filtered. Speciation samples have been filtered and frozen.

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Jennifer Ings/Minnow	September 21, 2021	[signature]	9/23/21 @ 0715

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	Jennifer Ings	Mobile #	519-500-3444
Sampler's Signature	[signature]	Date/Time	September 21, 2021

RW HOT SHOT SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

No. 87409

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: Sept 22 - 21

INVOICE TO:

BILL OF LADING #:

PURCHASE ORDER NUMBER: (BAL)

SHIPPER (FROM): Teck Coal Ltd

STREET: West Line Creek Treatment

CITY/PROVINCE: Sparwood, BC

POSTAL CODE: 11:16 AM

CONSIGNEE (TO): Brooks Applied Labs

STREET: 18804 N. Creek Parkway

CITY/PROVINCE: Bothell, WA

POSTAL CODE: 98011

SPECIAL INSTRUCTIONS: 7AM

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
4	Coolers - Water Samples	97 LBS
	PAPS# RWHV87409	

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

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

NOTICE OF CLAIM: [illegible fine print terms and conditions]

SHIPPER PRINT: Rob Beneteau

SHIPPER SIGN: [signature]

CONSIGNEE PRINT: SEAN 7:16 AM

CONSIGNEE SIGN: [signature]

DATE: 09/23/21
TIME: 7:15
NUMBER OF PIECES RECEIVED: 4

GST # 864540398RT0001

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROAD: Shipper

Cooler ID: Styrofoam Cooler # 1 **COC (Y/N):** Y **Temperature:** ~~3~~ 2.0 EE TQ 9/23/21 **IR:** 30

Coolant Type: Ice **Blue Ice** Ambient

Notes:

Sampling Locations:	RG		EN							
Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:	40 ml		40 ml							

Opened By: TQ **Date:** 9/23/21

Effective 7/29/20

COPY

2109307

n 004

STRAIGHT BILL OF LADING NOT NEGOTIABLE

RW HOT SHOT SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

No. 87409

Sparwood, BC / Teltzece, 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: Sept 22-21

PURCHASE ORDER NUMBER

SHIPPER (FROM): Teck Coal Ltd.
STREET: West Line Creek Treatment
CITY/PROVINCE: Sparwood, BC
POSTAL CODE

CONSIGNEE (TO): Brooks Applied Labs
STREET: 18804 N. Creek Parkway
CITY/PROVINCE: Bothell, WA
POSTAL CODE: 98011

SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
4	Coolers - Water Samples	97 LBS

TAPS# RWHV87409

FREIGHT CHARGES
SHIPPER TO CHECK
☐ PREPAID ☐ COLLECT

FEE / WAITING / XPU / CHARGES / FSC / US / SUB TOTAL / GST / TOTAL $

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

Rob Beneiel

CONSIGNEE PRINT: SEAN ZIGAM
CONSIGNEE SIGN

DATE: 09/23/21
TIME: 7:15

GST # 864548390RT0001

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROD: Shipper

Cooler ID: Styrofoam Cooler #: 4 COC (Y/N) Temperature: 0.5 IR: 31

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations:	RG		GH		EV					
Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:		60mL		60mL		60mL				

Opened By: CVL Date: 9/23/21

COPY

Effective 7/29/20 Revision 004

BROOKS APPLIED LABS
18804 North Creek Parkway, Ste 100, Bothell, WA 98011 • USA • T: 206 632 6206 F: 206 632 6017 • info@brooksapplied.com

October 29, 2021

Teck Resources Limited - Vancouver
Allie Ferguson
421 Pine Avenue
Sparwood, B.C. CANADA V0B2G0
allie.ferguson@teck.com

Re: REP

Dear Allie Ferguson,

On October 7, 2021, Brooks Applied Labs (BAL) received two (2) aqueous samples. The samples were logged-in for total recoverable selenium [*Se*], dissolved Se, and Se speciation analyses, according to the chain-of-custody (COC) forms.

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.

In the trace metals digest (Batch B212828), the method blank samples (*B212828-BLK1, B212828-BLK2, B212828-BLK3, and B212828-BLK4*) and reference material samples (*B212828-SRM1, B212828-SRM2, and B212828-SRM3*) contained volumes of 11.0 milliliters (mL) following the heating step of the digestion. The target volume for this stage of the digest is 11.5 mL. All client samples in Batch B212828 yielded the targeted final volumes of 11.5 mL and so did the blank spike samples (B212828-BS1, B212828-BS2, and B212828-BS3). Spike recoveries for the blank spike samples were within acceptable ranges, demonstrating acceptable digest performance. Spike recoveries for the reference material samples were acceptable as well. After the digest, all client samples and QC samples are diluted to a final volume of 12.0 mL prior to analysis. Since blank spike samples and reference material samples yielded acceptable recoveries, the associated results are reported unqualified. No additional corrective actions were necessary.

Se Speciation

Each aqueous sample was analyzed for Se 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 Se species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting Se 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 when 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 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 met 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
Brooks Applied Labs
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), and DoD/DOE (3)

Issued by: ANAB

Issued on: September 21, 2021; Valid to: March 30, 2024

Method	Matrix	ISO and Non-Gov. TNI Accredited Analyte(s)	DoD/DOE Accredited Analytes
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	Ag, Al, As, Ba, Ca, Cd, Cr, Cu, Fe, Pb, Mg, Mn, Ni, Sb, Se, 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)	Not Accredited
EPA 1640 Mod	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn Ag, As, Cr, Co, Se, Tl, V (ISO Only)	Not Accredited
EPA 1631E Mod BAL-3100	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury	Methyl Mercury (excluding Solids/Chemicals)
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic (ISO Only)	Not Accredited
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)	Not Accredited
AOAC 2015.01 Mod BAL-5000	Food	As, Cd, Hg, Pb	Not Accredited
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs	Not Accredited
	Biological by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)	Not Accredited
BAL-4101	Food by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)	Not Accredited
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet	Not Accredited
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)	Not Accredited
SM2340B	Non-Potable Waters	Hardness	Hardness
SM 2540G BAL-0501	Solids/Chemicals & Biological	% Dry Weight	% Dry Weight

(1) ISO/IEC 17025:2017 – Certificate Number ADE-1447.02

(2) Non-Governmental NELAC Institute 2016 Standard – Certificate Number ADE-1447.01

(3) Department of Defense/Energy Consolidated Quality Systems Manual v. 5.3 – Certificate Numbers ADE-1447 for DoD, ADE-1447.03 for DOE.

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
RG_GHP_WS_GGCAMP_2021-09-23_N	2110067-01	WS	Sample	09/23/2021	10/07/2021
RG_GHP_WS_GGCAMP_2021-09-23_N_NAL	2110067-02	WS	Sample	09/23/2021	10/07/2021
RG_GHP_WS_GGCAMP_2021-09-23_N_NAL	2110067-03	WS	Sample	09/23/2021	10/07/2021

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201	10/06/2021	10/07/2021	B212803	S211154
MeSe(IV)	Water	SOP BAL-4201	10/06/2021	10/07/2021	B212803	S211154
MeSe(VI)	Water	SOP BAL-4201	10/06/2021	10/07/2021	B212803	S211154
Se	Water	EPA 1638 Mod	10/08/2021	10/13/2021	B212828	S211178
Se(IV)	Water	SOP BAL-4201	10/06/2021	10/07/2021	B212803	S211154
Se(VI)	Water	SOP BAL-4201	10/06/2021	10/07/2021	B212803	S211154
SeCN	Water	SOP BAL-4201	10/06/2021	10/07/2021	B212803	S211154
SeMet	Water	SOP BAL-4201	10/06/2021	10/07/2021	B212803	S211154
SeSO3	Water	SOP BAL-4201	10/06/2021	10/07/2021	B212803	S211154
Unk Se Sp	Water	SOP BAL-4201	10/06/2021	10/07/2021	B212803	S211154

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
RG_GHP_WS_GGCAMP_2021-09-23_N										
2110067-01	DMSeO	WS	D	0.213		0.010	0.025	µg/L	B212803	S211154
2110067-01	MeSe(IV)	WS	D	0.098		0.010	0.025	µg/L	B212803	S211154
2110067-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212803	S211154
2110067-01	Se(IV)	WS	D	3.52		0.010	0.075	µg/L	B212803	S211154
2110067-01	Se(VI)	WS	D	124		0.010	0.055	µg/L	B212803	S211154
2110067-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B212803	S211154
2110067-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B212803	S211154
2110067-01	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B212803	S211154
2110067-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B212803	S211154
RG_GHP_WS_GGCAMP_2021-09-23_N_NAL										
2110067-02	Se	WS	TR	132		0.165	0.528	µg/L	B212828	S211178
RG_GHP_WS_GGCAMP_2021-09-23_N_NAL										
2110067-03	Se	WS	D	132		0.165	0.528	µg/L	B212828	S211178

Accuracy & Precision Summary

Batch: B212803
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B212803-BS1	**Blank Spike, (2124033)**								
	MeSe(IV)		5.095	5.406	µg/L	106%	75-125		
	Se(IV)		5.000	4.898	µg/L	98%	75-125		
	Se(VI)		5.000	4.712	µg/L	94%	75-125		
	SeCN		5.015	4.754	µg/L	95%	75-125		
	SeMet		4.932	4.850	µg/L	98%	75-125		
B212803-DUP1	**Duplicate, (2110068-01)**								
	DMSeO	0.014		0.014	µg/L			1%	25
	MeSe(IV)	0.019		0.019	µg/L			0.5%	25
	MeSe(VI)	ND		ND	µg/L			N/C	25
	Se(IV)	0.326		0.311	µg/L			5%	25
	Se(VI)	51.28		51.36	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
B212803-MS1	**Matrix Spike, (2110068-01)**								
	Se(IV)	0.326	4.900	4.947	µg/L	94%	75-125		
	Se(VI)	51.28	5.100	54.74	µg/L	NR	75-125		
	SeCN	ND	1.962	1.805	µg/L	92%	75-125		
	SeMet	ND	1.977	1.857	µg/L	94%	75-125		
B212803-MSD1	**Matrix Spike Duplicate, (2110068-01)**								
	Se(IV)	0.326	4.900	4.955	µg/L	94%	75-125	0.1%	25
	Se(VI)	51.28	5.100	54.22	µg/L	NR	75-125	N/C	25
	SeCN	ND	1.962	1.756	µg/L	89%	75-125	3%	25
	SeMet	ND	1.977	1.841	µg/L	93%	75-125	0.9%	25

Accuracy & Precision Summary

Batch: B212828
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B212828-BS1	**Blank Spike, (2104075)**								
	Se		200.0	198.1	µg/L	99%	75-125		
B212828-BS2	**Blank Spike, (2104075)**								
	Se		200.0	184.4	µg/L	92%	75-125		
B212828-BS3	**Blank Spike, (2104075)**								
	Se		200.0	187.0	µg/L	94%	75-125		
B212828-SRM1	**Reference Material (2110009, TMDA 51.5 Reference Standard - Bottle 9 - SRM)**								
	Se		14.30	12.87	µg/L	90%	75-125		
B212828-SRM2	**Reference Material (2110009, TMDA 51.5 Reference Standard - Bottle 9 - SRM)**								
	Se		14.30	12.92	µg/L	90%	75-125		
B212828-SRM3	**Reference Material (2110009, TMDA 51.5 Reference Standard - Bottle 9 - SRM)**								
	Se		14.30	12.77	µg/L	89%	75-125		
B212828-DUP1	**Duplicate, (2110080-11)**								
	Se	30.27		30.11	µg/L			0.5%	20
B212828-MS1	**Matrix Spike, (2110080-11)**								
	Se	30.27	220.0	235.1	µg/L	93%	75-125		
B212828-MSD1	**Matrix Spike Duplicate, (2110080-11)**								
	Se	30.27	220.0	235.6	µg/L	93%	75-125	0.2%	20

Method Blanks & Reporting Limits

Batch: B212803
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B212803-BLK1	0.00	µg/L
B212803-BLK2	0.00	µg/L
B212803-BLK3	0.00	µg/L
B212803-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B212803-BLK1	0.00	µg/L
B212803-BLK2	0.00	µg/L
B212803-BLK3	0.00	µg/L
B212803-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B212803-BLK1	0.00	µg/L
B212803-BLK2	0.00	µg/L
B212803-BLK3	0.00	µg/L
B212803-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
B212803-BLK1	0.00	µg/L
B212803-BLK2	0.00	µg/L
B212803-BLK3	0.00	µg/L
B212803-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B212803-BLK1	0.00	µg/L
B212803-BLK2	0.00	µg/L
B212803-BLK3	0.00	µg/L
B212803-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B212803-BLK1	0.00	µg/L
B212803-BLK2	0.00	µg/L
B212803-BLK3	0.00	µg/L
B212803-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B212803-BLK1	0.00	µg/L
B212803-BLK2	0.00	µg/L
B212803-BLK3	0.00	µg/L
B212803-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		
B212803-BLK1	0.00	µg/L		
B212803-BLK2	0.00	µg/L		
B212803-BLK3	0.00	µg/L		
B212803-BLK4	0.00	µg/L		
	Average: 0.000		**MDL:**	0.002
	Limit: 0.011		**MRL:**	0.011

Analyte: Unk Se Sp

Sample	Result	Units		
B212803-BLK1	0.00	µg/L		
B212803-BLK2	0.00	µg/L		
B212803-BLK3	0.00	µg/L		
B212803-BLK4	0.00	µg/L		
	Average: 0.000		**MDL:**	0.002
	Limit: 0.015		**MRL:**	0.015

18804 North Creek Parkway, Suite 100, Bothell, WA 98011 · P(206) 632-6206 · F(206) 632-6017 · info@brooksapplied.com · www.brooksapplied.com

Method Blanks & Reporting Limits

Batch: B212828
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B212828-BLK1	0.098	µg/L
B212828-BLK2	0.081	µg/L
B212828-BLK3	0.094	µg/L
B212828-BLK4	0.065	µg/L
Average:	0.084	
Limit:	0.480	

MDL: 0.150
MRL: 0.480

Sample Containers

Lab ID: 2110067-01
Sample: RG_GHP_WS_GGCAMP_2021-09-23_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/23/2021
Received: 10/07/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler #1 - 2110067
B	XTRA_VOL	15 mL	na	none	na	na	Cooler #1 - 2110067
C	XTRA_VOL	60 mL	na	none	na	na	Cooler #1 - 2110067

Lab ID: 2110067-02
Sample: RG_GHP_WS_GGCAMP_2021-09-23_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/23/2021
Received: 10/07/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Cooler #1 - 2110067

Lab ID: 2110067-03
Sample: RG_GHP_WS_GGCAMP_2021-09-23_N_NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/23/2021
Received: 10/07/2021

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	60 mL	na	10% HNO3 (BAL)	2127026	<2	Cooler #1 - 2110067

Shipping Containers

Cooler #1 - 2110067

Received: October 7, 2021 7:20
Tracking No: RWHV87445 via Courier
Coolant Type: Ice
Temperature: 4.2 °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

COC ID:	September GGCAMP	TURNAROUND TIME:	Regular

PROJECT/CLIENT INFO

Facility Name / Job#	REP
Project Manager	Allie Ferguson
Email	allie.ferguson@teck.com
Address	421 Pine Avenue
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Country	Canada
Phone Number	250-910-8755

LABORATORY

Lab Name	Brooks Applied Labs
Lab Contact	Ben Wozniak
Email	ben@brooksapplied.com
Address	18804 North Creek Parkway
City	Bothell
Province	WA
Postal Code	98011
Country	USA
Phone Number	206-632-6206

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	allie.ferguson@teck.com	x	x	x
Email 2:	teckcoal@equisonline.com			x
Email 3:	monica.bartha@teck.com	x	x	x
Email 4:	lbowron@minnow.ca	x	x	x
Email 5:	awiebe@minnow.ca	x	x	x
Email 5:				
PO number	VPO00748540			

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.	Total Selenium	Dissolved Selenium (F)	Selenium Speciation (F)
RG_GHP_WS_GGCAMP_2021-09-23_N	RG_GHP	WS	No	September 23, 2021	9:30	G	1			1
RG_GHP_WS_GGCAMP_2021-09-23_N_NAL	RG_GHP	WS	No	September 23, 2021	9:30	G	2	1	1	

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

Total and dissolved selenium samples have NOT been preserved. Dissolved selenium have been filtered. Speciation samples have been filtered and frozen.

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Jennifer Ings/Minnow	September 23, 2021	S.Z. (BAL)	10/7/21 7:20

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	Jennifer Ings	Mobile #	519-500-3444
Sampler's Signature	Jennifer Ings	Date/Time	October 4, 2021

RW HOT SHOT SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

No. 87445

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
BILL OF LADING #	PURCHASE ORDER NUMBER
SHIPPER (FROM)	CONSIGNEE (TO)
STREET	STREET
CITY/PROVINCE / POSTAL CODE	CITY/PROVINCE / POSTAL CODE

SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
PAPS# RWHV87445		

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 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

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROAD: Shipper GST # 864540398RT0001

AMIGOS PRINTING

Cooler ID: Cooler #1 COC (Y/N) Temperature: 4.2 IR: 31

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations: RG | EV

Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:	40mL Glass 125mL Glass	60mL Plastic	125mL Glass	60mL Plastic						

Opened By: S.T. 10/7/21 Date: 10/7/21

Effective 7/29/20

COPY

2110067

CORDILLERA - BENTHIC INVERTEBRATE COMMUNITY

Methods and QC Report 2021

Project ID: GGCAMP (21-52)

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 October 15, 2021, Cordillera Consulting received 3 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_2021-09-23	CC221898	9/23/2021	400µM	1
RG_GHNF_BIC_2_2021-09-23	CC221899	9/23/2021	400µM	2
RG_GHNF_BIC_3_2021-09-23	CC221900	9/23/2021	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_2021-09-23	23-Sep-21	CC221898	15%	354
RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	5%	403
RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	20%	496

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# - CC221899, Percent sampled = 5%, Sieve size = 400				
Diptera		2		
Chironomidae		3		
Plecoptera		5		
Trichoptera		1		
	Total:	**11**	**403**	**97%**

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
221900	RG_GHNF_BIC-3	497	490	477	470	482																RH	540	2416	1.04	5.43	0.25	2.86

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 - 2021, Sample - RG_GHNF_BIC_2_2021-09-23, CC# - CC221899, Percent sampled = 5%, Sieve size = 400	403	0.00	0	0.49627792	0.00496278

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 - 2021, Sample - RG_GHNF_BIC_2_2021-09-23, CC# - CC221899, Percent sampled = 5%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Brillia	4	4						
Capniidae	79	78	No			X		
Chironomidae	17	17						
Chloroperlidae	1	1						
Corynoneura	1	1						
Dicranota	15	15						
Diptera	1	1						
Empididae	2	2						
Heleniella	14	14						

Hydrobaenus	7	6	No			X		
Leuctridae	3	3						
Limnephilidae	6	6						
Limnophyes	1	1						
Micropsectra	40	41	No			X		
Naididae	2	2						
Nemouridae	26	26						
Neoplasta	1	1						
Orthocladius complex	16	17	No			X		
Pagastia	29	29						
Pericoma/Telmatoscopus	36	36						
Perlodidae	16	16						
Plecoptera	1	1						
Plecoptera	1	1						
Pseudodiamesa	6	6						
Skwala	1	1						
Taeniopterygidae	2	2						
Tanypodinae	2	2						
Tvetenia	22	22						
Zapada cinctipes	50	50						
Zapada columbiana	1	1						
Total:	**403**	**403**						
					0	**4**	**0**	
% Total Misidentification Rate =	misidentifications	x100 =	0.00	**Pass**				
	total number							

References

[1] McDermott, H., Paull, T., Strachan, S. (May 2014). Laboratory Methods: Processing, Taxonomy, and Quality Control of Benthic Macroinvertebrate Samples, Environment Canada. ISBN: 978-1-100-25417-3

[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).
http://www.safit.org/Docs/SAFIT_Taxonomic_Literature_Database_1_March_2011.enl

Brook, Arthur R. and Leonard A. Kelton. 1967. Aquatic and semiaquatic Heteroptera of Alberta, Saskatchewan and Manitoba (Hemiptera) Memoirs of the Entomological Society of Canada. No. 51.

Brown HP & White DS (1978) Notes on Seperation and Identification of North American Riffle Beetles (Coleoptera: Dryopidea: Elmidae).Entomological News 89 (1&2): 1-13

Clifford, Hugh F. 1991. Aquatic Invertebrates of Alberta. University of Alberta Press Edmonton, Alberta.

Epler, John. 2001 The Larval Chironomids of North and South Carolina. http://home.earthlink.net/~johnepler/

Epler, John. Identification Manual for the Water Beetles of Florida. http://home.earthlink.net/~johnepler/

Epler, John. Identification Manual for the Aquatic and Semi-aquatic Heteroptera of Florida. http://home.earthlink.net/~johnepler/

Trond Andersen, Peter S. Cranston & John H. Epler (Eds) (2013) Chironomidae of the Holarctic Region: Keys and DIagnoses. Part 1. Larvae. *Insect Systematics and Evolution Supplements* 66: 1-571.

Jacobus, Luke and Pat Randolph. 2005. Northwest Ephemeroptera Nymphs. Manual from Northwest Biological Assessment Working Group. Moscow Idaho 2005. Not Published.

Jacobus LM, McCafferty WP (2004) Revisionary Contributions to the Genus Drunella (Ephemeroptera : Ephemerellidae). Journal of the New York Entomological Society 112: 127-147

Jacobus LM, McCafferty WP (2003) Revisionary Contributions to North American Ephemerella and Serratella (Ephemeroptera : Ephemerellidae). Journal of the New York Entomological Society 111 (4): 174-193.

Kathman,R.D., R.O. Brinkhurst. 1999. Guide to the Freshwater Oligochaetes of North America. Aquatic Resources Center, College Grove, Tennessee.

Larson, D.J., Y. Alarie, R.E. Roughly.2005. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Neararctic Region. NRC-CNRC Research Press. Ottawa.

Merritt, R.W., K.W. Cummins, M. B. Berg. (eds.). 2007. An introduction to the aquatic insects of North America, 4th. Kendall/Hunt, Dubuque, IA

Morihara DK, McCafferty WP (1979) The Baetis Larvae of North American (Ephemeroptera: Baetidae). Transactions of the American Entomological Society 105: 139-221.

Needham, James, M. May, M. Westfall Jr. 2000. Dragonflies of North America. Scientific Publishers. Gainsville FL.

Prescott David, R.C.and Medea M. Curteanu.2004. Survey of Aquatic Gastropods of Alberta. Species at Risk Report No. 104. ISSN: 1496-7146 (Online Edition)

Needham, K. 1996. An Identification Guide to the Nymphal Mayflies of British Columbia. Publication #046 Resource Inventory Committee, Government of British Columbia.

Oliver, Donald R. and Mary E. Roussel. 1983. The Insects and Arachnids of Canada Part 11. The Genera of larval midges of Canada. Biosystematics Research Institute. Ottawa, Ontario. Research Branch, Agriculture Canada. Publication 1746.

Proctor, H. The ‘Top 18’ Water Mite Families in Alberta. Zoology 351. University of Alberta, Edmonton, Alberta.

Rogers, D.C. and M. Hill, 2008. Key to the Freshwater Malacostraca (Crustacea) of the mid-Atlantic Region. EPA-230-R-08-017. US Environmental Protection Agency, Office of Environmental Information, Washington, DC.

Stewart, Kenneth W. and Bill Stark. 2002. The Nymphs of North American Stonefly Genera (Plecoptera). The Caddis Press. Columbus Ohio.

Stewart, Kenneth W. and Mark W. Oswood. 2006 The Stoneflies (Plecoptera) of Alaska and Western Canada. The Caddis Press.

Stonedahl, Gary and John D. Lattin. 1986. The Corixidae of Oregon and Washington (Hemiptera: Heteroptera). Technical Bulletin 150. Oregon State University, Corvalis Oregon.

Thorpe, J. H. and A. P. Covich [Eds.] 1991. Ecology and classification of North American freshwater invertebrates. Academic Press, San Diego.

Tinerella, Paul P. and Ralph W. Gunderson.2005. The Waterboatmen (Insecta: Heteroptera: Corixidae) of Minisota. Publication No.23 Dept. Of Entomology, North Dakota State University, Fargo, North Dakota, USA.

Weiderholm, Torgny (Ed.) 1983. The larvae of Chironomidae (Diptera) of the Holartic region. Entomologica Scaninavica. Supplement No. 19.

Westfall, Minter J. Jr. and May, Michael L. 1996. Damselflies of North America. Scientific Publishers, Gainesville, FL.

Wiggins, Glenn B. 1998. Larvae of the North American Caddisfly Genera (Tricoptera) 2nd ed. University of Toronto Press. Toronto Ontario.

Project: GGCAMP (21-52)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2021	2021	2021
Sample:	RG_GHNF_BIC_1_2021-09-23	RG_GHNF_BIC_2_2021-09-23	RG_GHNF_BIC_3_2021-09-23
Sample Collection Date:	23-Sep-21	23-Sep-21	23-Sep-21
CC#:	CC221898	CC221899	CC221900
Richness Measures			
Species Richness	23	26	21
EPT Richness	9	9	8
Ephemeroptera Richness			
Plecoptera Richness	9	8	7
Trichoptera Richness		1	1
Chironomidae Richness	9	11	6
Oligochaeta Richness		1	1
Non-Chiro. Non-Olig. Richness			
Abundance Measures			
Corrected Abundance	2360	8060	2460
EPT Abundance	1554	3740	1120
Dominance Measures			
1st Dominant Taxon	Capniidae	Capniidae	Pagastia
1st Dominant Abundance	1168	1598	689
2nd Dominant Taxon	Pericoma/Telmatoscopus	Zapada cinctipes	Tvetenia
2nd Dominant Abundance	240	1527	330
3rd Dominant Taxon	Tvetenia	Micropsectra	Capniidae
3rd Dominant Abundance	145	896	307
% 1 Dominant Taxon	49.51%	19.82%	28.00%
% 2 Dominant Taxon	10.17%	18.94%	13.43%
% 3 Dominant Taxon	6.15%	11.11%	12.46%
Percent Dominance	65.83%	49.88%	53.89%
Community Composition			
% Ephemeroptera			
% Plecoptera	65.85%	44.91%	45.12%
% Trichoptera		1.49%	0.41%
% EPT	65.85%	46.40%	45.53%
% Diptera	33.31%	53.10%	53.46%
% Oligochaeta		0.50%	0.61%
% Baetidae			
% Chironomidae	17.75%	39.45%	45.53%
% Odonata			
Functional Group Composition			
% Predators	10.37%	9.54%	10.52%
% Shredder-Herbivores	61.27%	41.51%	39.91%
% Collector-Gatherers	28.36%	48.71%	49.57%
% Scrapers			
% Macrophyte-Herbivore			
% Collector-Filterer			
% Omnivore			
% Parasite			
% Piercer-Herbivore			
% Gatherer			
% Unclassified		0.25%	
Functional Group Richness			
Predators Richness	5	7	4
Shredder-Herbivores Richness	7	6	8
Collector-Gatherers Richness	11	12	9
Scrapers Richness			
MH Richness			
CF Richness			
OM Richness			
PA Richness			
Piercer-Herbivore Richness			
Gatherer Richness			
Unclassified		1	

Project: GGCAMP (21-52)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2021	2021	2021
Sample:	RG_GHNF_BIC_1_2021-09-23	RG_GHNF_BIC_2_2021-09-23	RG_GHNF_BIC_3_2021-09-23
Sample Collection Date:	23-Sep-21	23-Sep-21	23-Sep-21
CC#:	CC221898	CC221899	CC221900
EPA Functional Group Composition			
% Predators			
% Parasite			
% Collector-Gatherers			
% Collector-Filterer			
% Macrophyte-Herbivore			
% Xylophage			
% Scraper			
% Shredder			
% Piercer			
% Omnivore			
% Unclassified			
EPA Functional Group Richness			
Predators			
Parasite			
Collector-Gatherers			
Collector-Filterer			
Macrophyte-Herbivore			
Xylophage			
Scraper			
Shredder			
Piercer			
Omnivore			
Unclassified			
SAFIT Functional Group Composition			
% Predators			
% Parasite			
% Collector-Gatherers			
% Collector-Filterer			
% Macrophyte-Herbivore			
% Periphyton-Herbivore			
% Scraper			
% Shredder			
% Omnivore			
% Unclassified			
SAFIT Functional Group Richness			
Predators			
Parasite			
Collector-Gatherers			
Collector-Filterer			
Macrophyte-Herbivore			
Periphyton-Herbivore			
Scraper			
Shredder			
Omnivore			
Unclassified			
EPA Habitat Composition			
% Clinger			
% Climber			
% Sprawler			
% Burrower			
% Swimmer			
% Diver			
% Skater			
EPA Habitat Richness			
Clinger			
Climber			
Sprawler			
Burrower			
Swimmer			
Diver			
Skater			

Project: GGCAMP (21-52)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2021	2021	2021
Sample:	RG_GHNF_BIC_1_2021-09-23	RG_GHNF_BIC_2_2021-09-23	RG_GHNF_BIC_3_2021-09-23
Sample Collection Date:	23-Sep-21	23-Sep-21	23-Sep-21
CC#:	CC221898	CC221899	CC221900
Voltinism Composition			
% Univoltine	8.90%	23.41%	3.46%
% Semivoltine	0.31%	0.38%	0.21%
% Multivoltine			
Voltinism Richness			
Univoltine	3	4	2
Semivoltine	1	1	1
Multivoltine			
Diversity/Evenness Measures			
Shannon-Weiner H' (log 10)	0.87	1.09	0.99
Shannon-Weiner H' (log 2)	2.90	3.61	3.30
Shannon-Weiner H' (log e)	2.01	2.50	2.28
Simpson's Index (D)	0.27	0.11	0.14
Simpson's Index of Diversity (1 - D)	0.73	0.89	0.86
Simpson's Reciprocal Index (1/D)	3.71	8.82	7.14
Biotic Indices			
Hilsenhoff Biotic Index	2.26	3.36	2.38

Project: GGCAMP (21-52)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2021	2021	2021
Sample:	RG_GHNF_BIC_1_2021-09-23	RG_GHNF_BIC_2_2021-09-23	RG_GHNF_BIC_3_2021-09-23
Sample Collection Date:	23-Sep-21	23-Sep-21	23-Sep-21
CC#:	CC221898	CC221899	CC221900
Sieve Size:	400	400	400
Subsample %:	15	5	20
Phylum: Arthropoda	0	0	0
| Order: Collembola	3	0	2
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Plecoptera	7	2	12
| Family: Capniidae	170	79	58
| Family: Chloroperlidae	0	1	0
Sweltsa	1	0	0
| Family: Leuctridae	3	3	3
| Family: Nemouridae	9	26	35
Zapada	4	0	40
Zapada cinctipes	14	50	0
Zapada columbiana	0	1	1
| Family: Perlodidae	16	16	31
Skwala	1	1	0
| Family: Taeniopterygidae	8	2	42
| Order: Trichoptera	0	0	0
| Family: Limnephilidae	0	6	2
| Order: Diptera	0	1	0
| Family: Chironomidae	14	17	24
| Subfamily: Chironominae	0	0	0
| Tribe: Tanytarsini	0	0	0
Micropsectra	2	40	6
| Subfamily: Diamesinae	0	0	0
| Tribe: Diamesini	0	0	0
Pagastia	13	29	123
Pseudodiamesa	1	6	0
| Subfamily: Orthocladiinae	0	0	0
Brillia	2	4	1
Corynoneura	2	1	0
Heleniella	1	14	0
Hydrobaenus	0	7	0
Limnophyes	3	1	1
Orthocladius complex	8	16	10
Tvetenia	17	22	59
| Subfamily: Tanypodinae	0	2	0
| Family: Dixidae	0	0	0
Dixa	1	0	0
| Family: Empididae	0	2	5
Neoplasta	0	1	2
| Family: Muscidae	0	0	0
Limnophora	2	0	0
| Family: Psychodidae	0	0	0
Pericoma/Telmatoscopus	36	36	14
| Family: Tipulidae	4	0	6
Dicranota	12	15	16
Phylum: Annelida	0	0	0
Subphylum: Clitellata	0	0	0
| Class: Oligochaeta	0	0	0
| Order: Tubificida	0	0	0
| Family: Naididae	0	2	0
Nais	0	0	3
Totals:	**354**	**403**	**496**

Taxa present but not included:

Phylum: Arthropoda	0	0	0
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Diptera	0	0	0
| Family: Cecidomyiidae	1	0	0
Subphylum: Crustacea	0	0	0
| Class: Ostracoda	1	1	1
Phylum: Nemata	0	0	1
Phylum: Platyhelminthes	0	0	0
| Class: Turbellaria	1	0	1
Totals:	**3**	**1**	**3**

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 represented by Genus or Species level identifications.

Project: GGCAMP (21-52)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2021		2021		2021	
Sample:	RG_GHNF_BIC_1_2021-09-23		RG_GHNF_BIC_2_2021-09-23		RG_GHNF_BIC_3_2021-09-23	
Sample Collection Date:	23-Sep-21		23-Sep-21		23-Sep-21	
CC#:	CC221898		CC221899		CC221900	
Sieve Size:	400		400		400	
Subsample %:	15		5		20	
Phylum: Arthropoda	0		0		0	
| Order: Collembola	3		0		2	
Subphylum: Hexapoda	0		0		0	
| Class: Insecta	0		0		0	
| Order: Plecoptera	7	ND	2	ND	12	ND
| Family: Capniidae	170		79		58	
| Family: Chloroperlidae	0		1		0	
Sweltsa	1		0		0	
| Family: Leuctridae	3		3		3	
| Family: Nemouridae	9		26	ND	35	
Zapada	4		0		40	
Zapada cinctipes	14		50		0	
Zapada columbiana	0		1		1	
| Family: Perlodidae	16		16		31	
Skwala	1		1		0	
| Family: Taeniopterygidae	8		2		42	
| Order: Trichoptera	0		0		0	
| Family: Limnephilidae	0		6		2	
| Order: Diptera	0		1		0	
| Family: Chironomidae	14	ND	17	ND	24	ND
| Subfamily: Chironominae	0		0		0	
| Tribe: Tanytarsini	0		0		0	
Micropsectra	2		40		6	
| Subfamily: Diamesinae	0		0		0	
| Tribe: Diamesini	0		0		0	
Pagastia	13		29		123	
Pseudodiamesa	1		6		0	
| Subfamily: Orthocladiinae	0		0		0	
Brillia	2		4		1	
Corynoneura	2		1		0	
Heleniella	1		14		0	
Hydrobaenus	0		7		0	
Limnophyes	3		1		1	
Orthocladius complex	8		16		10	
Tvetenia	17		22		59	
| Subfamily: Tanypodinae	0		2		0	
| Family: Dixidae	0		0		0	
Dixa	1		0		0	
| Family: Empididae	0		2		5	
Neoplasta	0		1		2	
| Family: Muscidae	0		0		0	
Limnophora	2		0		0	
| Family: Psychodidae	0		0		0	
Pericoma/Telmatoscopus	36		36		14	
| Family: Tipulidae	4	ND	0		6	
Dicranota	12		15		16	
Phylum: Annelida	0		0		0	
Subphylum: Clitellata	0		0		0	
| Class: Oligochaeta	0		0		0	
| Order: Tubificida	0		0		0	
| Family: Naididae	0		2		0	
Nais	0		0		3	
Totals:	**354**		**403**		**496**	

Taxa present but not included:

Phylum: Arthropoda	0	0	0
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Diptera	0	0	0
| Family: Cecidomyiidae	1	0	0
Subphylum: Crustacea	0	0	0
| Class: Ostracoda	1	1	1
Phylum: Nemata	0	0	1
Phylum: Platyhelminthes	0	0	0
| Class: Turbellaria	1	0	1
Totals:	**3**	**1**	**3**

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 represented by Genus or Species level identifications.

Project: GGCAMP (21-52)

Minnow Environmental (BC)

Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

		Total from Sample	**Percent Efficiency**
Site - QC, Sample - QC 1, CC# - CC221899, Percent sampled = 5%, Sieve size = 400			
Diptera	2		
Chironomidae	3		
Plecoptera	5		
Trichoptera	1		
Total:	**11**	**403**	**97%**

Project: GGCAMP (21-52)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Phylum	Sub Phylum	Class	Order	Family	Subfamily	Tribe	Taxonomy	ITIS Code	Voltinism	Functional Feeding Group	Maturity	Name	ND	Site	Sample	Date	CC#	Count	Percent Sampled	Seive Size
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae				127917			Pupa	Chironomidae	ND	2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	14	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Micropsectra	129890		CG	Larvae	Micropsectra		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	2	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesini	Pagastia	128401		CG	Larvae	Pagastia		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	13	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesini	Pseudodiamesa	128416		CG	Larvae	Pseudodiamesa		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	1	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Brillia	128477		SH	Larvae	Brillia		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	2	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Heleniella	128730		CG	Larvae	Heleniella		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	1	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Limnophyes	128776		CG	Larvae	Limnophyes		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	3	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Orthocladius complex	128874A		CG	Larvae	Orthocladius complex		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	8	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Tvetenia	129197		CG	Larvae	Tvetenia		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	17	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Corynoneura	128563		CG	Larvae	Corynoneura		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	2	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Dixidae			Dixa	125810		CG	Larvae	Dixa		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	1	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Muscidae			Limnophora	150730		P	Larvae	Limnophora		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	2	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Psychodidae			Pericoma/Telmatoscopus	125351A		CG	Larvae	Pericoma/Telmatoscopus		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	36	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Tipulidae				118840		SH	Juvenile/Damaged	Tipulidae	ND	2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	4	15	400
Arthropoda	Hexapoda	Insecta	Diptera	Tipulidae			Dicranota	121027	UV	P	Larvae	Dicranota		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	12	15	400
Arthropoda	Hexapoda	Insecta	Plecoptera					102467	Unclassified		Adult	Plecoptera	ND	2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	1	15	400
Arthropoda	Hexapoda	Insecta	Plecoptera					102467	Unclassified		Juvenile/Damaged	Plecoptera	ND	2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	6	15	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Capniidae				102643	Unclassified	SH	Juvenile/Damaged	Capniidae		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	170	15	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Chloroperlidae			Sweltsa	103273	SV	P	Larvae	Sweltsa		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	1	15	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Leuctridae				102840	Unclassified	SH	Juvenile/Damaged	Leuctridae		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	3	15	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Nemouridae				102517	Unclassified	SH	Juvenile/Damaged	Nemouridae		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	9	15	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Nemouridae			Zapada cinctipes	102594	UV	SH	Larvae	Zapada cinctipes		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	14	15	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Perlodidae				102994	Unclassified	P	Juvenile/Damaged	Perlodidae		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	16	15	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Perlodidae			Skwala	103102	UV	P	Larvae	Skwala		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	1	15	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Nemouridae			Zapada	102591	Unclassified	SH	Larvae	Zapada		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	4	15	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Taeniopterygidae				102788	Unclassified	SH	Juvenile/Damaged	Taeniopterygidae		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	8	15	400
Arthropoda			Collembola					99237		CG	None	Collembola		2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	3	15	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Perlodidae				102994	Unclassified	P	Juvenile/Damaged	Perlodidae		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	16	5	400
Arthropoda	Hexapoda	Insecta	Trichoptera	Limnephilidae				115933	Unclassified	CG	Juvenile/Damaged	Limnephilidae		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	6	5	400
Annelida	Clitellata	Oligochaeta	Tubificida	Naididae				68854		CG	None	Naididae		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	2	5	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Perlodidae			Skwala	103102	UV	P	Larvae	Skwala		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	1	5	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Taeniopterygidae				102788	Unclassified	SH	Juvenile/Damaged	Taeniopterygidae		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	2	5	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Nemouridae			Zapada cinctipes	102594	UV	SH	Larvae	Zapada cinctipes		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	50	5	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Nemouridae			Zapada columbiana	102596	SV	SH	Larvae	Zapada columbiana		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	1	5	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Nemouridae				102517	Unclassified	SH	Juvenile/Damaged	Nemouridae	ND	2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	26	5	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Leuctridae				102840	Unclassified	SH	Juvenile/Damaged	Leuctridae		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	3	5	400
Arthropoda	Hexapoda	Insecta	Plecoptera					102467	Unclassified		Adult	Plecoptera	ND	2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	1	5	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Chloroperlidae				103202	Unclassified	P	Juvenile/Damaged	Chloroperlidae		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	1	5	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Capniidae				102643	Unclassified	SH	Juvenile/Damaged	Capniidae		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	79	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Tipulidae			Dicranota	121027	UV	P	Larvae	Dicranota		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	15	5	400
Arthropoda	Hexapoda	Insecta	Plecoptera					102467	Unclassified		Juvenile/Damaged	Plecoptera	ND	2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	1	5	400

Project: GGCAMP (21-52)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Phylum	Sub Phylum	Class	Order	Family	Subfamily	Tribe	Taxonomy	ITIS Code	Voltinism	Functional Feeding Group	Maturity	Name	ND	Site	Sample	Date	CC#	Count	Percent Sampled	Seive Size
Arthropoda	Hexapoda	Insecta	Diptera	Psychodidae			Pericoma/Telmatoscopus	125351A		CG	Larvae	Pericoma/Telmatoscopus		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	36	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Empididae				135830	UV	P	Pupa	Empididae		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	2	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Empididae			Neoplasta	136352		P	Larvae	Neoplasta		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	1	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Corynoneura	128563		CG	Larvae	Corynoneura		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	1	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Tanypodinae			127994		P	Juvenile/Damaged	Tanypodinae		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	2	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Orthocladius complex	128874A		CG	Larvae	Orthocladius complex		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	16	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Tvetenia	129197		CG	Larvae	Tvetenia		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	22	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Hydrobaenus	128750		CG	Larvae	Hydrobaenus		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	7	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Limnophyes	128776		CG	Larvae	Limnophyes		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	1	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Brillia	128477		SH	Larvae	Brillia		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	4	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Heleniella	128730		CG	Larvae	Heleniella		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	14	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesini	Pseudodiamesa	128416		CG	Larvae	Pseudodiamesa		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	6	5	400
Arthropoda	Hexapoda	Insecta	Diptera					118831			Juvenile/Damaged	Diptera		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	1	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Micropsectra	129890		CG	Larvae	Micropsectra		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	40	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesini	Pagastia	128401		CG	Larvae	Pagastia		2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	29	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae				127917			Pupa	Chironomidae	ND	2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	17	5	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae				127917			Pupa	Chironomidae	ND	2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	24	20	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Chironominae	Tanytarsini	Micropsectra	129890		CG	Larvae	Micropsectra		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	6	20	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Diamesinae	Diamesini	Pagastia	128401		CG	Larvae	Pagastia		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	123	20	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Brillia	128477		SH	Larvae	Brillia		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	1	20	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Limnophyes	128776		CG	Larvae	Limnophyes		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	1	20	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Tvetenia	129197		CG	Larvae	Tvetenia		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	59	20	400
Arthropoda	Hexapoda	Insecta	Diptera	Chironomidae	Orthocladiinae		Orthocladius complex	128874A		CG	Larvae	Orthocladius complex		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	10	20	400
Arthropoda	Hexapoda	Insecta	Diptera	Empididae			Neoplasta	136352		P	Larvae	Neoplasta		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	2	20	400
Arthropoda	Hexapoda	Insecta	Diptera	Empididae				135830	UV	P	Pupa	Empididae	ND	2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	4	20	400
Arthropoda	Hexapoda	Insecta	Diptera	Empididae				135830	UV	P	Juvenile/Damaged	Empididae		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	1	20	400
Arthropoda	Hexapoda	Insecta	Diptera	Psychodidae			Pericoma/Telmatoscopus	125351A		CG	Larvae	Pericoma/Telmatoscopus		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	14	20	400
Arthropoda	Hexapoda	Insecta	Diptera	Tipulidae				118840		SH	Juvenile/Damaged	Tipulidae		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	6	20	400
Arthropoda	Hexapoda	Insecta	Plecoptera					102467	Unclassified		Juvenile/Damaged	Plecoptera	ND	2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	12	20	400
Arthropoda	Hexapoda	Insecta	Diptera	Tipulidae			Dicranota	121027	UV	P	Larvae	Dicranota		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	16	20	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Capniidae				102643	Unclassified	SH	Juvenile/Damaged	Capniidae		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	58	20	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Leuctridae				102840	Unclassified	SH	Juvenile/Damaged	Leuctridae		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	3	20	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Nemouridae				102517	Unclassified	SH	Juvenile/Damaged	Nemouridae		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	35	20	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Nemouridae			Zapada columbiana	102596	SV	SH	Larvae	Zapada columbiana		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	1	20	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Perlodidae				102994	Unclassified	P	Juvenile/Damaged	Perlodidae		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	31	20	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Taeniopterygidae				102788	Unclassified	SH	Juvenile/Damaged	Taeniopterygidae		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	42	20	400
Arthropoda	Hexapoda	Insecta	Plecoptera	Nemouridae			Zapada	102591	Unclassified	SH	Larvae	Zapada		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	40	20	400
Annelida	Clitellata	Oligochaeta	Tubificida	Naididae			Nais	68946		CG	None	Nais		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	3	20	400
Arthropoda	Hexapoda	Insecta	Trichoptera	Limnephilidae				115933	Unclassified	CG	Juvenile/Damaged	Limnephilidae		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	2	20	400
Arthropoda			Collembola					99237		CG	None	Collembola		2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	2	20	400

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 represented by Genus or Species level identifications.

Project: GGCAMP (21-52)
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)	GGCAMP (21-52)	2021	RG_GHNF_BIC_1_2021-09-23	23-Sep-21	CC221898	15%	354
Minnow Environmental (BC)	GGCAMP (21-52)	2021	RG_GHNF_BIC_2_2021-09-23	23-Sep-21	CC221899	5%	403
Minnow Environmental (BC)	GGCAMP (21-52)	2021	RG_GHNF_BIC_3_2021-09-23	23-Sep-21	CC221900	20%	496

Project: GGCAMP (21-52)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

	Functional Feeding Groups	Abbreviation	ITIS Number	Tolerance	Voltinism
Phylum: Arthropoda	Unclassified		82696		
| Order: Collembola	Collector-Gatherer	CG	99237	10	
Subphylum: Hexapoda	Unclassified		563886		
| Class: Insecta	Unclassified		99208		
| Order: Plecoptera	Unclassified		102467		Unclassified
| Family: Capniidae	Shredder-Herbivore	SH	102643	1	Unclassified
| Family: Chloroperlidae	Predator	P	103202	1	Unclassified
Sweltsa	Predator	P	103273	1	SV
| Family: Leuctridae	Shredder-Herbivore	SH	102840		Unclassified
| Family: Nemouridae	Shredder-Herbivore	SH	102517	2	Unclassified
Zapada	Shredder-Herbivore	SH	102591	2	Unclassified
Zapada cinctipes	Shredder-Herbivore	SH	102594	2	UV
Zapada columbiana	Shredder-Herbivore	SH	102596	2	SV
| Family: Perlodidae	Predator	P	102994	2	Unclassified
Skwala	Predator	P	103102	2	UV
| Family: Taeniopterygidae	Shredder-Herbivore	SH	102788	2	Unclassified
| Order: Trichoptera	Unclassified		115095		
| Family: Limnephilidae	Collector-Gatherer	CG	115933	4	Unclassified
| Order: Diptera	Unclassified		118831		
| 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	
Heleniella	Collector-Gatherer	CG	128730	6	
Hydrobaenus	Collector-Gatherer	CG	128750	8	
Limnophyes	Collector-Gatherer	CG	128776	8	
Orthocladius complex	Collector-Gatherer	CG	128874A	6	
Tvetenia	Collector-Gatherer	CG	129197	5	
| Subfamily: Tanypodinae	Predator	P	127994	7	
| Family: Dixidae	Unclassified		125809	2	
Dixa	Collector-Gatherer	CG	125810	2	
| Family: Empididae	Predator	P	135830	6	UV
Neoplasta	Predator	P	136352	6	
| Family: Muscidae	Predator	P	150025	6	
Limnophora	Predator	P	150730	6	
| 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
Phylum: Annelida	Unclassified		64357		
Subphylum: Clitellata	Unclassified		568832		
| Class: Oligochaeta	Collector-Gatherer	CG	68422	5	
| Order: Tubificida	Unclassified		68498		
| Family: Naididae	Collector-Gatherer	CG	68854	10	
Nais	Collector-Gatherer	CG	68946	10	

Taxa present but not included:

Phylum: Arthropoda	Unclassified		82696		
Subphylum: Hexapoda	Unclassified		563886		
| Class: Insecta	Unclassified		99208		
| Order: Diptera	Unclassified		118831		
| Family: Cecidomyiidae	Unclassified		122975		
Subphylum: Crustacea	Collector-Gatherer	CG	83677	8	
| Class: Ostracoda	Collector-Gatherer	CG	84195	8	
Phylum: Nemata	Shredder-Herbivore	SH	563956		
Phylum: Platyhelminthes	Unclassified		53963	8	
| Class: Turbellaria	Predator	P	53964	4	

Project: GGCAMP (21-52)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2021	2021	2021
Sample:	RG_GHNF_BIC_1_2021-09-23	RG_GHNF_BIC_2_2021-09-23	RG_GHNF_BIC_3_2021-09-23
Sample Collection Date:	23-Sep-21	23-Sep-21	23-Sep-21
CC#:	CC221898	CC221899	CC221900
Phylum: Arthropoda	0	0	0
| Order: Collembola	20	0	10
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Plecoptera	47	40	60
| Family: Capniidae	1133	1580	290
| Family: Chloroperlidae	7	20	0
| Family: Leuctridae	20	60	15
| Family: Nemouridae	180	1540	380
| Family: Perlodidae	114	340	155
| Family: Taeniopterygidae	53	40	210
| Order: Trichoptera	0	0	0
| Family: Limnephilidae	0	120	10
| Order: Diptera	0	20	0
| Family: Chironomidae	419	3180	1120
| Family: Dixidae	7	0	0
| Family: Empididae	0	60	35
| Family: Muscidae	13	0	0
| Family: Psychodidae	240	720	70
| Family: Tipulidae	107	300	110
Phylum: Annelida	0	0	0
Subphylum: Clitellata	0	0	0
| Class: Oligochaeta	0	0	0
| Order: Tubificida	0	0	0
| Family: Naididae	0	40	15
Totals:	**2360**	**8060**	**2480**

Taxa present but not included:

Phylum: Arthropoda	0	0	0
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Diptera	0	0	0
| Family: Cecidomyiidae	7	0	0
Subphylum: Crustacea	0	0	0
| Class: Ostracoda	7	20	5
Phylum: Nemata	0	0	5
Phylum: Platyhelminthes	0	0	0
| Class: Turbellaria	7	0	5
Totals:	**21**	**20**	**15**

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 represented by Genus or Species level identifications.

Project: GGCAMP (21-52)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2021	2021	2021
Sample:	RG_GHNF_BIC_1_2021-09-23	RG_GHNF_BIC_2_2021-09-23	RG_GHNF_BIC_3_2021-09-23
Sample Collection Date:	23-Sep-21	23-Sep-21	23-Sep-21
CC#:	CC221898	CC221899	CC221900
Phylum: Arthropoda	0	0	0
| Order: Collembola	20	0	10
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Plecoptera	47	40	60
| Family: Capniidae	1133	1580	290
| Family: Chloroperlidae	0	20	0
Sweltsa	7	0	0
| Family: Leuctridae	20	60	15
| Family: Nemouridae	60	520	175
Zapada	27	0	200
Zapada cinctipes	93	1000	0
Zapada columbiana	0	20	5
| Family: Perlodidae	107	320	155
Skwala	7	20	0
| Family: Taeniopterygidae	53	40	210
| Order: Trichoptera	0	0	0
| Family: Limnephilidae	0	120	10
| Order: Diptera	0	20	0
| Family: Chironomidae	93	340	120
| Subfamily: Chironominae	0	0	0
| Tribe: Tanytarsini	0	0	0
Micropsectra	13	800	30
| Subfamily: Diamesinae	0	0	0
| Tribe: Diamesini	0	0	0
Pagastia	87	580	615
Pseudodiamesa	7	120	0
| Subfamily: Orthocladiinae	0	0	0
Brillia	13	80	5
Corynoneura	13	20	0
Heleniella	7	280	0
Hydrobaenus	0	140	0
Limnophyes	20	20	5
Orthocladius complex	53	320	50
Tvetenia	113	440	295
| Subfamily: Tanypodinae	0	40	0
| Family: Dixidae	0	0	0
Dixa	7	0	0
| Family: Empididae	0	40	25
Neoplasta	0	20	10
| Family: Muscidae	0	0	0
Limnophora	13	0	0
| Family: Psychodidae	0	0	0
Pericoma/Telmatoscopus	240	720	70
| Family: Tipulidae	27	0	30
Dicranota	80	300	80
Phylum: Annelida	0	0	0
Subphylum: Clitellata	0	0	0
| Class: Oligochaeta	0	0	0
| Order: Tubificida	0	0	0
| Family: Naididae	0	40	0
Nais	0	0	15
Totals:	**2360**	**8060**	**2480**

Taxa present but not included:

Phylum: Arthropoda	0	0	0
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Diptera	0	0	0
| Family: Cecidomyiidae	7	0	0
Subphylum: Crustacea	0	0	0
| Class: Ostracoda	7	20	5
Phylum: Nemata	0	0	5
Phylum: Platyhelminthes	0	0	0
| Class: Turbellaria	7	0	5
Totals:	**21**	**20**	**15**

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 represented by Genus or Species level identifications.

Invoice

Number: SI-220056
Reference: GGCAMP (21-52)
Issued: 12/07/2021
Due: 01/06/2022

Deliver To
BC V8T 2A2

Minnow Environmental
BC V8T 2A2

Cordillera Consulting
PO Box 1202, Unit 1 - 13216 Henry Ave
SUMMERLAND BC V0H 1Z0
Canada

www.cordilleraconsulting.ca
250-494-7553
scottfinlayson@cordilleraconsulting.ca

GST/HST 831642491 RT 0001

Item		Qty	Price	Sales Tax	Amount
0001	A Sorting and Taxonomic Analysis to Genus/Species Level	3.00	325.00	GST 5.00%	975.00
0021	EEM Subsample QC	4.00	100.00	GST 5.00%	400.00

Subtotal	1,375.00
GST 5.00%	68.75
Invoice Total	**1,443.75**
Total to Pay	**$1,443.75**

Terms and Conditions
Payments can be made by direct deposit or check to
Cordillera Consulting Inc.
Unit 1 - 13216 Henry Ave
Box 1202
Summerland, BC
V0H 1Z0
GST No. 831642491

CORDILLERA CONSULTING
FRESHWATER INVERTEBRATE TAXONOMY

Project: GGCAMP (21-52)

Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

	Client	Project	Site	Sample	CC#	Date	Size	# of Jars
1	Minnow Environmental (BC)	GGCAMP (21-52)	2021	RG_GHNF_BIC_1_2021-09-23	CC221898	9/23/2021	400µM	1
2	Minnow Environmental (BC)	GGCAMP (21-52)	2021	RG_GHNF_BIC_2_2021-09-23	CC221899	9/23/2021	400µM	2
3	Minnow Environmental (BC)	GGCAMP (21-52)	2021	RG_GHNF_BIC_3_2021-09-23	CC221900	9/23/2021	400µM	1

TRICHANALYTICS -
BENTHIC INVERTEBRATE
TISSUE

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client: Amy Wiebe
Aquatic Scientist
Minnow Environmental
Phone: (250) 595-1627
Email: awiebe@teck.com / awiebe@minnow.ca

Date Received:	28 Sep 2021
Date of Analysis:	17 Oct 2021
Final Report Date:	20 Oct 2021
Rev 02 Issued:	22 Oct 2021
Project No.:	2021-265
Method No.:	MET-002.05

Client Project: GGCAMP (21-52) (PO 750554)

Analytical Request: Composite-Taxa Benthic Invertebrate Tissue (total metals and moisture) - 24 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 108% (ranging from 104-110%).
Sample ID # 605 is clams only (ID # RG_GHP_INV-1_2021-09-22).
Report Rev02 includes the following changes to sample IDs, as per client request:

- Sample ID # 606a is clams only & assigned as RG_GHP_INVBIV-3_2021-09-22.
- Sample ID # 606b is all other benthic invertebrate tissues & assigned as RG_GHP_INV-3_2021-09-22.
- Sample ID # 607a is clams only & assigned as RG_GHP_INVBIV-5_2021-09-23.
- Sample ID # 607b is all other benthic invertebrate tissues & assigned as RG_GHP_INV-5_2021-09-23.

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 — Date: 22 Oct 2021

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_2021-09-15	RG_GAUT_INV-1_2021-09-16	RG_GAUT_INV-2_2021-09-16	RG_GAUT_INV-3_2021-09-16	RG_GHBP_INV-1_2021-09-14
		Lab ID	586	587	588	589	590
		Wet Weight (g)	0.5952	0.2086	0.1892	0.3416	0.3567
		Dry Weight (g)	0.1792	0.0418	0.0388	0.0495	0.0715
		Moisture (%)	69.9	80.0	79.5	85.5	80.0
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.009	0.030	0.767	2.8	5.2	4.5	3.1
11B	0.102	0.340	1.6	6.4	15	17	2.4
23Na	1.4	4.7	4,285	4,988	5,078	10,209	4,905
24Mg	0.024	0.080	1,906	1,501	2,384	2,626	3,188
27Al	0.058	0.193	1,164	6,541	14,715	13,927	1,506
31P	32	107	11,621	10,741	13,436	9,501	11,315
39K	2.0	6.7	10,182	12,441	17,449	21,859	11,045
44Ca	17	57	5,808	3,442	5,141	4,859	83,627
49Ti	0.116	0.387	70	373	990	841	102
51V	0.072	0.240	1.9	7.4	21	18	2.3
52Cr	0.184	0.613	6.0	21	31	28	7.4
55Mn	0.007	0.023	43	120	325	115	27
57Fe	0.906	3.0	448	1,574	3,922	4,001	552
59Co	0.010	0.033	0.511	1.9	3.8	3.8	0.806
60Ni	0.047	0.157	13	41	57	61	24
63Cu	0.010	0.033	16	31	28	18	64
66Zn	0.227	0.757	146	185	255	137	74
75As	0.423	1.4	<0.423	0.818	1.2	1.2	1.8
77Se	0.378	1.3	4.8	3.9	5.1	3.9	21
88Sr	0.001	0.003	9.8	13	23	21	80
95Mo	0.001	0.003	0.287	0.653	0.993	1.3	0.679
107Ag	0.001	0.003	0.143	0.184	0.273	0.136	0.715
111Cd	0.044	0.147	0.458	1.9	4.0	1.3	0.671
118Sn	0.027	0.090	0.218	1.0	1.9	0.906	0.481
121Sb	0.004	0.013	0.053	0.258	0.495	0.432	0.057
137Ba	0.001	0.003	59	123	281	265	147
202Hg	0.026	0.087	0.109	0.093	0.116	0.101	0.054
205Tl	0.001	0.003	0.041	0.103	0.204	0.208	0.120
208Pb	0.001	0.003	0.340	1.2	2.6	2.4	0.277
238U	0.001	0.003	0.059	0.161	0.359	0.407	0.272

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_GHBP_INV-2_2021-09-14	RG_GHBP_INV-3_2021-09-14	RG_GANF_INV-2_2021-09-15	RG_GANF_INV-3_2021-09-16	RG_GHFF_INV-1_2021-09-09
		Lab ID	591	592	593	594	595
		Wet Weight (g)	0.5314	0.3492	0.4483	0.1261	0.1870
		Dry Weight (g)	0.1004	0.0724	0.1103	0.0283	0.0335
		Moisture (%)	81.1	79.3	75.4	77.6	82.1
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.009	0.030	2.7	2.3	0.600	1.5	1.2
11B	0.102	0.340	2.1	1.5	1.2	3.1	1.6
23Na	1.4	4.7	6,472	5,091	2,228	3,183	5,928
24Mg	0.024	0.080	2,769	3,019	1,556	2,533	2,841
27Al	0.058	0.193	977	878	766	2,867	965
31P	32	107	12,447	12,659	10,625	13,497	15,742
39K	2.0	6.7	13,656	11,908	8,016	13,301	14,794
44Ca	17	57	39,060	57,497	4,870	16,862	11,361
49Ti	0.116	0.387	57	49	44	196	67
51V	0.072	0.240	1.8	1.4	1.1	3.9	1.3
52Cr	0.184	0.613	6.9	7.8	8.7	28	7.7
55Mn	0.007	0.023	47	39	39	45	36
57Fe	0.906	3.0	479	428	373	1,276	435
59Co	0.010	0.033	0.557	0.720	0.585	2.5	0.330
60Ni	0.047	0.157	23	23	15	56	22
63Cu	0.010	0.033	50	50	16	22	17
66Zn	0.227	0.757	157	96	152	113	176
75As	0.423	1.4	1.2	1.3	<0.423	0.961	<0.423
77Se	0.378	1.3	34	24	3.8	5.0	14
88Sr	0.001	0.003	42	61	5.6	15	9.1
95Mo	0.001	0.003	0.601	0.496	0.209	0.655	0.335
107Ag	0.001	0.003	0.606	0.538	0.129	0.234	0.117
111Cd	0.044	0.147	0.763	0.549	0.671	0.907	0.488
118Sn	0.027	0.090	0.422	0.343	0.376	1.9	1.1
121Sb	0.004	0.013	0.070	0.053	0.053	0.125	0.058
137Ba	0.001	0.003	78	98	27	77	33
202Hg	0.026	0.087	0.085	0.047	0.081	0.054	0.068
205Tl	0.001	0.003	0.127	0.122	0.035	0.107	0.041
208Pb	0.001	0.003	0.308	0.201	0.228	0.585	0.315
238U	0.001	0.003	0.141	0.124	0.044	0.133	0.209

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_GHFF_INV-2_2021-09-09	RG_GHFF_INV-3_2021-09-10	RG_GHFF_INVLUM-1_2021-09-10	RG_GHUT_INV-1_2021-09-13	RG_GHUT_INV-2_2021-09-13
		Lab ID	596	597	598	599	600
		Wet Weight (g)	0.0884	0.1420	0.0124	0.1856	0.1888
		Dry Weight (g)	0.0194	0.0286	0.0049	0.0395	0.0320
		Moisture (%)	78.1	79.9	60.5	78.7	83.1
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.009	0.030	1.2	1.3	0.342	1.7	2.1
11B	0.102	0.340	1.9	2.6	0.117	2.8	3.8
23Na	1.4	4.7	5,098	3,973	5,043	5,109	4,785
24Mg	0.024	0.080	2,847	3,155	2,469	3,073	2,996
27Al	0.058	0.193	1,220	2,058	59	3,944	4,933
31P	32	107	12,935	13,083	10,814	15,254	14,261
39K	2.0	6.7	13,541	13,943	8,402	15,637	14,627
44Ca	17	57	9,154	15,104	5,611	7,889	9,146
49Ti	0.116	0.387	85	147	3.8	284	389
51V	0.072	0.240	2.1	2.7	0.266	5.3	8.0
52Cr	0.184	0.613	16	20	7.3	9.3	20
55Mn	0.007	0.023	29	28	13	49	61
57Fe	0.906	3.0	678	863	192	1,243	1,524
59Co	0.010	0.033	0.911	1.3	0.339	1.6	2.3
60Ni	0.047	0.157	40	51	12	27	47
63Cu	0.010	0.033	18	19	14	32	43
66Zn	0.227	0.757	164	151	174	238	218
75As	0.423	1.4	0.494	0.522	<0.423	1.1	0.961
77Se	0.378	1.3	8.4	8.4	13	7.9	7.5
88Sr	0.001	0.003	7.4	9.1	8.2	7.1	8.7
95Mo	0.001	0.003	0.251	0.223	0.139	0.474	0.502
107Ag	0.001	0.003	0.135	0.216	0.171	0.099	0.135
111Cd	0.044	0.147	0.436	0.418	2.0	3.8	3.6
118Sn	0.027	0.090	0.630	1.3	0.256	1.1	1.1
121Sb	0.004	0.013	0.068	0.100	0.024	0.166	0.223
137Ba	0.001	0.003	29	56	19	49	61
202Hg	0.026	0.087	0.041	0.072	0.081	0.081	0.072
205Tl	0.001	0.003	0.038	0.049	0.009	0.116	0.126
208Pb	0.001	0.003	0.637	0.401	0.044	1.1	1.5
238U	0.001	0.003	0.215	0.287	0.018	0.241	0.307

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_GHUT_INV-3_2021-09-13	RG_GHNF_INV-1_2021-09-10	RG_GHNF_INV-2_2021-09-10	RG_GHNF_INV-3_2021-09-11	RG_GHP_INV-1_2021-09-22
		Lab ID	601	602	603	604	605
		Wet Weight (g)	0.2080	0.2392	0.1908	0.1149	0.3351
		Dry Weight (g)	0.0421	0.0415	0.0307	0.0179	0.1076
		Moisture (%)	79.8	82.7	83.9	84.4	67.9
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.009	0.030	1.5	1.3	1.1	0.914	1.9
11B	0.102	0.340	1.6	1.1	1.6	1.0	5.2
23Na	1.4	4.7	6,161	4,797	4,968	3,061	924
24Mg	0.024	0.080	3,083	3,243	2,625	2,606	1,267
27Al	0.058	0.193	2,245	1,211	1,089	1,059	5,711
31P	32	107	15,069	14,220	13,850	12,973	1,187
39K	2.0	6.7	15,451	12,196	13,164	9,905	1,942
44Ca	17	57	4,946	10,478	6,189	9,311	215,780
49Ti	0.116	0.387	181	89	69	58	475
51V	0.072	0.240	3.2	2.0	2.1	1.7	11
52Cr	0.184	0.613	9.0	7.5	5.3	6.0	77
55Mn	0.007	0.023	43	42	32	29	38
57Fe	0.906	3.0	672	457	369	359	3,218
59Co	0.010	0.033	1.6	0.642	0.447	0.384	4.2
60Ni	0.047	0.157	24	20	21	17	138
63Cu	0.010	0.033	39	17	16	17	9.6
66Zn	0.227	0.757	178	147	135	220	26
75As	0.423	1.4	0.576	0.615	0.615	0.643	0.951
77Se	0.378	1.3	7.9	10	11	10	12
88Sr	0.001	0.003	3.8	6.0	5.4	4.8	181
95Mo	0.001	0.003	0.418	0.290	0.232	0.203	0.406
107Ag	0.001	0.003	0.117	0.050	0.084	0.092	0.218
111Cd	0.044	0.147	2.9	1.5	1.2	0.689	0.517
118Sn	0.027	0.090	0.851	0.909	0.877	1.3	0.642
121Sb	0.004	0.013	0.105	0.058	0.061	0.052	0.244
137Ba	0.001	0.003	23	22	17	19	169
202Hg	0.026	0.087	0.072	0.035	0.052	0.087	0.052
205Tl	0.001	0.003	0.087	0.068	0.066	0.101	0.084
208Pb	0.001	0.003	0.758	0.285	0.251	0.243	1.4
238U	0.001	0.003	0.208	0.201	0.273	0.191	0.385

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_GHP_INVBIV-3_2021-09-22	RG_GHP_INV-3_2021-09-22	RG_GHP_INVBIV-5_2021-09-23	RG_GHP_INV-5_2021-09-23
		Lab ID	606a	606b	607a	607b
		Wet Weight (g)	0.0585	0.2374	0.0846	0.2885
		Dry Weight (g)	0.0304	0.0472	0.0495	0.0494
		Moisture (%)	48.0	80.1	41.5	82.9
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.009	0.030	2.9	6.5	5.3	5.3
11B	0.102	0.340	5.4	9.7	11	11
23Na	1.4	4.7	3,827	5,863	5,967	5,544
24Mg	0.024	0.080	1,742	5,038	2,363	3,794
27Al	0.058	0.193	5,872	10,651	13,669	12,090
31P	32	107	4,839	12,801	5,461	10,876
39K	2.0	6.7	7,596	13,876	9,996	11,851
44Ca	17	57	319,525	134,919	500,159	96,029
49Ti	0.116	0.387	439	1,036	998	878
51V	0.072	0.240	14	18	31	18
52Cr	0.184	0.613	163	19	437	29
55Mn	0.007	0.023	91	86	207	84
57Fe	0.906	3.0	4,342	2,807	10,575	3,530
59Co	0.010	0.033	7.3	1.8	21	2.9
60Ni	0.047	0.157	315	52	740	62
63Cu	0.010	0.033	36	77	61	71
66Zn	0.227	0.757	49	65	68	82
75As	0.423	1.4	1.5	3.7	2.0	3.1
77Se	0.378	1.3	9.4	17	11	20
88Sr	0.001	0.003	669	125	176	90
95Mo	0.001	0.003	0.638	1.0	2.6	0.638
107Ag	0.001	0.003	0.916	1.4	0.983	1.1
111Cd	0.044	0.147	0.751	0.720	1.5	1.2
118Sn	0.027	0.090	0.670	0.886	1.3	1.0
121Sb	0.004	0.013	0.220	0.345	0.405	0.263
137Ba	0.001	0.003	338	335	255	270
202Hg	0.026	0.087	0.052	0.074	0.052	0.078
205Tl	0.001	0.003	0.100	0.263	0.199	0.305
208Pb	0.001	0.003	1.2	2.0	2.3	2.5
238U	0.001	0.003	0.402	0.390	0.448	0.357

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_GANF_INV-1_2021-09-15			RG_GHFF_INV-1_2021-09-09			RG_GHNF_INV-1_2021-09-10		
	Lab ID	586			595			602		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.009	0.767	0.745	2.9	1.2	1.1	8.7	1.3	1.2	8.0
11B	0.102	1.6	1.3	21	1.6	1.6	0.0	1.1	1.0	-
23Na	1.4	4,285	4,113	4.1	5,928	5,317	11	4,797	4,816	0.4
24Mg	0.024	1,906	1,581	19	2,841	2,547	11	3,243	3,068	5.5
27Al	0.058	1,164	1,139	2.1	965	1,008	4.4	1,211	1,286	6.0
31P	32	11,621	12,941	11	15,742	14,241	10	14,220	13,519	5.1
39K	2.0	10,182	11,066	8.3	14,794	13,386	10	12,196	12,135	0.5
44Ca	17	5,808	7,112	20	11,361	9,640	16	10,478	9,960	5.1
49Ti	0.116	70	51	31	67	69	2.9	89	92	3.3
51V	0.072	1.9	2.1	10	1.3	1.4	7.4	2.0	2.1	4.9
52Cr	0.184	6.0	8.2	31	7.7	5.7	30	7.5	7.0	6.9
55Mn	0.007	43	51	17	36	33	8.7	42	34	21
57Fe	0.906	448	589	27	435	410	5.9	457	438	4.2
59Co	0.010	0.511	0.640	22	0.330	0.278	17	0.642	0.522	21
60Ni	0.047	13	17	27	22	16	32	20	18	11
63Cu	0.010	16	22	31	17	16	6.1	17	16	6.1
66Zn	0.227	146	178	20	176	136	26	147	131	12
75As	0.423	<0.423	<0.423	-	<0.423	<0.423	-	0.615	0.671	-
77Se	0.378	4.8	5.1	5.5	14	12	15	10	11	9.5
88Sr	0.001	9.8	9.2	5.8	9.1	8.7	4.5	6.0	5.7	5.1
95Mo	0.001	0.287	0.287	0.1	0.335	0.293	13	0.290	0.261	11
107Ag	0.001	0.143	0.143	0.0	0.117	0.108	8.0	0.050	0.050	0.0
111Cd	0.044	0.458	0.458	0.1	0.488	0.453	7.4	1.5	1.6	6.5
118Sn	0.027	0.218	0.197	10	1.1	0.989	11	0.909	0.804	12
121Sb	0.004	0.053	0.068	25	0.058	0.056	3.5	0.058	0.060	3.4
137Ba	0.001	59	62	4.7	33	33	0.0	22	23	4.4
202Hg	0.026	0.109	0.124	-	0.068	0.063	-	0.035	0.035	-
205Tl	0.001	0.041	0.032	26	0.041	0.036	13	0.068	0.059	14
208Pb	0.001	0.340	0.348	2.4	0.315	0.315	0.0	0.285	0.308	7.8
238U	0.001	0.059	0.067	13	0.209	0.176	17	0.201	0.194	3.5

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	0.009	1.21	1.3	106	10	1.3	109	3.7
11B	0.102	4.5	4.8	107	2.8	5.2	115	2.6
23Na	1.4	14,000	14,726	105	5.4	15,492	111	1.7
24Mg	0.024	910	1,026	113	9.2	977	107	2.8
27Al	0.058	197.2	207	105	11	219	111	7.6
31P	32	8,000	8,569	107	7.4	8,619	108	3.7
39K	2.0	15,500	16,450	106	4.1	17,265	111	4.1
44Ca	17	2,360	2,572	109	6.2	2,531	107	3.6
49Ti	0.116	12.24	12	97	14	14	118	10
51V	0.072	1.57	1.9	118	3.7	1.6	102	13
52Cr	0.184	1.87	2.0	109	4.0	2.0	108	4.1
55Mn	0.007	3.17	3.7	117	7.8	3.5	109	2.4
57Fe	0.906	343	388	113	5.1	381	111	2.6
59Co	0.010	0.25	0.300	120	6.6	0.268	107	2.8
60Ni	0.047	1.34	1.5	114	7.4	1.5	110	3.1
63Cu	0.010	15.7	18	114	6.2	18	114	2.1
66Zn	0.227	51.6	59	115	7.6	57	110	1.4
75As	0.423	6.87	7.3	106	6.5	7.6	111	2.5
77Se	0.378	3.45	3.9	110	1.5	3.8	109	4.8
88Sr	0.001	10.1	11	109	5.2	11	112	4.2
95Mo	0.001	0.29	0.324	112	4.4	0.310	107	8.1
107Ag	0.001	0.0252	0.033	130	9.3	0.033	132	12
111Cd	0.044	0.299	0.311	104	10	0.334	112	9.3
118Sn	0.027	0.061	0.075	124	12	0.067	109	17
121Sb	0.004	0.011	0.009	77	13	0.014	124	4.2
137Ba	0.001	8.6	8.9	104	3.6	9.8	114	2.5
202Hg	0.026	0.412	0.462	112	3.9	0.480	116	2.8
205Tl	0.001	0.0013	-	-	-	-	-	-
208Pb	0.001	0.404	0.508	126	8.1	0.380	94	4.4
238U	0.001	0.05	0.062	124	7.8	0.051	102	7.3

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

Tissue QA/QC Accuracy and Precision Results

Sample Group ID: 03

Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.009	1.21	1.2	100	5.8
11B	0.102	4.5	4.5	100	3.6
23Na	1.4	14,000	14,638	105	5.4
24Mg	0.024	910	998	110	2.8
27Al	0.058	197.2	189	96	5.8
31P	32	8,000	8,756	109	4.1
39K	2.0	15,500	16,559	107	2.9
44Ca	17	2,360	2,531	107	3.9
49Ti	0.116	12.24	12	97	12
51V	0.072	1.57	1.8	115	2.2
52Cr	0.184	1.87	2.0	106	2.5
55Mn	0.007	3.17	3.5	112	2.6
57Fe	0.906	343	368	107	3.1
59Co	0.010	0.25	0.283	113	4.1
60Ni	0.047	1.34	1.5	112	4.4
63Cu	0.010	15.7	17	109	4.6
66Zn	0.227	51.6	54	106	1.9
75As	0.423	6.87	7.3	106	3.1
77Se	0.378	3.45	3.6	104	7.3
88Sr	0.001	10.1	11	109	3.4
95Mo	0.001	0.29	0.302	104	11
107Ag	0.001	0.0252	0.024	93	16
111Cd	0.044	0.299	0.351	117	10
118Sn	0.027	0.061	0.067	111	16
121Sb	0.004	0.011	0.009	82	0.0
137Ba	0.001	8.6	8.3	97	3.3
202Hg	0.026	0.412	0.396	96	6.5
205Tl	0.001	0.0013	-	-	-
208Pb	0.001	0.404	0.491	122	8.6
238U	0.001	0.05	0.060	121	5.4

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_2021-09-15	586	17 Oct 2021
	RG_GAUT_INV-1_2021-09-16	587	
	RG_GAUT_INV-2_2021-09-16	588	
	RG_GAUT_INV-3_2021-09-16	589	
	RG_GHBP_INV-1_2021-09-14	590	
	RG_GHBP_INV-2_2021-09-14	591	
	RG_GHBP_INV-3_2021-09-14	592	
	RG_GANF_INV-2_2021-09-15	593	
02	RG_GANF_INV-3_2021-09-16	594	17 Oct 2021
	RG_GHFF_INV-1_2021-09-09	595	
	RG_GHFF_INV-2_2021-09-09	596	
	RG_GHFF_INV-3_2021-09-10	597	
	RG_GHFF_INVLUM-1_2021-09-10	598	
	RG_GHUT_INV-1_2021-09-13	599	
	RG_GHUT_INV-2_2021-09-13	600	
	RG_GHUT_INV-3_2021-09-13	601	
03	RG_GHNF_INV-1_2021-09-10	602	17 Oct 2021
	RG_GHNF_INV-2_2021-09-10	603	
	RG_GHNF_INV-3_2021-09-11	604	
	RG_GHP_INV-1_2021-09-22	605	
	RG_GHP_INVBIV-3_2021-09-22	606a	
	RG_GHP_INV-3_2021-09-22	606b	
	RG_GHP_INVBIV-5_2021-09-23	607a	
	RG_GHP_INV-5_2021-09-23	607b	

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 (21-52) (PO 750554)			
Company Name:	Teck Coal Limited	Company Name:	Minnow Environmental
Contact Name:	Allie Ferguson	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:		Phone:	250-595-1627
Email:	allie.ferguson@teck.com	Email:	awiebe@teck.com

Sample Analysis Requested

TRICH ID.		Sample Identification:	Species	Sample Type: Sample type
586	1	RG_GANF_INV-1_2021-09-15 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
587	2	RG_GAUT_INV-1_2021-09-16 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
588	3	RG_GAUT_INV-2_2021-09-16 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
589	4	RG_GAUT_INV-3_2021-09-16 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
590	5	RG_GHBP_INV-1_2021-09-14 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
591	6	RG_GHBP_INV-2_2021-09-14 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
592	7	RG_GHBP_INV-3_2021-09-14 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
593	8	RG_GANF_INV-2_2021-09-15 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
594	9	RG_GANF_INV-3_2021-09-16 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
595	10	RG_GHFF_INV-1_2021-09-09 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
596	11	RG_GHFF_INV-2_2021-09-09 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
597	12	RG_GHFF_INV-3_2021-09-10 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
598	13	RG_GHFF_INVLUM-1_2021-09-10 ✓	Composite	Single taxon
599	14	RG_GHUT_INV-1_2021-09-13 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
600	15	RG_GHUT_INV-2_2021-09-13 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
601	16	RG_GHUT_INV-3_2021-09-13 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
602	17	RG_GHNF_INV-1_2021-09-10 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
603	18	RG_GHNF_INV-2_2021-09-10 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
604	19	RG_GHNF_INV-3_2021-09-11 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
605	20	RG_GHP_INV-1_2021-09-22 ✓	Composite	Composite-taxa benthic invertebrate tissue samples

Sample(s) Released By:	Sample(s) Received By: Alex Wade
Signature:	Signature:
Date Sent:	Date Received: (lab) 28 Sep 2021 (Proj #: 2021-265)
Sample(s) Returned to Client By:	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

AW 05 oct 2021

COM-011.01

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 (21-52) (PO 750554)			
Company Name:	Teck Coal Limited	Company Name:	Minnow Environmental
Contact Name:	Cait Good	Contact Name:	Peter Schnurr
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:	cait.good@teck.com	Email:	pschnurr@minnow.ca

Sample Analysis Requested

TRICH ID		Sample Identification:	Sample Type: Species	Sample type
606	21	RG_GHP_INV-3_2021-09-22 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
607	22	RG_GHP_INV-5_2021-09-23 ✓	Composite	Composite-taxa benthic invertebrate tissue samples
	23		Composite	Composite-taxa benthic invertebrate tissue samples
	24		Composite	Composite-taxa benthic invertebrate tissue samples
	25		Composite	Composite-taxa benthic invertebrate tissue samples
	26		Composite	Composite-taxa benthic invertebrate tissue samples
	27		Composite	Composite-taxa benthic invertebrate tissue samples
	28		Composite	Composite-taxa benthic invertebrate tissue samples
	29		Composite	Composite-taxa benthic invertebrate tissue samples
	30		Composite	Composite-taxa benthic invertebrate tissue samples
	31		Composite	Composite-taxa benthic invertebrate tissue samples
	32		Composite	Composite-taxa benthic invertebrate tissue samples
	33		Composite	Composite-taxa benthic invertebrate tissue samples
	34		Composite	Composite-taxa benthic invertebrate tissue samples
	35		Composite	Composite-taxa benthic invertebrate tissue samples
	36		Composite	Composite-taxa benthic invertebrate tissue samples
	37		Composite	Composite-taxa benthic invertebrate tissue samples
	38		Composite	Composite-taxa benthic invertebrate tissue samples
	39		Composite	Composite-taxa benthic invertebrate tissue samples
	40		Composite	Composite-taxa benthic invertebrate tissue samples

Sample(s) Released By:	Sample(s) Received By: Alex Wade
Signature:	Signature:
Date Sent:	Date Received: 28 Sep 2021 (Proj #: 2021 - 265) aw 05 oct 2021
Sample(s) Returned to Client By:	Shipping Conditions:
	Shipping Container:
Signature:	Date Sent:

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client:	Amy Wiebe	Date Received:	18 Mar 2021
	Aquatic Scientist	Date of Analysis:	23 Mar 2021
	Minnow Environmental	Final Report Date:	23 Mar 2021
Phone:	(306) 952-3779	Project No.:	2021-194
Email:	awiebe@minnow.ca	Method No.:	MET-002.05

Client Project: Teck Coal/Minnow Environmental 20-14 (Greenhills Creek Calcite)

Analytical Request: Benthic Invertebrate Tissue Microchemistry (total metals and moisture) – 6 samples.
See chain of custody form provided for sample identification numbers.

Notes:
Analytical results are expressed in part 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.
Client specific DQO for Selenium accuracy is 90 - 110% of the certified value; (result achieved 100%).
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.

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

23 Mar 2021
Date

TrichAnalytics Inc.
207-1753 Sean Heights
Saanichton, BC V8M 0B3
www.trichanalytics.com

CALA
Testing Accreditation No. A4196

		Client ID	RG_GHUT_INV-01_2021-02-17	RG_GHUT_INV-02_2021-02-17	RG_GHUT_INV-03_2021-02-17	RG_GHBP_INV_01-2021-02-17	RG_GHBP_INV_02-2021-02-17
		Lab ID	062	063	064	065	066
		Wet Weight (g)	0.2181	0.2198	0.2627	0.8680	0.4608
		Dry Weight (g)	0.0325	0.0350	0.0342	0.1509	0.0823
		Moisture (%)	85.1	84.1	87.0	82.6	82.1
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.004	0.013	1.3	1.5	1.6	0.703	1.1
11B	0.095	0.317	0.596	0.830	1.1	1.9	3.4
23Na	0.504	1.7	5,375	6,380	5,096	2,445	3,377
24Mg	0.019	0.063	2,170	2,385	2,690	2,144	2,723
27Al	0.031	0.103	414	730	930	1,144	1,251
31P	51	170	13,516	14,081	12,712	9,137	10,329
39K	0.638	2.1	9,421	12,352	9,770	7,674	7,791
44Ca	5.4	18	3,965	4,854	5,123	2,339	3,887
49Ti	0.138	0.460	30	56	73	85	100
51V	0.042	0.140	1.1	1.5	2.2	2.2	2.5
52Cr	0.140	0.467	9.7	7.4	9.3	6.2	7.5
55Mn	0.008	0.027	30	33	33	74	67
57Fe	0.575	1.9	396	416	533	533	646
59Co	0.002	0.007	0.663	0.580	0.848	1.1	0.995
60Ni	0.001	0.003	24	19	22	23	29
63Cu	0.004	0.013	12	12	16	17	25
66Zn	0.416	1.4	245	145	156	246	267
75As	0.431	1.4	<0.431	0.509	0.538	1.1	0.768
77Se	0.356	1.2	8.8	6.4	5.9	33	33
88Sr	0.001	0.003	2.6	3.0	4.3	5.3	8.6
95Mo	0.001	0.003	0.246	0.266	0.307	0.246	0.430
107Ag	0.001	0.003	0.025	0.028	0.032	0.107	0.151
111Cd	0.041	0.137	3.1	2.7	2.8	0.816	0.917
118Sn	0.021	0.070	0.569	0.809	1.6	0.305	0.516
121Sb	0.004	0.013	0.042	0.054	0.067	0.076	0.111
137Ba	0.001	0.003	7.1	9.4	15	25	37
202Hg	0.032	0.107	<0.032	0.036	0.036	0.120	0.120
205Tl	0.001	0.003	0.036	0.047	0.045	0.089	0.040
208Pb	0.004	0.013	0.124	0.210	0.258	0.347	0.503
238U	0.001	0.003	0.145	0.134	0.213	0.122	0.252

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

		Client ID	RG_GHBP_INV_03-2021-02-17
		Lab ID	067
		Wet Weight (g)	0.8407
		Dry Weight (g)	0.1675
		Moisture (%)	80.1
Parameter	DL (ppm)	LOQ (ppm)	(ppm)
7Li	0.004	0.013	0.445
11B	0.095	0.317	0.915
23Na	0.504	1.7	3,605
24Mg	0.019	0.063	2,407
27Al	0.031	0.103	655
31P	51	170	12,142
39K	0.638	2.1	10,117
44Ca	5.4	18	2,727
49Ti	0.138	0.460	39
51V	0.042	0.140	1.2
52Cr	0.140	0.467	3.0
55Mn	0.008	0.027	62
57Fe	0.575	1.9	207
59Co	0.002	0.007	0.781
60Ni	0.001	0.003	17
63Cu	0.004	0.013	23
66Zn	0.416	1.4	237
75As	0.431	1.4	0.499
77Se	0.356	1.2	32
88Sr	0.001	0.003	3.9
95Mo	0.001	0.003	0.246
107Ag	0.001	0.003	0.145
111Cd	0.041	0.137	0.374
118Sn	0.021	0.070	0.179
121Sb	0.004	0.013	0.062
137Ba	0.001	0.003	15
202Hg	0.032	0.107	0.084
205Tl	0.001	0.003	0.039
208Pb	0.004	0.013	0.213
238U	0.001	0.003	0.093

Notes:

ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

Tissue QA/QC Relative Percent Difference Results

Client ID	RG_GHBP_INV_03-2021-02-17
Lab ID	067

Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.004	0.445	0.460	3.3
11B	0.095	0.915	1.1	-
23Na	0.504	3,605	3,126	14
24Mg	0.019	2,407	2,187	9.6
27Al	0.031	655	634	3.3
31P	51	12,142	10,483	15
39K	0.638	10,117	8,606	16
44Ca	5.4	2,727	2,429	12
49Ti	0.138	39	52	29
51V	0.042	1.2	1.3	8.0
52Cr	0.140	3.0	3.0	0.0
55Mn	0.008	62	72	15
57Fe	0.575	207	268	26
59Co	0.002	0.781	0.735	6.1
60Ni	0.001	17	17	0.0
63Cu	0.004	23	20	14
66Zn	0.416	237	284	18
75As	0.431	0.499	0.519	-
77Se	0.356	32	26	21
88Sr	0.001	3.9	5.1	27
95Mo	0.001	0.246	0.287	15
107Ag	0.001	0.145	0.164	12
111Cd	0.041	0.374	0.561	-
118Sn	0.021	0.179	0.226	-
121Sb	0.004	0.062	0.062	0.0
137Ba	0.001	15	18	18
202Hg	0.032	0.084	0.132	-
205Tl	0.001	0.039	0.046	17
208Pb	0.004	0.213	0.258	19
238U	0.001	0.093	0.112	19

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	0.004	1.21	1.4	119	3.7
11B	0.095	4.5	4.8	108	2.8
23Na	0.504	14,000	15,660	112	6.5
24Mg	0.019	910	1,020	112	6.0
27Al	0.031	197.2	184	93	9.3
31P	51	8,000	8,488	106	4.1
39K	0.638	15,500	16,599	107	4.1
44Ca	5.4	2,360	2,501	106	7.1
49Ti	0.138	12.24	13	104	11
51V	0.042	1.57	1.7	110	12
52Cr	0.140	1.87	2.1	110	5.3
55Mn	0.008	3.17	3.4	109	11
57Fe	0.575	343	397	116	6.4
59Co	0.002	0.25	0.276	111	4.4
60Ni	0.001	1.34	1.6	116	8.5
63Cu	0.004	15.7	18	115	6.3
66Zn	0.416	51.6	60	116	6.0
75As	0.431	6.87	7.6	110	6.1
77Se	0.356	3.45	3.4	100	7.3
88Sr	0.001	10.1	11	111	4.3
95Mo	0.001	0.29	0.311	107	5.5
107Ag	0.001	0.0252	0.029	115	12
111Cd	0.041	0.299	0.334	112	10
118Sn	0.021	0.061	0.060	98	14
121Sb	0.004	0.011	0.015	134	13
137Ba	0.001	8.6	9.4	110	6.9
202Hg	0.032	0.412	0.463	112	12
205Tl	0.001	0.0013	-	-	-
208Pb	0.004	0.404	0.506	125	17
238U	0.001	0.05	0.056	113	9.5

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_GHUT_INV-01_2021-02-17	062	23 Mar 2021
	RG_GHUT_INV-02_2021-02-17	063	
	RG_GHUT_INV-03_2021-02-17	064	
	RG_GHBP_INV_01-2021-02-17	065	
	RG_GHBP_INV_02-2021-02-17	066	
	RG_GHBP_INV_03-2021-02-17	067	

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: 20-14 (Greenhills Creek Calcite)			
Company Name:	Teck	Company Name.	Minnow Environmental
Contact Name:	Allie Ferguson	Contact Name:	Amy Wiebe
Address:	PO Box 1777	Address:	110 - 2750 Faithful Ave
City, Province:	Sparwood, BC	City, Province:	Saskatoon, SK
Postal Code:	V0B 2G0	Postal Code:	S7K 6M6
Phone:	250.425.8048	Phone:	306.952.3379
Email:	Allie.Ferguson@teck.com	Email:	awiebe@minnow.ca

Sample Analysis Requested

Trich Sample ID:	Sample Identification:	Sample Type: Species	Sample type
062 1	RG_GHUT_INV-01_2021-02-17	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
063 2	RG_GHUT_INV-02_2021-02-17	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
064 3	RG_GHUT_INV-03_2021-02-17	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
065 4	RG_GHBP_INV_01-2021-02-17	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
066 5	RG_GHBP_INV_02-2021-02-17	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
067 6	RG_GHBP_INV_03-2021-02-17	Composite	Freshwater Benthic Invertebrate Tissue for Metals Analysis
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Sample(s) Release	Maddy Stokes	Sample(s) Received By.	GERIENE LABINE
Signature:		Signature:	
Date Sent:	17-Mar-21	Date Received:	18 Mar 2021 (Project #: 2021-194)
Sample(s) Returned to Client By:		Shipping Conditions:	
		Shipping Container:	
Signature:		Date Sent:	

COM-011.01

ZEAS - BENTHIC
INVERTEBRATE COMMUNITY

TABLE 1: CALCULATION OF SUBSAMPLING ERROR FOR BENTHIC MACROINVERTEBRATE SAMPLES FROM LOWER GREENHILLS (2021).

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
GANF-2	-	188	200	-	-	388	6.0	-	3.1	-
GANF-2	-	91	97	99	101	388	2.0	9.9	0.0	6.2
GANF-1	2	192	208	-	-	400	7.7	-	-	-
GHBP-1	-	210	249	-	-	459	15.7	-	-	-

* 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 GREENHILLS (2021).

Station	Number of Organisms Recovered (initial sort)	Number of Organisms in Re-sort	Percent Recovery
GANF-1	398	402	99.0%
GAUT-3	193	196	98.5%
GHBP-4	469	482	97.3%
GHUT-6	280	284	98.6%
		Average % Recovery	98.3%

TABLE 3: SAMPLE FRACTIONS SORTED FROM LOWER GREENHILLS (2021).

Station	Fraction Sorted	Station	Fraction Sorted	Station	Fraction Sorted
GANF-1	1/2[c]	GHBP-1	1/4[d]	GHFF-1	1/4
GANF-2	Whole[a, b]	GHBP-2	1/2	GHFF-2	Whole
GANF-3	1/2	GHBP-3	1/4	GHFF-3	1/2
GANF-4	1/4	GHBP-4	1/4	GHFF-4	1/2
GANF-5	1/2	GHBP-5	1/4	GHFF-5	1/4
GANF-6	1/2	GHBP-6	1/4	GHFF-6	1/4
GAUT-1	1/4	GHNF-1	1/8	GHUT-1	1/8
GAUT-2	1/4	GHNF-2	1/16	GHUT-2	1/4
GAUT-3	1/2	GHNF-3	1/16	GHUT-3	1/8
GAUT-4	1/4	GHNF-4	1/8	GHUT-4	1/8
GAUT-5	1/2	GHNF-5	1/4	GHUT-5	1/8
GAUT-6	1/2	GHNF-6	1/8	GHUT-6	1/8

[a] four quarters sorted for subsampling error calculations
[b] two halves sorted for subsampling error calculations.
[c] two quarters sorted for subsampling error calculations.
[d] two eighths sorted for subsampling error calculations.

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).

Ostracods, nematodes and collembola included in data set and can be deleted if not required by CABIN.

Densities expressed per fraction sorted.

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	*Text(20)*	*Text(40)*	*Text(255)*	*Numeric*	*Text(255)*	*Text(255)*
1	none	RG_GANF_BIC-1_2021-09-15	Nematoda	50	0.0002	
		RG_GANF_BIC-1_2021-09-15	Planariidae	50	0.0210	
10	none	RG_GANF_BIC-1_2021-09-15	Polycelis	50		
1	none	RG_GANF_BIC-1_2021-09-15	Enchytraeidae	50	0.0002	
		RG_GANF_BIC-1_2021-09-15	Lebertiidae	50	0.0002	
3	Adult	RG_GANF_BIC-1_2021-09-15	Lebertia	50		
235	none	RG_GANF_BIC-1_2021-09-15	Ostracoda	50	0.0548	
		RG_GANF_BIC-1_2021-09-15	Elmidae	50	0.0019	
2	larvae	RG_GANF_BIC-1_2021-09-15	Heterlimnius	50		
		RG_GANF_BIC-1_2021-09-15	Baetidae	50	0.0081	
4	Nymph	RG_GANF_BIC-1_2021-09-15	Baetis	50		
		RG_GANF_BIC-1_2021-09-15	Capniidae	50	0.0025	
9	Nymph	RG_GANF_BIC-1_2021-09-15	Paracapnia	50		
21	Nymph/immature	RG_GANF_BIC-1_2021-09-15	Capniidae	50		
		RG_GANF_BIC-1_2021-09-15	Leuctridae	50	0.0002	
3	Nymph	RG_GANF_BIC-1_2021-09-15	Paraleuctra	50		
		RG_GANF_BIC-1_2021-09-15	Nemouridae	50	0.0202	
40	Nymph	RG_GANF_BIC-1_2021-09-15	Zapada	50		
11	Nymph/immature	RG_GANF_BIC-1_2021-09-15	Nemouridae	50		
		RG_GANF_BIC-1_2021-09-15	Peltoperlidae	50	0.0003	
1	Nymph	RG_GANF_BIC-1_2021-09-15	Yoraperla	50		
		RG_GANF_BIC-1_2021-09-15	Perlodidae	100	0.0372	large/rare search
1	Nymph	RG_GANF_BIC-1_2021-09-15	Megarcys	100		large/rare search
		RG_GANF_BIC-1_2021-09-15	Taeniopterygidae	50	0.0001	
3	Nymph/immature	RG_GANF_BIC-1_2021-09-15	Taeniopterygidae	50		
		RG_GANF_BIC-1_2021-09-15	Glossosomatidae	50		
2	larvae	RG_GANF_BIC-1_2021-09-15	Anagapetus	50		
		RG_GANF_BIC-1_2021-09-15	Limnephilidae	50	0.0005	
3	larvae/immature	RG_GANF_BIC-1_2021-09-15	Limnephilidae	50		
		RG_GANF_BIC-1_2021-09-15	Rhyacophilidae	50	0.0221	
17	larvae	RG_GANF_BIC-1_2021-09-15	Rhyacophila	50		
		RG_GANF_BIC-1_2021-09-15	Chironomidae	50	0.0109	
2	larvae	RG_GANF_BIC-1_2021-09-15	Micropsectra	50		
10	larvae	RG_GANF_BIC-1_2021-09-15	Pagastia	50		
2	larvae	RG_GANF_BIC-1_2021-09-15	Cricotopus/Orthocladius	50		
3	larvae	RG_GANF_BIC-1_2021-09-15	Zavrelimyia	50		
		RG_GANF_BIC-1_2021-09-15	Empididae	50	0.0020	
5	larvae	RG_GANF_BIC-1_2021-09-15	Chelifera/Metachela	50		
		RG_GANF_BIC-1_2021-09-15	Pelecorhyncidae	100	0.0236	large/rare search
		RG_GANF_BIC-1_2021-09-15	Pelecorhyncidae	50	0.0015	
1	larvae	RG_GANF_BIC-1_2021-09-15	Glutops	100		large/rare search
8	larvae	RG_GANF_BIC-1_2021-09-15	Glutops	50		
		RG_GANF_BIC-1_2021-09-15	Psychodidae	50	0.0002	
2	larvae	RG_GANF_BIC-1_2021-09-15	Pericoma	50		
		RG_GANF_BIC-1_2021-09-15	Tipulidae	50	0.0001	
1	larvae	RG_GANF_BIC-1_2021-09-15	Dicranota	50		
		RG_GANF_BIC-1_2021-09-15	Pisidiidae	50	0.0002	
1	none	RG_GANF_BIC-1_2021-09-15	Pisidium	50		
		RG_GANF_BIC-2_2021-09-15	Planariidae	100	0.0048	
4	none	RG_GANF_BIC-2_2021-09-15	Polycelis	100		
116	none	RG_GANF_BIC-2_2021-09-15	Ostracoda	100	0.0274	
		RG_GANF_BIC-2_2021-09-15	Elmidae	100	0.0062	
3	larvae	RG_GANF_BIC-2_2021-09-15	Heterlimnius	100		
		RG_GANF_BIC-2_2021-09-15	Baetidae	100	0.0248	
5	Nymph	RG_GANF_BIC-2_2021-09-15	Baetis	100		
2	Nymph/immature	RG_GANF_BIC-2_2021-09-15	Ephemerellidae	100	0.0004	
		RG_GANF_BIC-2_2021-09-15	Heptageniidae	100	0.0006	
1	Nymph/indeterminate	RG_GANF_BIC-2_2021-09-15	Heptageniidae	100		
		RG_GANF_BIC-2_2021-09-15	Capniidae	100	0.0035	
6	Nymph	RG_GANF_BIC-2_2021-09-15	Paracapnia	100		
18	Nymph/immature	RG_GANF_BIC-2_2021-09-15	Capniidae	100		
		RG_GANF_BIC-2_2021-09-15	Chloroperlidae	100	0.0019	
6	Nymph/immature	RG_GANF_BIC-2_2021-09-15	Chloroperlidae	100		
		RG_GANF_BIC-2_2021-09-15	Leuctridae	100	0.0001	
1	Nymph	RG_GANF_BIC-2_2021-09-15	Paraleuctra	100		
		RG_GANF_BIC-2_2021-09-15	Nemouridae	100	0.0338	
32	Nymph	RG_GANF_BIC-2_2021-09-15	Zapada	100		
22	Nymph/immature	RG_GANF_BIC-2_2021-09-15	Nemouridae	100		
		RG_GANF_BIC-2_2021-09-15	Peltoperlidae	100	0.0005	
1	Nymph	RG_GANF_BIC-2_2021-09-15	Yoraperla	100		
		RG_GANF_BIC-2_2021-09-15	Perlodidae	100	0.0888	
3	Nymph	RG_GANF_BIC-2_2021-09-15	Megarcys	100		
1	Nymph/immature	RG_GANF_BIC-2_2021-09-15	Perlodidae	100		
	Nymph/immature	RG_GANF_BIC-2_2021-09-15	Taeniopterygidae	100	0.0090	
3	Nymph/immature	RG_GANF_BIC-2_2021-09-15	Taeniopterygidae	100		
		RG_GANF_BIC-2_2021-09-15	Glossosomatidae	100	0.0130	
67	larvae	RG_GANF_BIC-2_2021-09-15	Anagapetus	100		
		RG_GANF_BIC-2_2021-09-15	Lepidostomatidae	100	0.0007	
2	larvae	RG_GANF_BIC-2_2021-09-15	Lepidostoma	100		
		RG_GANF_BIC-2_2021-09-15	Limnephilidae	100	0.0018	
1	larvae	RG_GANF_BIC-2_2021-09-15	Ecclisomyia	100		
1	larvae	RG_GANF_BIC-2_2021-09-15	Philocasca	100		
4	larvae/immature	RG_GANF_BIC-2_2021-09-15	Limnephilidae	100		
		RG_GANF_BIC-2_2021-09-15	Rhyacophilidae	100	0.0320	
20	larvae	RG_GANF_BIC-2_2021-09-15	Rhyacophila	100		

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	*Text(20)*	*Text(40)*	*Text(255)*	*Numeric*	*Text(255)*	*Text(255)*
		RG_GANF_BIC-2_2021-09-15	Chironomidae	100	0.0421	
9	pupae	RG_GANF_BIC-2_2021-09-15	Chironomidae	100		
5	larvae	RG_GANF_BIC-2_2021-09-15	Micropsectra	100		
25	larvae	RG_GANF_BIC-2_2021-09-15	Pagastia	100		
2	larvae	RG_GANF_BIC-2_2021-09-15	Brillia	100		
1	larvae	RG_GANF_BIC-2_2021-09-15	Corynoneura	100		
3	larvae	RG_GANF_BIC-2_2021-09-15	Cricotopus/Orthocladius	100		
2	larvae	RG_GANF_BIC-2_2021-09-15	Eukiefferiella	100		
1	larvae	RG_GANF_BIC-2_2021-09-15	Tvetenia	100		
5	larvae	RG_GANF_BIC-2_2021-09-15	Zavrelimyia	100		
		RG_GANF_BIC-2_2021-09-15	Empididae	100	0.0047	
6	larvae	RG_GANF_BIC-2_2021-09-15	Chelifera/Metachela	100		
		RG_GANF_BIC-2_2021-09-15	Pelecorhyncidae	100	0.0266	
4	larvae	RG_GANF_BIC-2_2021-09-15	Glutops	100		
		RG_GANF_BIC-2_2021-09-15	Psychodidae	100	0.0010	
1	larvae	RG_GANF_BIC-2_2021-09-15	Pericoma	100		
		RG_GANF_BIC-2_2021-09-15	Tipulidae	100	0.0065	
5	larvae	RG_GANF_BIC-2_2021-09-15	Dicranota	100		
		RG_GANF_BIC-3_2021-09-15	Planariidae	50	0.0060	
5	none	RG_GANF_BIC-3_2021-09-15	Polycelis	50		
5	none	RG_GANF_BIC-3_2021-09-15	Enchytraeidae	50	0.0008	
61	none	RG_GANF_BIC-3_2021-09-15	Ostracoda	50	0.0153	
7	none	RG_GANF_BIC-3_2021-09-15	Collembola	50	0.0007	
		RG_GANF_BIC-3_2021-09-15	Baetidae	50	0.0147	
6	Nymph	RG_GANF_BIC-3_2021-09-15	Baetis	50		
		RG_GANF_BIC-3_2021-09-15	Ephemerellidae	50	0.0001	
1	Nymph/immature	RG_GANF_BIC-3_2021-09-15	Ephemerellidae	50		
		RG_GANF_BIC-3_2021-09-15	Capniidae	50	0.0002	
9	Nymph	RG_GANF_BIC-3_2021-09-15	Paracapnia	50		
		RG_GANF_BIC-3_2021-09-15	Chloroperlidae	50	0.0058	
1	Nymph	RG_GANF_BIC-3_2021-09-15	Sweltsa	50		
1	Nymph/immature	RG_GANF_BIC-3_2021-09-15	Chloroperlidae	50		
		RG_GANF_BIC-3_2021-09-15	Leuctridae	50	0.0011	
1	Nymph	RG_GANF_BIC-3_2021-09-15	Paraleuctra	50		
		RG_GANF_BIC-3_2021-09-15	Nemouridae	50	0.0325	
47	Nymph	RG_GANF_BIC-3_2021-09-15	Zapada	50		
		RG_GANF_BIC-3_2021-09-15	Perlodidae	50	0.0361	
1	Nymph	RG_GANF_BIC-3_2021-09-15	Isoperla	50		
	Nymph	RG_GANF_BIC-3_2021-09-15	Megarcys	50		
3	Nymph	RG_GANF_BIC-3_2021-09-15	Megarcys	50		
3	Nymph/immature	RG_GANF_BIC-3_2021-09-15	Perlodidae	50		
		RG_GANF_BIC-3_2021-09-15	Taeniopterygidae	50	0.0011	
10	Nymph/immature	RG_GANF_BIC-3_2021-09-15	Taeniopterygidae	50		
		RG_GANF_BIC-3_2021-09-15	Glossosomatidae	50	0.0002	
6	larvae	RG_GANF_BIC-3_2021-09-15	Anagapetus	50		
		RG_GANF_BIC-3_2021-09-15	Limnephilidae	50	0.0001	
1	larvae/immature	RG_GANF_BIC-3_2021-09-15	Limnephilidae	50		
		RG_GANF_BIC-3_2021-09-15	Rhyacophilidae	50	0.0072	
8	larvae	RG_GANF_BIC-3_2021-09-15	Rhyacophila	50		
		RG_GANF_BIC-3_2021-09-15	Chironomidae	50	0.0485	
8	pupae	RG_GANF_BIC-3_2021-09-15	Chironomidae	50		
3	larvae	RG_GANF_BIC-3_2021-09-15	Micropsectra	50		
37	larvae	RG_GANF_BIC-3_2021-09-15	Pagastia	50		
1	larvae	RG_GANF_BIC-3_2021-09-15	Brillia	50		
5	larvae	RG_GANF_BIC-3_2021-09-15	Cricotopus/Orthocladius	50		
5	larvae	RG_GANF_BIC-3_2021-09-15	Eukiefferiella	50		
4	larvae	RG_GANF_BIC-3_2021-09-15	Zavrelimyia	50		
		RG_GANF_BIC-3_2021-09-15	Empididae	50	0.0002	
1	larvae	RG_GANF_BIC-3_2021-09-15	Chelifera/Metachela	50		
		RG_GANF_BIC-3_2021-09-15	Pelecorhyncidae	100	0.0241	large/rare search
		RG_GANF_BIC-3_2021-09-15	Pelecorhyncidae	50	0.0117	
1	larvae	RG_GANF_BIC-3_2021-09-15	Glutops	100		large/rare search
2	larvae	RG_GANF_BIC-3_2021-09-15	Glutops	50		
		RG_GANF_BIC-3_2021-09-15	Psychodidae	50	0.0004	
3	larvae	RG_GANF_BIC-3_2021-09-15	Pericoma	50		
		RG_GANF_BIC-3_2021-09-15	Tipulidae	50	0.0042	
1	larvae	RG_GANF_BIC-3_2021-09-15	Dicranota	50		
1	larvae	RG_GANF_BIC-3_2021-09-15	Pseudolimnophila	50		
		RG_GANF_BIC-4_2021-09-16	Naididae	25	0.0017	
1		RG_GANF_BIC-4_2021-09-16	Limnodrilus hoffmeisteri	25		
26	none	RG_GANF_BIC-4_2021-09-16	Ostracoda	25	0.0064	
2	none	RG_GANF_BIC-4_2021-09-16	Collembola	25	0.0001	
		RG_GANF_BIC-4_2021-09-16	Elmidae	25	0.0017	
1	adult	RG_GANF_BIC-4_2021-09-16	Heterlimnius	25		
		RG_GANF_BIC-4_2021-09-16	Baetidae	25	0.0479	
19	Nymph	RG_GANF_BIC-4_2021-09-16	Baetis	25		
		RG_GANF_BIC-4_2021-09-16	Capniidae	25	0.0032	
10	Nymph	RG_GANF_BIC-4_2021-09-16	Paracapnia	25		
18	Nymph/immature	RG_GANF_BIC-4_2021-09-16	Capniidae	25		
		RG_GANF_BIC-4_2021-09-16	Chloroperlidae	25	0.0002	
1	Nymph/immature	RG_GANF_BIC-4_2021-09-16	Chloroperlidae	25		
		RG_GANF_BIC-4_2021-09-16	Nemouridae	25	0.0563	
101	Nymph	RG_GANF_BIC-4_2021-09-16	Zapada	25		
9	Nymph/immature	RG_GANF_BIC-4_2021-09-16	Nemouridae	25		
		RG_GANF_BIC-4_2021-09-16	Perlodidae	25	0.0084	

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	*Text(20)*	*Text(40)*	*Text(255)*	*Numeric*	*Text(255)*	*Text(255)*
6	Nymph	RG_GANF_BIC-4_2021-09-16	Isoperla	25		
1	Nymph/immature	RG_GANF_BIC-4_2021-09-16	Perlodidae	25		
		RG_GANF_BIC-4_2021-09-16	Taeniopterygidae	25	0.0025	
20	Nymph/immature	RG_GANF_BIC-4_2021-09-16	Taeniopterygidae	25		
		RG_GANF_BIC-4_2021-09-16	Glossosomatidae	25	0.0002	
2	larvae	RG_GANF_BIC-4_2021-09-16	Anagapetus	25		
		RG_GANF_BIC-4_2021-09-16	Limnephilidae	25	0.0003	
2	larvae/immature	RG_GANF_BIC-4_2021-09-16	Limnephilidae	25		
		RG_GANF_BIC-4_2021-09-16	Rhyacophilidae	25	0.0018	
5	larvae	RG_GANF_BIC-4_2021-09-16	Rhyacophila	25		
		RG_GANF_BIC-4_2021-09-16	Chironomidae	25	0.0372	
8	pupae	RG_GANF_BIC-4_2021-09-16	Chironomidae	25		
45	larvae	RG_GANF_BIC-4_2021-09-16	Pagastia	25		
1	larvae	RG_GANF_BIC-4_2021-09-16	Brillia	25		
2	larvae	RG_GANF_BIC-4_2021-09-16	Cricotopus/Orthocladius	25		
1	larvae	RG_GANF_BIC-4_2021-09-16	Eukiefferiella	25		
1	larvae	RG_GANF_BIC-4_2021-09-16	Tvetenia	25		
5	larvae	RG_GANF_BIC-4_2021-09-16	Zavrelimyia	25		
		RG_GANF_BIC-4_2021-09-16	Dixidae	25	0.0002	
1	larvae	RG_GANF_BIC-4_2021-09-16	Dixa	25		
		RG_GANF_BIC-4_2021-09-16	Empididae	25	0.0049	
5	larvae	RG_GANF_BIC-4_2021-09-16	Chelifera/Metachela	25		
1	pupae	RG_GANF_BIC-4_2021-09-16	Empididae	25		
		RG_GANF_BIC-4_2021-09-16	Pelecorhyncidae	25	0.0002	
1	larvae	RG_GANF_BIC-4_2021-09-16	Glutops	25		
		RG_GANF_BIC-4_2021-09-16	Psychodidae	25	0.0001	
2	larvae	RG_GANF_BIC-4_2021-09-16	Pericoma	25		
		RG_GANF_BIC-4_2021-09-16	Tipulidae	25	0.0017	
2	larvae	RG_GANF_BIC-4_2021-09-16	Dicranota	25		
		RG_GANF_BIC-5_2021-09-16	Planariidae	50	0.0003	
1	none	RG_GANF_BIC-5_2021-09-16	Polycelis	50		
8	none	RG_GANF_BIC-5_2021-09-16	Ostracoda	50	0.0025	
12	none	RG_GANF_BIC-5_2021-09-16	Collembola	50	0.0028	
		RG_GANF_BIC-5_2021-09-16	Baetidae	50	0.0292	
27	Nymph	RG_GANF_BIC-5_2021-09-16	Baetis	50		
		RG_GANF_BIC-5_2021-09-16	Capniidae	50	0.0018	
7	Nymph/immature	RG_GANF_BIC-5_2021-09-16	Capniidae	50		
		RG_GANF_BIC-5_2021-09-16	Nemouridae	50	0.0287	
44	Nymph	RG_GANF_BIC-5_2021-09-16	Zapada	50		
12	Nymph/immature	RG_GANF_BIC-5_2021-09-16	Nemouridae	50		
		RG_GANF_BIC-5_2021-09-16	Perlodidae	50	0.0114	
5	Nymph	RG_GANF_BIC-5_2021-09-16	Isoperla	50		
		RG_GANF_BIC-5_2021-09-16	Taeniopterygidae	50	0.0060	
18	Nymph/immature	RG_GANF_BIC-5_2021-09-16	Taeniopterygidae	50		
		RG_GANF_BIC-5_2021-09-16	Rhyacophilidae	50	0.0001	
1	larvae	RG_GANF_BIC-5_2021-09-16	Rhyacophila	50		
		RG_GANF_BIC-5_2021-09-16	Chironomidae	50	0.0325	
1	pupae	RG_GANF_BIC-5_2021-09-16	Chironomidae	50		
2	larvae	RG_GANF_BIC-5_2021-09-16	Micropsectra	50		
48	larvae	RG_GANF_BIC-5_2021-09-16	Pagastia	50		
		RG_GANF_BIC-5_2021-09-16	Empididae	50	0.0089	
10	larvae	RG_GANF_BIC-5_2021-09-16	Chelifera/Metachela	50		
		RG_GANF_BIC-5_2021-09-16	Psychodidae	50	0.0011	
3	larvae	RG_GANF_BIC-5_2021-09-16	Pericoma	50		
		RG_GANF_BIC-5_2021-09-16	Tipulidae	50	0.0026	
3	larvae	RG_GANF_BIC-5_2021-09-16	Dicranota	50		
1	larvae	RG_GANF_BIC-5_2021-09-16	Helius	50		
2	none	RG_GANF_BIC-6_2021-09-16	Enchytraeidae	50	0.0003	
		RG_GANF_BIC-6_2021-09-16	Sperchonidae	50	0.0001	
1	Adult	RG_GANF_BIC-6_2021-09-16	Sperchon	50		
4	none	RG_GANF_BIC-6_2021-09-16	Ostracoda	50	0.0009	
3	none	RG_GANF_BIC-6_2021-09-16	Collembola	50	0.0001	
		RG_GANF_BIC-6_2021-09-16	Baetidae	50	0.0253	
12	Nymph	RG_GANF_BIC-6_2021-09-16	Baetis	50		
		RG_GANF_BIC-6_2021-09-16	Capniidae	50	0.0023	
3	Nymph	RG_GANF_BIC-6_2021-09-16	Paracapnia	50		
11	Nymph/immature	RG_GANF_BIC-6_2021-09-16	Capniidae	50		
		RG_GANF_BIC-6_2021-09-16	Nemouridae	50	0.0199	
48	Nymph	RG_GANF_BIC-6_2021-09-16	Zapada	50		
17	Nymph/immature	RG_GANF_BIC-6_2021-09-16	Nemouridae	50		
		RG_GANF_BIC-6_2021-09-16	Perlodidae	50	0.0051	
5	Nymph	RG_GANF_BIC-6_2021-09-16	Isoperla	50		
1	Nymph/immature	RG_GANF_BIC-6_2021-09-16	Perlodidae	50		
		RG_GANF_BIC-6_2021-09-16	Taeniopterygidae	50	0.0013	
10	Nymph/immature	RG_GANF_BIC-6_2021-09-16	Taeniopterygidae	50		
		RG_GANF_BIC-6_2021-09-16	Limnephilidae	50	0.0005	
4	larvae/immature	RG_GANF_BIC-6_2021-09-16	Limnephilidae	50		
		RG_GANF_BIC-6_2021-09-16	Rhyacophilidae	50	0.0001	
1	larvae	RG_GANF_BIC-6_2021-09-16	Rhyacophila	50		
		RG_GANF_BIC-6_2021-09-16	Chironomidae	50	0.0162	
2	pupae	RG_GANF_BIC-6_2021-09-16	Chironomidae	50		
19	larvae	RG_GANF_BIC-6_2021-09-16	Pagastia	50		
5	larvae	RG_GANF_BIC-6_2021-09-16	Eukiefferiella	50		
1	larvae	RG_GANF_BIC-6_2021-09-16	Zavrelimyia	50		
		RG_GANF_BIC-6_2021-09-16	Empididae	50	0.0075	

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	Text(20)	Text(40)	Text(255)	Numeric	Text(255)	Text(255)
11	larvae	RG_GANF_BIC-6_2021-09-16	Chelifera/Metachela	50		
		RG_GANF_BIC-6_2021-09-16	Psychodidae	50	0.0002	
3	larvae	RG_GANF_BIC-6_2021-09-16	Pericoma	50		
		RG_GANF_BIC-6_2021-09-16	Tipulidae	50	0.0001	
1	larvae	RG_GANF_BIC-6_2021-09-16	Dicranota	50		
		RG_GAUT_BIC-1_2021-09-16	Hygrobatidae	25	0.0027	
3	Adult	RG_GAUT_BIC-1_2021-09-16	Hygrobates	25		
58	none	RG_GAUT_BIC-1_2021-09-16	Ostracoda	25	0.0134	
		RG_GAUT_BIC-1_2021-09-16	Elmidae	25	0.0005	
1	larvae	RG_GAUT_BIC-1_2021-09-16	Heterlimnius	25		
		RG_GAUT_BIC-1_2021-09-16	Baetidae	25	0.0007	
1	Nymph	RG_GAUT_BIC-1_2021-09-16	Baetis	25		
	Nymph/immature	RG_GAUT_BIC-1_2021-09-16	Heptageniidae	25	0.0055	
1	Nymph	RG_GAUT_BIC-1_2021-09-16	Cinygma	25		
		RG_GAUT_BIC-1_2021-09-16	Capniidae	25	0.0020	
4	Nymph	RG_GAUT_BIC-1_2021-09-16	Paracapnia	25		
6	Nymph/immature	RG_GAUT_BIC-1_2021-09-16	Capniidae	25		
		RG_GAUT_BIC-1_2021-09-16	Nemouridae	25	0.0079	
1	Nymph	RG_GAUT_BIC-1_2021-09-16	Zapada	25		
		RG_GAUT_BIC-1_2021-09-16	Glossosomatidae	25	0.0024	
8	larvae	RG_GAUT_BIC-1_2021-09-16	Anagapetus	25		
		RG_GAUT_BIC-1_2021-09-16	Limnephilidae	25	0.0014	
2	larvae	RG_GAUT_BIC-1_2021-09-16	Ecclisomyia	25		
		RG_GAUT_BIC-1_2021-09-16	Chironomidae	25	0.0025	
2	larvae	RG_GAUT_BIC-1_2021-09-16	Micropsectra	25		
1	larvae/immature	RG_GAUT_BIC-1_2021-09-16	Tanypodinae	25		
		RG_GAUT_BIC-1_2021-09-16	Tipulidae	25	0.0321	
4	larvae	RG_GAUT_BIC-1_2021-09-16	Dicranota	25		
1	larvae/indeterminate	RG_GAUT_BIC-1_2021-09-16	Tipulidae	25		
		RG_GAUT_BIC-2_2021-09-16	Planariidae	25	0.0094	
5	none	RG_GAUT_BIC-2_2021-09-16	Polycelis	25		
		RG_GAUT_BIC-2_2021-09-16	Hygrobatidae	25	0.0020	
2	Adult	RG_GAUT_BIC-2_2021-09-16	Hygrobates	25		
39	none	RG_GAUT_BIC-2_2021-09-16	Ostracoda	25	0.0089	
		RG_GAUT_BIC-2_2021-09-16	Dytiscidae	25	0.0009	
1	larvae/indeterminate	RG_GAUT_BIC-2_2021-09-16	Dytiscidae	25		
		RG_GAUT_BIC-2_2021-09-16	Elmidae	25	0.0077	
5	larvae	RG_GAUT_BIC-2_2021-09-16	Heterlimnius	25		
2	larvae/immature	RG_GAUT_BIC-2_2021-09-16	Elmidae	25		
		RG_GAUT_BIC-2_2021-09-16	Baetidae	25	0.0001	
2	Nymph	RG_GAUT_BIC-2_2021-09-16	Baetis	25		
	Nymph/immature	RG_GAUT_BIC-2_2021-09-16	Heptageniidae	25	0.0151	
3	Nymph	RG_GAUT_BIC-2_2021-09-16	Cinygma	25		
		RG_GAUT_BIC-2_2021-09-16	Capniidae	25	0.0066	
2	Nymph	RG_GAUT_BIC-2_2021-09-16	Eucapnopsis	25		
9	Nymph	RG_GAUT_BIC-2_2021-09-16	Paracapnia	25		
36	Nymph/immature	RG_GAUT_BIC-2_2021-09-16	Capniidae	25		
		RG_GAUT_BIC-2_2021-09-16	Nemouridae	25	0.0031	
2	Nymph	RG_GAUT_BIC-2_2021-09-16	Zapada	25		
		RG_GAUT_BIC-2_2021-09-16	Perlodidae	100	0.0911	large/rare search
		RG_GAUT_BIC-2_2021-09-16	Perlodidae	25	0.0022	
2	Nymph	RG_GAUT_BIC-2_2021-09-16	Isoperla	25		
2	Nymph	RG_GAUT_BIC-2_2021-09-16	Megarcys	100		large/rare search
		RG_GAUT_BIC-2_2021-09-16	Taeniopterygidae	25	0.0002	
3	Nymph/immature	RG_GAUT_BIC-2_2021-09-16	Taeniopterygidae	25		
		RG_GAUT_BIC-2_2021-09-16	Glossosomatidae	25	0.0001	
1	larvae	RG_GAUT_BIC-2_2021-09-16	Anagapetus	25		
		RG_GAUT_BIC-2_2021-09-16	Limnephilidae	25	0.0056	
2	larvae	RG_GAUT_BIC-2_2021-09-16	Ecclisomyia	25		
		RG_GAUT_BIC-2_2021-09-16	Rhyacophilidae	25	0.0016	
1	larvae	RG_GAUT_BIC-2_2021-09-16	Rhyacophila	25		
		RG_GAUT_BIC-2_2021-09-16	Chironomidae	25	0.0013	
1	larvae	RG_GAUT_BIC-2_2021-09-16	Metriocnemus	25		
1	larvae	RG_GAUT_BIC-2_2021-09-16	Tvetenia	25		
1	larvae	RG_GAUT_BIC-2_2021-09-16	Zavrelimyia	25		
		RG_GAUT_BIC-3_2021-09-16	Planariidae	50	0.0122	
9	none	RG_GAUT_BIC-3_2021-09-16	Polycelis	50		
1	none	RG_GAUT_BIC-3_2021-09-16	Enchytraeidae	50	0.0002	
		RG_GAUT_BIC-3_2021-09-16	Hygrobatidae	50	0.0040	
7	Adult	RG_GAUT_BIC-3_2021-09-16	Hygrobates	50		
		RG_GAUT_BIC-3_2021-09-16	Hydryphantidae	50	0.0006	
2	Adult	RG_GAUT_BIC-3_2021-09-16	Wandesia	50		
		RG_GAUT_BIC-3_2021-09-16	Sperchonidae	50	0.0016	
3	Adult	RG_GAUT_BIC-3_2021-09-16	Sperchon	50		
74	none	RG_GAUT_BIC-3_2021-09-16	Ostracoda	50	0.0180	
		RG_GAUT_BIC-3_2021-09-16	Elmidae	50	0.0014	
5	larvae	RG_GAUT_BIC-3_2021-09-16	Heterlimnius	50		
		RG_GAUT_BIC-3_2021-09-16	Baetidae	50	0.0004	
3	Nymph	RG_GAUT_BIC-3_2021-09-16	Baetis	50		
		RG_GAUT_BIC-3_2021-09-16	Capniidae	50	0.0089	
3	Nymph	RG_GAUT_BIC-3_2021-09-16	Eucapnopsis	50		
43	Nymph	RG_GAUT_BIC-3_2021-09-16	Paracapnia	50		
17	Nymph/immature	RG_GAUT_BIC-3_2021-09-16	Capniidae	50		
		RG_GAUT_BIC-3_2021-09-16	Chloroperlidae	50	0.0037	
2	Nymph	RG_GAUT_BIC-3_2021-09-16	Sweltsa	50		

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	Text(20)	Text(40)	Text(255)	Numeric	Text(255)	Text(255)
		RG_GAUT_BIC-3_2021-09-16	Nemouridae	50	0.0013	
3	Nymph	RG_GAUT_BIC-3_2021-09-16	Zapada	50		
		RG_GAUT_BIC-3_2021-09-16	Perlodidae	50	0.0317	
2	Nymph	RG_GAUT_BIC-3_2021-09-16	Isoperla	50		
2	Nymph	RG_GAUT_BIC-3_2021-09-16	Megarcys	50		
		RG_GAUT_BIC-3_2021-09-16	Glossosomatidae	50	0.0013	
4	larvae	RG_GAUT_BIC-3_2021-09-16	Anagapetus	50		
		RG_GAUT_BIC-3_2021-09-16	Limnephilidae	50	0.0071	
1	larvae/immature	RG_GAUT_BIC-3_2021-09-16	Limnephilidae	50		
		RG_GAUT_BIC-3_2021-09-16	Rhyacophilidae	50	0.0073	
1	larvae	RG_GAUT_BIC-3_2021-09-16	Rhyacophila	50		
		RG_GAUT_BIC-3_2021-09-16	Chironomidae	50	0.0005	
1	pupae	RG_GAUT_BIC-3_2021-09-16	Chironomidae	50		
1	larvae	RG_GAUT_BIC-3_2021-09-16	Chaetocladius	50		
1	larvae	RG_GAUT_BIC-3_2021-09-16	Zavrelimyia	50		
		RG_GAUT_BIC-3_2021-09-16	Empididae	50	0.0015	
2	larvae	RG_GAUT_BIC-3_2021-09-16	Chelifera/Metachela	50		
1	larvae	RG_GAUT_BIC-3_2021-09-16	Wiedemannia	50		
		RG_GAUT_BIC-3_2021-09-16	Psychodidae	50	0.0001	
1	larvae	RG_GAUT_BIC-3_2021-09-16	Pericoma	50		
		RG_GAUT_BIC-3_2021-09-16	Tipulidae	50	0.0081	
6	larvae	RG_GAUT_BIC-3_2021-09-16	Dicranota	50		
1	larvae	RG_GAUT_BIC-3_2021-09-16	Limnophila	50		
		RG_GAUT_BIC-4_2021-09-16	Naididae	25	0.0002	
1		RG_GAUT_BIC-4_2021-09-16	immatures with hair chaetae	25		
96	none	RG_GAUT_BIC-4_2021-09-16	Ostracoda	25	0.0226	
		RG_GAUT_BIC-4_2021-09-16	Elmidae	25	0.0071	
6	larvae	RG_GAUT_BIC-4_2021-09-16	Heterlimnius	25		
3	larvae/immature	RG_GAUT_BIC-4_2021-09-16	Elmidae	25		
		RG_GAUT_BIC-4_2021-09-16	Baetidae	25	0.0010	
1	Nymph	RG_GAUT_BIC-4_2021-09-16	Baetis	25		
		RG_GAUT_BIC-4_2021-09-16	Capniidae	25	0.0035	
21	Nymph	RG_GAUT_BIC-4_2021-09-16	Paracapnia	25		
4	Nymph/immature	RG_GAUT_BIC-4_2021-09-16	Capniidae	25		
		RG_GAUT_BIC-4_2021-09-16	Nemouridae	25	0.0006	
2	Nymph/immature	RG_GAUT_BIC-4_2021-09-16	Nemouridae	25		
		RG_GAUT_BIC-4_2021-09-16	Perlodidae	100	0.1821	large/rare search
6	Nymph	RG_GAUT_BIC-4_2021-09-16	Megarcys	100		large/rare search
		RG_GAUT_BIC-4_2021-09-16	Taeniopterygidae	25	0.0006	
1	Nymph/immature	RG_GAUT_BIC-4_2021-09-16	Taeniopterygidae	25		
		RG_GAUT_BIC-4_2021-09-16	Glossosomatidae	25	0.0016	
8	larvae	RG_GAUT_BIC-4_2021-09-16	Anagapetus	25		
		RG_GAUT_BIC-4_2021-09-16	Limnephilidae	25	0.0004	
1	larvae	RG_GAUT_BIC-4_2021-09-16	Ecclisomyia	25		
		RG_GAUT_BIC-4_2021-09-16	Chironomidae	25	0.0026	
1	larvae	RG_GAUT_BIC-4_2021-09-16	Brillia	25		
1	larvae	RG_GAUT_BIC-4_2021-09-16	Cricotopus/Orthocladius	25		
3	larvae	RG_GAUT_BIC-4_2021-09-16	Zavrelimyia	25		
		RG_GAUT_BIC-4_2021-09-16	Empididae	25	0.0008	
1	larvae	RG_GAUT_BIC-4_2021-09-16	Chelifera/Metachela	25		
		RG_GAUT_BIC-4_2021-09-16	Tipulidae	25	0.0059	
2	larvae	RG_GAUT_BIC-4_2021-09-16	Dicranota	25		
1	larvae	RG_GAUT_BIC-4_2021-09-16	Rhabdomastix	25		
		RG_GAUT_BIC-5_2021-09-16	Planariidae	50	0.0061	
2	none	RG_GAUT_BIC-5_2021-09-16	Polycelis	50		
		RG_GAUT_BIC-5_2021-09-16	Lumbricidae	50	0.0051	
1	none	RG_GAUT_BIC-5_2021-09-16	Lumbricidae	50		
40	none	RG_GAUT_BIC-5_2021-09-16	Ostracoda	50	0.0115	
		RG_GAUT_BIC-5_2021-09-16	Elmidae	50	0.0008	
2	larvae	RG_GAUT_BIC-5_2021-09-16	Heterlimnius	50		
		RG_GAUT_BIC-5_2021-09-16	Capniidae	50	0.0073	
4	Nymph	RG_GAUT_BIC-5_2021-09-16	Eucapnopsis	50		
6	Nymph	RG_GAUT_BIC-5_2021-09-16	Paracapnia	50		
31	Nymph/immature	RG_GAUT_BIC-5_2021-09-16	Capniidae	50		
		RG_GAUT_BIC-5_2021-09-16	Nemouridae	50	0.0038	
7	Nymph	RG_GAUT_BIC-5_2021-09-16	Zapada	50		
		RG_GAUT_BIC-5_2021-09-16	Perlodidae	100	0.0519	large/rare search
		RG_GAUT_BIC-5_2021-09-16	Perlodidae	50	0.0204	
2	Nymph	RG_GAUT_BIC-5_2021-09-16	Megarcys	100		large/rare search
1	Nymph	RG_GAUT_BIC-5_2021-09-16	Megarcys	50		
		RG_GAUT_BIC-5_2021-09-16	Taeniopterygidae	50	0.0005	
2	Nymph/immature	RG_GAUT_BIC-5_2021-09-16	Taeniopterygidae	50		
		RG_GAUT_BIC-5_2021-09-16	Glossosomatidae	50	0.0059	
28	larvae	RG_GAUT_BIC-5_2021-09-16	Anagapetus	50		
		RG_GAUT_BIC-5_2021-09-16	Limnephilidae	50	0.0014	
1	larvae	RG_GAUT_BIC-5_2021-09-16	Ecclisomyia	50		
		RG_GAUT_BIC-5_2021-09-16	Rhyacophilidae	50	0.0001	
1	larvae	RG_GAUT_BIC-5_2021-09-16	Rhyacophila	50		
		RG_GAUT_BIC-5_2021-09-16	Chironomidae	50	0.0012	
2	larvae	RG_GAUT_BIC-5_2021-09-16	Brillia	50		
1	larvae	RG_GAUT_BIC-5_2021-09-16	Corynoneura	50		
1	larvae	RG_GAUT_BIC-5_2021-09-16	Heleniella	50		
1	larvae	RG_GAUT_BIC-5_2021-09-16	Zavrelimyia	50		
		RG_GAUT_BIC-5_2021-09-16	Dixidae	50	0.0055	
2	larvae	RG_GAUT_BIC-5_2021-09-16	Dixa	50		

quantity	**life_stage_code**	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	*Text(20)*	*Text(40)*	*Text(255)*	*Numeric*	*Text(255)*	*Text(255)*
1	larvae	RG_GAUT_BIC-5_2021-09-16	Meringodixa	50		
		RG_GAUT_BIC-5_2021-09-16	Tipulidae	50	0.0005	
1	larvae	RG_GAUT_BIC-5_2021-09-16	Dicranota	50		
		RG_GAUT_BIC-6_2021-09-16	Planariidae	50	0.0076	
7	none	RG_GAUT_BIC-6_2021-09-16	Polycelis	50		
		RG_GAUT_BIC-6_2021-09-16	Lumbricidae	100	0.0934	large/rare search
1	none	RG_GAUT_BIC-6_2021-09-16	Eiseniella tetraedra	100		large/rare search
2	none	RG_GAUT_BIC-6_2021-09-16	Lumbricidae	50	0.0013	
		RG_GAUT_BIC-6_2021-09-16	Sperchonidae	50	0.0005	
1	Adult	RG_GAUT_BIC-6_2021-09-16	Sperchon	50		
153	none	RG_GAUT_BIC-6_2021-09-16	Ostracoda	50	0.0375	
		RG_GAUT_BIC-6_2021-09-16	Elmidae	50	0.0006	
2	larvae	RG_GAUT_BIC-6_2021-09-16	Heterlimnius	50		
1	larvae/immature	RG_GAUT_BIC-6_2021-09-16	Elmidae	50		
	Nymph/immature	RG_GAUT_BIC-6_2021-09-16	Heptageniidae	50	0.0045	
2	Nymph	RG_GAUT_BIC-6_2021-09-16	Cinygma	50		
		RG_GAUT_BIC-6_2021-09-16	Capniidae	50	0.0130	
3	Nymph	RG_GAUT_BIC-6_2021-09-16	Eucapnopsis	50		
25	Nymph	RG_GAUT_BIC-6_2021-09-16	Paracapnia	50		
49	Nymph/immature	RG_GAUT_BIC-6_2021-09-16	Capniidae	50		
		RG_GAUT_BIC-6_2021-09-16	Leuctridae	50	0.0001	
2	Nymph/immature	RG_GAUT_BIC-6_2021-09-16	Leuctridae	50		
		RG_GAUT_BIC-6_2021-09-16	Nemouridae	50	0.0158	
11	Nymph	RG_GAUT_BIC-6_2021-09-16	Zapada	50		
5	Nymph/immature	RG_GAUT_BIC-6_2021-09-16	Nemouridae	50		
		RG_GAUT_BIC-6_2021-09-16	Perlodidae	100	0.1066	large/rare search
		RG_GAUT_BIC-6_2021-09-16	Perlodidae	50	0.0883	
3	Nymph	RG_GAUT_BIC-6_2021-09-16	Megarcys	100		large/rare search
4	Nymph	RG_GAUT_BIC-6_2021-09-16	Megarcys	50		
		RG_GAUT_BIC-6_2021-09-16	Glossosomatidae	50	0.0026	
11	larvae	RG_GAUT_BIC-6_2021-09-16	Anagapetus	50		
		RG_GAUT_BIC-6_2021-09-16	Rhyacophilidae	50	0.0005	
3	larvae	RG_GAUT_BIC-6_2021-09-16	Rhyacophila	50		
		RG_GAUT_BIC-6_2021-09-16	Chironomidae	50	0.0031	
1	pupae	RG_GAUT_BIC-6_2021-09-16	Chironomidae	50		
1	larvae	RG_GAUT_BIC-6_2021-09-16	Brillia	50		
2	larvae	RG_GAUT_BIC-6_2021-09-16	Chaetocladius	50		
1	larvae	RG_GAUT_BIC-6_2021-09-16	Orthocladius lignicola	50		
1	larvae	RG_GAUT_BIC-6_2021-09-16	Tvetenia	50		
2	larvae	RG_GAUT_BIC-6_2021-09-16	Zavrelimyia	50		
7	none	RG_GHBP_BIC-1_2021-09-11	Nematoda	25	0.0004	
1	none	RG_GHBP_BIC-1_2021-09-11	Enchytraeidae	25	0.0001	
		RG_GHBP_BIC-1_2021-09-11	Lumbricidae	25	0.0815	
6	none	RG_GHBP_BIC-1_2021-09-11	Lumbricidae	25		
		RG_GHBP_BIC-1_2021-09-11	Lebertiidae	25	0.0007	
5	Adult	RG_GHBP_BIC-1_2021-09-11	Lebertia	25		
4	none	RG_GHBP_BIC-1_2021-09-11	Ostracoda	25	0.0006	
		RG_GHBP_BIC-1_2021-09-11	Gammaridae	25	0.4238	
11	none	RG_GHBP_BIC-1_2021-09-11	Gammarus	25		
		RG_GHBP_BIC-1_2021-09-11	Elmidae	25	0.0086	
5	larvae/adult	RG_GHBP_BIC-1_2021-09-11	Heterlimnius	25		
		RG_GHBP_BIC-1_2021-09-11	Capniidae	25	0.0003	
1	Nymph	RG_GHBP_BIC-1_2021-09-11	Paracapnia	25		
		RG_GHBP_BIC-1_2021-09-11	Chloroperlidae	25	0.0013	
1	Nymph	RG_GHBP_BIC-1_2021-09-11	Sweltsa	25		
		RG_GHBP_BIC-1_2021-09-11	Nemouridae	25	0.1030	
33	Nymph	RG_GHBP_BIC-1_2021-09-11	Malenka	25		
20	Nymph	RG_GHBP_BIC-1_2021-09-11	Zapada	25		
		RG_GHBP_BIC-1_2021-09-11	Brachycentridae	25	0.0045	
7	larvae	RG_GHBP_BIC-1_2021-09-11	Micrasema	25		
		RG_GHBP_BIC-1_2021-09-11	Lepidostomatidae	25	0.0002	
1	larvae	RG_GHBP_BIC-1_2021-09-11	Lepidostoma	25		
		RG_GHBP_BIC-1_2021-09-11	Rhyacophilidae	25	0.0743	
12	larvae	RG_GHBP_BIC-1_2021-09-11	Rhyacophila	25		
		RG_GHBP_BIC-1_2021-09-11	Chironomidae	25	0.0012	
1	pupae	RG_GHBP_BIC-1_2021-09-11	Chironomidae	25		
1	larvae	RG_GHBP_BIC-1_2021-09-11	Pentaneura	25		
		RG_GHBP_BIC-1_2021-09-11	Pelecorhyncidae	25	0.0036	
4	larvae	RG_GHBP_BIC-1_2021-09-11	Glutops	25		
		RG_GHBP_BIC-1_2021-09-11	Psychodidae	25	0.0185	
72	larvae	RG_GHBP_BIC-1_2021-09-11	Pericoma	25		
		RG_GHBP_BIC-1_2021-09-11	Pisidiidae	25	0.3141	
267	none	RG_GHBP_BIC-1_2021-09-11	Pisidium	25		
5	none	RG_GHBP_BIC-2_2021-09-14	Nematoda	50	0.0005	
		RG_GHBP_BIC-2_2021-09-14	Planariidae	50	0.0023	
2	none	RG_GHBP_BIC-2_2021-09-14	Polycelis	50		
9	none	RG_GHBP_BIC-2_2021-09-14	Enchytraeidae	50	0.0010	
		RG_GHBP_BIC-2_2021-09-14	Lumbricidae	100	0.2373	large/rare search
2	none	RG_GHBP_BIC-2_2021-09-14	Eiseniella tetraedra	100		large/rare search
2	none	RG_GHBP_BIC-2_2021-09-14	Lumbricidae	100		large/rare search
		RG_GHBP_BIC-2_2021-09-14	Lebertiidae	50	0.0010	
2	Adult	RG_GHBP_BIC-2_2021-09-14	Lebertia	50		
3	none	RG_GHBP_BIC-2_2021-09-14	Ostracoda	50	0.0009	
		RG_GHBP_BIC-2_2021-09-14	Gammaridae	100	0.0730	large/rare search
		RG_GHBP_BIC-2_2021-09-14	Gammaridae	50	0.0247	

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	*Text(20)*	*Text(40)*	*Text(255)*	*Numeric*	*Text(255)*	*Text(255)*
1	none	RG_GHBP_BIC-2_2021-09-14	Gammarus	100		large/rare search
2	none	RG_GHBP_BIC-2_2021-09-14	Gammarus	50		
1	none	RG_GHBP_BIC-2_2021-09-14	Collembola	50	0.0003	
		RG_GHBP_BIC-2_2021-09-14	Elmidae	50	0.0018	
4	larvae/adult	RG_GHBP_BIC-2_2021-09-14	Heterlimnius	50		
		RG_GHBP_BIC-2_2021-09-14	Baetidae	50	0.0059	
1	Nymph	RG_GHBP_BIC-2_2021-09-14	Baetis	50		
		RG_GHBP_BIC-2_2021-09-14	Chloroperlidae	50	0.0014	
1	Nymph	RG_GHBP_BIC-2_2021-09-14	Sweltsa	50		
		RG_GHBP_BIC-2_2021-09-14	Nemouridae	100	0.0476	large/rare search
		RG_GHBP_BIC-2_2021-09-14	Nemouridae	50	0.2849	
12	Nymph	RG_GHBP_BIC-2_2021-09-14	Malenka	100		large/rare search
40	Nymph	RG_GHBP_BIC-2_2021-09-14	Malenka	50		
3	Nymph	RG_GHBP_BIC-2_2021-09-14	Zapada	100		large/rare search
184	Nymph	RG_GHBP_BIC-2_2021-09-14	Zapada	50		
5	Nymph/immature	RG_GHBP_BIC-2_2021-09-14	Nemouridae	50		
		RG_GHBP_BIC-2_2021-09-14	Perlodidae	50	0.0004	
1	Nymph/immature	RG_GHBP_BIC-2_2021-09-14	Perlodidae	50		
		RG_GHBP_BIC-2_2021-09-14	Brachycentridae	50	0.0063	
14	larvae	RG_GHBP_BIC-2_2021-09-14	Micrasema	50		
		RG_GHBP_BIC-2_2021-09-14	Lepidostomatidae	50	0.0003	
4	larvae	RG_GHBP_BIC-2_2021-09-14	Lepidostoma	50		
		RG_GHBP_BIC-2_2021-09-14	Rhyacophilidae	100	0.2840	large/rare search
		RG_GHBP_BIC-2_2021-09-14	Rhyacophilidae	50	0.0481	
12	larvae	RG_GHBP_BIC-2_2021-09-14	Rhyacophila	100		large/rare search
46	larvae	RG_GHBP_BIC-2_2021-09-14	Rhyacophila	50		
		RG_GHBP_BIC-2_2021-09-14	Ceratopogonidae	50	0.0009	
3	larvae	RG_GHBP_BIC-2_2021-09-14	Probezzia	50		
		RG_GHBP_BIC-2_2021-09-14	Chironomidae	50	0.0057	
18	pupae	RG_GHBP_BIC-2_2021-09-14	Chironomidae	50		
1	larvae	RG_GHBP_BIC-2_2021-09-14	Micropsectra	50		
2	larvae	RG_GHBP_BIC-2_2021-09-14	Corynoneura	50		
7	larvae	RG_GHBP_BIC-2_2021-09-14	Cricotopus/Orthocladius	50		
1	larvae	RG_GHBP_BIC-2_2021-09-14	Eukiefferiella	50		
3	larvae	RG_GHBP_BIC-2_2021-09-14	Pentaneura	50		
		RG_GHBP_BIC-2_2021-09-14	Dixidae	50	0.0032	
1	larvae	RG_GHBP_BIC-2_2021-09-14	Dixa	50		
		RG_GHBP_BIC-2_2021-09-14	Pelecorhyncidae	100	0.1373	large/rare search
		RG_GHBP_BIC-2_2021-09-14	Pelecorhyncidae	50	0.0358	
14	larvae	RG_GHBP_BIC-2_2021-09-14	Glutops	100		large/rare search
7	larvae	RG_GHBP_BIC-2_2021-09-14	Glutops	50		
		RG_GHBP_BIC-2_2021-09-14	Psychodidae	50	0.0943	
260	larvae	RG_GHBP_BIC-2_2021-09-14	Pericoma	50		
8	larvae/indeterminate	RG_GHBP_BIC-2_2021-09-14	Simuliidae	50	0.0128	
		RG_GHBP_BIC-2_2021-09-14	Pisidiidae	50	0.1388	
104	none	RG_GHBP_BIC-2_2021-09-14	Pisidium	50		
1	none	RG_GHBP_BIC-3_2021-09-11	Tricladida	25	0.0022	
		RG_GHBP_BIC-3_2021-09-11	Planariidae	25	0.0001	
1	none	RG_GHBP_BIC-3_2021-09-11	Polycelis	25		
1	none	RG_GHBP_BIC-3_2021-09-11	Enchytraeidae	25	0.0003	
		RG_GHBP_BIC-3_2021-09-11	Lumbricidae	100	0.6873	large/rare search
		RG_GHBP_BIC-3_2021-09-11	Lumbricidae	25	0.0018	
10	none	RG_GHBP_BIC-3_2021-09-11	Eiseniella tetraedra	100		large/rare search
1	none	RG_GHBP_BIC-3_2021-09-11	Lumbricidae	100		large/rare search
1	none	RG_GHBP_BIC-3_2021-09-11	Lumbricidae	25		
		RG_GHBP_BIC-3_2021-09-11	Lebertiidae	25	0.0008	
2	Adult	RG_GHBP_BIC-3_2021-09-11	Lebertia	25		
		RG_GHBP_BIC-3_2021-09-11	Gammaridae	100	0.1084	large/rare search
		RG_GHBP_BIC-3_2021-09-11	Gammaridae	25	0.0123	
4	none	RG_GHBP_BIC-3_2021-09-11	Gammarus	100		large/rare search
2	none	RG_GHBP_BIC-3_2021-09-11	Gammarus	25		
		RG_GHBP_BIC-3_2021-09-11	Elmidae	25	0.0005	
1	larvae/adult	RG_GHBP_BIC-3_2021-09-11	Heterlimnius	25		
		RG_GHBP_BIC-3_2021-09-11	Baetidae	25	0.0146	
2	Nymph	RG_GHBP_BIC-3_2021-09-11	Baetis	25		
		RG_GHBP_BIC-3_2021-09-11	Chloroperlidae	25	0.0054	
3	Nymph	RG_GHBP_BIC-3_2021-09-11	Sweltsa	25		
		RG_GHBP_BIC-3_2021-09-11	Nemouridae	100	0.0137	large/rare search
		RG_GHBP_BIC-3_2021-09-11	Nemouridae	25	0.1874	
4	Nymph	RG_GHBP_BIC-3_2021-09-11	Malenka	100		large/rare search
45	Nymph	RG_GHBP_BIC-3_2021-09-11	Malenka	25		
54	Nymph	RG_GHBP_BIC-3_2021-09-11	Zapada	25		
7	Nymph/immature	RG_GHBP_BIC-3_2021-09-11	Nemouridae	25		
		RG_GHBP_BIC-3_2021-09-11	Brachycentridae	25	0.0017	
7	larvae	RG_GHBP_BIC-3_2021-09-11	Micrasema	25		
		RG_GHBP_BIC-3_2021-09-11	Lepidostomatidae	25	0.0002	
6	larvae	RG_GHBP_BIC-3_2021-09-11	Lepidostoma	25		
		RG_GHBP_BIC-3_2021-09-11	Limnephilidae	25	0.0001	
1	larvae/immature	RG_GHBP_BIC-3_2021-09-11	Limnephilidae	25		
		RG_GHBP_BIC-3_2021-09-11	Rhyacophilidae	100	0.4698	large/rare search
		RG_GHBP_BIC-3_2021-09-11	Rhyacophilidae	25	0.0499	
25	larvae	RG_GHBP_BIC-3_2021-09-11	Rhyacophila	100		large/rare search
16	larvae	RG_GHBP_BIC-3_2021-09-11	Rhyacophila	25		
		RG_GHBP_BIC-3_2021-09-11	Ceratopogonidae	25	0.0002	
1	larvae/indeterminate	RG_GHBP_BIC-3_2021-09-11	Ceratopogonidae	25		

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	Text(20)	Text(40)	Text(255)	Numeric	Text(255)	Text(255)
		RG_GHBP_BIC-3_2021-09-11	Chironomidae	25	0.0032	
8	pupae	RG_GHBP_BIC-3_2021-09-11	Chironomidae	25		
1	larvae	RG_GHBP_BIC-3_2021-09-11	Micropsectra	25		
3	larvae	RG_GHBP_BIC-3_2021-09-11	Eukiefferiella	25		
		RG_GHBP_BIC-3_2021-09-11	Pelecorhyncidae	100	0.0118	large/rare search
1	larvae	RG_GHBP_BIC-3_2021-09-11	Glutops	100		large/rare search
		RG_GHBP_BIC-3_2021-09-11	Psychodidae	25	0.0075	
24	larvae	RG_GHBP_BIC-3_2021-09-11	Pericoma	25		
		RG_GHBP_BIC-3_2021-09-11	Simuliidae	25	0.0247	
8	larvae/indeterminate	RG_GHBP_BIC-3_2021-09-11	Simuliidae	25		
		RG_GHBP_BIC-3_2021-09-11	Pisidiidae	25	0.2791	
203	none	RG_GHBP_BIC-3_2021-09-11	Pisidium	25		
3	none	RG_GHBP_BIC-4_2021-09-14	Enchytraeidae	25	0.0007	
		RG_GHBP_BIC-4_2021-09-14	Lumbricidae	25	0.2187	
2	none	RG_GHBP_BIC-4_2021-09-14	Lumbricidae	100		large/rare search
		RG_GHBP_BIC-4_2021-09-14	Trombidiformes	25	0.0005	
2	Adult/indeterminate	RG_GHBP_BIC-4_2021-09-14	Trombidiformes	25		
		RG_GHBP_BIC-4_2021-09-14	Lebertiidae	25	0.0004	
1	Adult	RG_GHBP_BIC-4_2021-09-14	Lebertia	25		
1	Adult/indeterminate	RG_GHBP_BIC-4_2021-09-14	Torrenticolidae	25	0.0003	
2	none	RG_GHBP_BIC-4_2021-09-14	Ostracoda	25	0.0008	
		RG_GHBP_BIC-4_2021-09-14	Gammaridae	100	0.1168	large/rare search
		RG_GHBP_BIC-4_2021-09-14	Gammaridae	25	0.0596	
4	none	RG_GHBP_BIC-4_2021-09-14	Gammarus	100		large/rare search
5	none	RG_GHBP_BIC-4_2021-09-14	Gammarus	25		
		RG_GHBP_BIC-4_2021-09-14	Elmidae	25	0.0016	
1	larvae/adult	RG_GHBP_BIC-4_2021-09-14	Heterlimnius	25		
		RG_GHBP_BIC-4_2021-09-14	Baetidae	25	0.0037	
2	Nymph	RG_GHBP_BIC-4_2021-09-14	Baetis	25		
		RG_GHBP_BIC-4_2021-09-14	Capniidae	25	0.0002	
1	Nymph/immature	RG_GHBP_BIC-4_2021-09-14	Capniidae	25		
		RG_GHBP_BIC-4_2021-09-14	Nemouridae	25	0.2565	
41	Nymph	RG_GHBP_BIC-4_2021-09-14	Malenka	25		
117	Nymph	RG_GHBP_BIC-4_2021-09-14	Zapada	25		
6	Nymph/immature	RG_GHBP_BIC-4_2021-09-14	Nemouridae	25		
		RG_GHBP_BIC-4_2021-09-14	Brachycentridae	25	0.0067	
15	larvae	RG_GHBP_BIC-4_2021-09-14	Micrasema	25		
		RG_GHBP_BIC-4_2021-09-14	Lepidostomatidae	25	0.0002	
1	larvae	RG_GHBP_BIC-4_2021-09-14	Lepidostoma	25		
		RG_GHBP_BIC-4_2021-09-14	Rhyacophilidae	100	0.2605	large/rare search
		RG_GHBP_BIC-4_2021-09-14	Rhyacophilidae	25	0.1257	
13	larvae	RG_GHBP_BIC-4_2021-09-14	Rhyacophila	100		large/rare search
51	larvae	RG_GHBP_BIC-4_2021-09-14	Rhyacophila	25		
		RG_GHBP_BIC-4_2021-09-14	Ceratopogonidae	25	0.0004	
1	larvae	RG_GHBP_BIC-4_2021-09-14	Probezzia	25		
		RG_GHBP_BIC-4_2021-09-14	Chironomidae	25	0.0034	
6	pupae	RG_GHBP_BIC-4_2021-09-14	Chironomidae	25		
3	larvae	RG_GHBP_BIC-4_2021-09-14	Micropsectra	25		
		RG_GHBP_BIC-4_2021-09-14	Pelecorhyncidae	100	0.0094	large/rare search
1	larvae	RG_GHBP_BIC-4_2021-09-14	Glutops	100		large/rare search
		RG_GHBP_BIC-4_2021-09-14	Psychodidae	25	0.0348	
77	larvae	RG_GHBP_BIC-4_2021-09-14	Pericoma	25		
		RG_GHBP_BIC-4_2021-09-14	Simuliidae	25	0.0170	
6	larvae/indeterminate	RG_GHBP_BIC-4_2021-09-14	Simuliidae	25		
		RG_GHBP_BIC-4_2021-09-14	Pisidiidae	25	0.1406	
120	none	RG_GHBP_BIC-4_2021-09-14	Pisidium	25		
8	none	RG_GHBP_BIC-5_2021-09-11	Nematoda	25	0.0003	
1	none	RG_GHBP_BIC-5_2021-09-11	Enchytraeidae	100	0.0059	large/rare search
28	none	RG_GHBP_BIC-5_2021-09-11	Enchytraeidae	25	0.0050	
		RG_GHBP_BIC-5_2021-09-11	Lumbricidae	100	0.6553	large/rare search
6	none	RG_GHBP_BIC-5_2021-09-11	Eiseniella tetraedra	100		large/rare search
		RG_GHBP_BIC-5_2021-09-11	Trombidiformes	25	0.0003	
1	Adult/indeterminate	RG_GHBP_BIC-5_2021-09-11	Trombidiformes	25		
		RG_GHBP_BIC-5_2021-09-11	Lebertiidae	25	0.0008	
5	Adult	RG_GHBP_BIC-5_2021-09-11	Lebertia	25		
2	none	RG_GHBP_BIC-5_2021-09-11	Ostracoda	25	0.0004	
		RG_GHBP_BIC-5_2021-09-11	Gammaridae	100	0.2152	large/rare search
		RG_GHBP_BIC-5_2021-09-11	Gammaridae	25	0.1526	
6	none	RG_GHBP_BIC-5_2021-09-11	Gammarus	100		large/rare search
16	none	RG_GHBP_BIC-5_2021-09-11	Gammarus	25		
		RG_GHBP_BIC-5_2021-09-11	Elmidae	25	0.0036	
2	larvae/adult	RG_GHBP_BIC-5_2021-09-11	Heterlimnius	25		
1	adult/indeterminate	RG_GHBP_BIC-5_2021-09-11	Staphylinidae	25	0.0004	
		RG_GHBP_BIC-5_2021-09-11	Baetidae	25	0.0071	
6	Nymph	RG_GHBP_BIC-5_2021-09-11	Baetis	25		
		RG_GHBP_BIC-5_2021-09-11	Chloroperlidae	25	0.0130	
9	Nymph	RG_GHBP_BIC-5_2021-09-11	Sweltsa	25		
1	Nymph/immature	RG_GHBP_BIC-5_2021-09-11	Chloroperlidae	25		
		RG_GHBP_BIC-5_2021-09-11	Nemouridae	100	0.0047	large/rare search
		RG_GHBP_BIC-5_2021-09-11	Nemouridae	25	0.3348	
1	Nymph	RG_GHBP_BIC-5_2021-09-11	Malenka	100		large/rare search
85	Nymph	RG_GHBP_BIC-5_2021-09-11	Malenka	25		
1	Nymph	RG_GHBP_BIC-5_2021-09-11	Zapada	100		large/rare search
145	Nymph	RG_GHBP_BIC-5_2021-09-11	Zapada	25		
24	Nymph/immature	RG_GHBP_BIC-5_2021-09-11	Nemouridae	25		

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	Text(20)	Text(40)	Text(255)	Numeric	Text(255)	Text(255)
		RG_GHBP_BIC-5_2021-09-11	Brachycentridae	25	0.0184	
30	larvae	RG_GHBP_BIC-5_2021-09-11	Micrasema	25		
		RG_GHBP_BIC-5_2021-09-11	Lepidostomatidae	25	0.0015	
15	larvae	RG_GHBP_BIC-5_2021-09-11	Lepidostoma	25		
		RG_GHBP_BIC-5_2021-09-11	Rhyacophilidae	100	0.2016	large/rare search
		RG_GHBP_BIC-5_2021-09-11	Rhyacophilidae	25	0.1320	
9	larvae	RG_GHBP_BIC-5_2021-09-11	Rhyacophila	100		large/rare search
84	larvae	RG_GHBP_BIC-5_2021-09-11	Rhyacophila	25		
		RG_GHBP_BIC-5_2021-09-11	Ceratopogonidae	25	0.0006	
1	larvae	RG_GHBP_BIC-5_2021-09-11	Probezzia	25		
		RG_GHBP_BIC-5_2021-09-11	Chironomidae	25	0.0187	
17	pupae	RG_GHBP_BIC-5_2021-09-11	Chironomidae	25		
24	larvae	RG_GHBP_BIC-5_2021-09-11	Micropsectra	25		
1	larvae	RG_GHBP_BIC-5_2021-09-11	Corynoneura	25		
1	larvae	RG_GHBP_BIC-5_2021-09-11	Heleniella	25		
3	larvae	RG_GHBP_BIC-5_2021-09-11	Pentaneura	25		
		RG_GHBP_BIC-5_2021-09-11	Empididae	25	0.0011	
2	larvae	RG_GHBP_BIC-5_2021-09-11	Chelifera/Metachela	25		
		RG_GHBP_BIC-5_2021-09-11	Pelecorhyncidae	25	0.0022	
6	larvae	RG_GHBP_BIC-5_2021-09-11	Glutops	25		
		RG_GHBP_BIC-5_2021-09-11	Psychodidae	25	0.2554	
514	larvae	RG_GHBP_BIC-5_2021-09-11	Pericoma	25		
		RG_GHBP_BIC-5_2021-09-11	Simuliidae	25	0.0208	
9	larvae/indeterminate	RG_GHBP_BIC-5_2021-09-11	Simuliidae	25		
		RG_GHBP_BIC-5_2021-09-11	Tipulidae	25	0.0011	
1	larvae	RG_GHBP_BIC-5_2021-09-11	Dicranota	25		
		RG_GHBP_BIC-5_2021-09-11	Pisidiidae	100	0.0130	large/rare search
		RG_GHBP_BIC-5_2021-09-11	Pisidiidae	25	0.4692	
8	none	RG_GHBP_BIC-5_2021-09-11	Pisidium	100		large/rare search
315	none	RG_GHBP_BIC-5_2021-09-11	Pisidium	25		
		RG_GHBP_BIC-6_2021-09-14	Planariidae	25	0.0065	
7	none	RG_GHBP_BIC-6_2021-09-14	Polycelis	25		
7	none	RG_GHBP_BIC-6_2021-09-14	Enchytraeidae	25	0.0013	
		RG_GHBP_BIC-6_2021-09-14	Lumbricidae	100	0.3400	large/rare search
3	none	RG_GHBP_BIC-6_2021-09-14	Lumbricidae	100		large/rare search
		RG_GHBP_BIC-6_2021-09-14	Lebertiidae	25	0.0006	
3	Adult	RG_GHBP_BIC-6_2021-09-14	Lebertia	25		
5	none	RG_GHBP_BIC-6_2021-09-14	Ostracoda	25	0.0011	
		RG_GHBP_BIC-6_2021-09-14	Gammaridae	100	0.0996	large/rare search
		RG_GHBP_BIC-6_2021-09-14	Gammaridae	25	0.0804	
2	none	RG_GHBP_BIC-6_2021-09-14	Gammarus	100		large/rare search
6	none	RG_GHBP_BIC-6_2021-09-14	Gammarus	25		
		RG_GHBP_BIC-6_2021-09-14	Baetidae	25	0.0003	
1	Nymph	RG_GHBP_BIC-6_2021-09-14	Baetis	25		
		RG_GHBP_BIC-6_2021-09-14	Nemouridae	25	0.1304	
16	Nymph	RG_GHBP_BIC-6_2021-09-14	Malenka	25		
49	Nymph	RG_GHBP_BIC-6_2021-09-14	Zapada	25		
		RG_GHBP_BIC-6_2021-09-14	Brachycentridae	25	0.0147	
43	larvae	RG_GHBP_BIC-6_2021-09-14	Micrasema	25		
		RG_GHBP_BIC-6_2021-09-14	Lepidostomatidae	25	0.0010	
5	larvae	RG_GHBP_BIC-6_2021-09-14	Lepidostoma	25		
		RG_GHBP_BIC-6_2021-09-14	Rhyacophilidae	25	0.1110	
20	larvae	RG_GHBP_BIC-6_2021-09-14	Rhyacophila	25		
		RG_GHBP_BIC-6_2021-09-14	Chironomidae	25	0.0036	
3	pupae	RG_GHBP_BIC-6_2021-09-14	Chironomidae	25		
5	larvae	RG_GHBP_BIC-6_2021-09-14	Micropsectra	25		
1	larvae	RG_GHBP_BIC-6_2021-09-14	Pagastia	25		
		RG_GHBP_BIC-6_2021-09-14	Empididae	25	0.0003	
1	larvae	RG_GHBP_BIC-6_2021-09-14	Chelifera/Metachela	25		
		RG_GHBP_BIC-6_2021-09-14	Pelecorhyncidae	25	0.0010	
1	larvae	RG_GHBP_BIC-6_2021-09-14	Glutops	25		
		RG_GHBP_BIC-6_2021-09-14	Psychodidae	25	0.0433	
76	larvae	RG_GHBP_BIC-6_2021-09-14	Pericoma	25		
		RG_GHBP_BIC-6_2021-09-14	Simuliidae	25	0.0074	
2	larvae/indeterminate	RG_GHBP_BIC-6_2021-09-14	Simuliidae	25		
		RG_GHBP_BIC-6_2021-09-14	Pisidiidae	25	0.4527	
299	none	RG_GHBP_BIC-6_2021-09-14	Pisidium	25		
		RG_GHNF_BIC-1_2021-09-10	Planariidae	12.5	0.0145	
5	none	RG_GHNF_BIC-1_2021-09-10	Polycelis	12.5		
5	none	RG_GHNF_BIC-1_2021-09-10	Enchytraeidae	12.5	0.0013	
		RG_GHNF_BIC-1_2021-09-10	Sperchonidae	12.5	0.0002	
1	Adult	RG_GHNF_BIC-1_2021-09-10	Sperchon	12.5		
12	none	RG_GHNF_BIC-1_2021-09-10	Ostracoda	12.5	0.0025	
		RG_GHNF_BIC-1_2021-09-10	Capniidae	12.5	0.0148	
5	Nymph	RG_GHNF_BIC-1_2021-09-10	Mesocapnia/Capnia	12.5		
13	Nymph	RG_GHNF_BIC-1_2021-09-10	Paracapnia	12.5		
26	Nymph/immature	RG_GHNF_BIC-1_2021-09-10	Capniidae	12.5		
		RG_GHNF_BIC-1_2021-09-10	Chloroperlidae	12.5	0.0001	
1	Nymph/immature	RG_GHNF_BIC-1_2021-09-10	Chloroperlidae	12.5		
		RG_GHNF_BIC-1_2021-09-10	Nemouridae	12.5	0.0207	
1	Nymph	RG_GHNF_BIC-1_2021-09-10	Malenka	12.5		
32	Nymph	RG_GHNF_BIC-1_2021-09-10	Zapada	12.5		
44	Nymph/immature	RG_GHNF_BIC-1_2021-09-10	Nemouridae	12.5		
		RG_GHNF_BIC-1_2021-09-10	Perlodidae	100	0.0136	large/rare search
		RG_GHNF_BIC-1_2021-09-10	Perlodidae	12.5	0.0183	

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	*Text(20)*	*Text(40)*	*Text(255)*	*Numeric*	*Text(255)*	*Text(255)*
17	Nymph	RG_GHNF_BIC-1_2021-09-10	Isoperla	12.5		
1	Nymph	RG_GHNF_BIC-1_2021-09-10	Megarcys	100		large/rare search
		RG_GHNF_BIC-1_2021-09-10	Taeniopterygidae	12.5	0.0005	
4	Nymph/immature	RG_GHNF_BIC-1_2021-09-10	Taeniopterygidae	12.5		
		RG_GHNF_BIC-1_2021-09-10	Limnephilidae	12.5	0.0027	
6	larvae/immature	RG_GHNF_BIC-1_2021-09-10	Limnephilidae	12.5		
		RG_GHNF_BIC-1_2021-09-10	Chironomidae	12.5	0.0638	
23	pupae	RG_GHNF_BIC-1_2021-09-10	Chironomidae	12.5		
1	larvae	RG_GHNF_BIC-1_2021-09-10	Micropsectra	12.5		
1	larvae	RG_GHNF_BIC-1_2021-09-10	Diamesa	12.5		
79	larvae	RG_GHNF_BIC-1_2021-09-10	Pagastia	12.5		
2	larvae	RG_GHNF_BIC-1_2021-09-10	Pseudodiamesa	12.5		
1	larvae	RG_GHNF_BIC-1_2021-09-10	Corynoneura	12.5		
12	larvae	RG_GHNF_BIC-1_2021-09-10	Cricotopus/Orthocladius	12.5		
3	larvae	RG_GHNF_BIC-1_2021-09-10	Eukiefferiella	12.5		
2	larvae	RG_GHNF_BIC-1_2021-09-10	Heleniella	12.5		
145	larvae	RG_GHNF_BIC-1_2021-09-10	Tvetenia	12.5		
		RG_GHNF_BIC-1_2021-09-10	Empididae	12.5	0.0324	
15	larvae	RG_GHNF_BIC-1_2021-09-10	Chelifera/Metachela	12.5		
3	larvae	RG_GHNF_BIC-1_2021-09-10	Clinocera	12.5		
		RG_GHNF_BIC-1_2021-09-10	Psychodidae	12.5	0.0025	
5	larvae	RG_GHNF_BIC-1_2021-09-10	Pericoma	12.5		
		RG_GHNF_BIC-1_2021-09-10	Tipulidae	12.5	0.0049	
14	larvae	RG_GHNF_BIC-1_2021-09-10	Dicranota	12.5		
		RG_GHNF_BIC-2_2021-09-10	Planariidae	6.25	0.0044	
1	none	RG_GHNF_BIC-2_2021-09-10	Polycelis	6.25		
2	none	RG_GHNF_BIC-2_2021-09-10	Enchytraeidae	6.25	0.0001	
8	none	RG_GHNF_BIC-2_2021-09-10	Ostracoda	6.25	0.0015	
		RG_GHNF_BIC-2_2021-09-10	Capniidae	6.25	0.0142	
3	Nymph	RG_GHNF_BIC-2_2021-09-10	Mesocapnia/Capnia	6.25		
31	Nymph	RG_GHNF_BIC-2_2021-09-10	Paracapnia	6.25		
24	Nymph/immature	RG_GHNF_BIC-2_2021-09-10	Capniidae	6.25		
		RG_GHNF_BIC-2_2021-09-10	Nemouridae	6.25	0.0180	
1	Nymph	RG_GHNF_BIC-2_2021-09-10	Malenka	6.25		
18	Nymph	RG_GHNF_BIC-2_2021-09-10	Zapada	6.25		
16	Nymph/immature	RG_GHNF_BIC-2_2021-09-10	Nemouridae	6.25		
		RG_GHNF_BIC-2_2021-09-10	Perlodidae	6.25	0.0162	
13	Nymph	RG_GHNF_BIC-2_2021-09-10	Isoperla	6.25		
		RG_GHNF_BIC-2_2021-09-10	Taeniopterygidae	6.25	0.0002	
2	Nymph/immature	RG_GHNF_BIC-2_2021-09-10	Taeniopterygidae	6.25		
		RG_GHNF_BIC-2_2021-09-10	Limnephilidae	6.25	0.0023	
8	larvae/immature	RG_GHNF_BIC-2_2021-09-10	Limnephilidae	6.25		
		RG_GHNF_BIC-2_2021-09-10	Chironomidae	6.25	0.0541	
11	pupae	RG_GHNF_BIC-2_2021-09-10	Chironomidae	6.25		
4	larvae	RG_GHNF_BIC-2_2021-09-10	Micropsectra	6.25		
10	larvae	RG_GHNF_BIC-2_2021-09-10	Pagastia	6.25		
6	larvae	RG_GHNF_BIC-2_2021-09-10	Pseudodiamesa	6.25		
1	larvae	RG_GHNF_BIC-2_2021-09-10	Brillia	6.25		
2	larvae	RG_GHNF_BIC-2_2021-09-10	Corynoneura	6.25		
1	larvae	RG_GHNF_BIC-2_2021-09-10	Cricotopus/Orthocladius	6.25		
4	larvae	RG_GHNF_BIC-2_2021-09-10	Heleniella	6.25		
5	larvae	RG_GHNF_BIC-2_2021-09-10	Hydrobaenus	6.25		
98	larvae	RG_GHNF_BIC-2_2021-09-10	Tvetenia	6.25		
		RG_GHNF_BIC-2_2021-09-10	Empididae	6.25	0.0034	
2	larvae	RG_GHNF_BIC-2_2021-09-10	Chelifera/Metachela	6.25		
1	pupae	RG_GHNF_BIC-2_2021-09-10	Empididae	6.25		
		RG_GHNF_BIC-2_2021-09-10	Pelecorhyncidae	6.25	0.0242	
1	larvae	RG_GHNF_BIC-2_2021-09-10	Glutops	6.25		
		RG_GHNF_BIC-2_2021-09-10	Psychodidae	6.25	0.0046	
18	larvae	RG_GHNF_BIC-2_2021-09-10	Pericoma	6.25		
		RG_GHNF_BIC-2_2021-09-10	Tipulidae	6.25	0.0011	
3	larvae	RG_GHNF_BIC-2_2021-09-10	Dicranota	6.25		
		RG_GHNF_BIC-3_2021-09-10	Planariidae	6.25	0.0019	
2	none	RG_GHNF_BIC-3_2021-09-10	Polycelis	6.25		
3	none	RG_GHNF_BIC-3_2021-09-10	Ostracoda	6.25	0.0007	
		RG_GHNF_BIC-3_2021-09-10	Capniidae	6.25	0.0092	
1	Nymph	RG_GHNF_BIC-3_2021-09-10	Mesocapnia/Capnia	6.25		
28	Nymph	RG_GHNF_BIC-3_2021-09-10	Paracapnia	6.25		
19	Nymph/immature	RG_GHNF_BIC-3_2021-09-10	Capniidae	6.25		
		RG_GHNF_BIC-3_2021-09-10	Nemouridae	6.25	0.0101	
2	Nymph	RG_GHNF_BIC-3_2021-09-10	Malenka	6.25		
17	Nymph	RG_GHNF_BIC-3_2021-09-10	Zapada	6.25		
15	Nymph/immature	RG_GHNF_BIC-3_2021-09-10	Nemouridae	6.25		
		RG_GHNF_BIC-3_2021-09-10	Perlodidae	6.25	0.0013	
1	Nymph	RG_GHNF_BIC-3_2021-09-10	Isoperla	6.25		
		RG_GHNF_BIC-3_2021-09-10	Taeniopterygidae	6.25	0.0004	
5	Nymph/immature	RG_GHNF_BIC-3_2021-09-10	Taeniopterygidae	6.25		
		RG_GHNF_BIC-3_2021-09-10	Limnephilidae	6.25	0.0002	
1	larvae/immature	RG_GHNF_BIC-3_2021-09-10	Limnephilidae	6.25		
		RG_GHNF_BIC-3_2021-09-10	Chironomidae	6.25	0.0511	
14	pupae	RG_GHNF_BIC-3_2021-09-10	Chironomidae	6.25		
1	larvae	RG_GHNF_BIC-3_2021-09-10	Micropsectra	6.25		
30	larvae	RG_GHNF_BIC-3_2021-09-10	Pagastia	6.25		
4	larvae	RG_GHNF_BIC-3_2021-09-10	Pseudodiamesa	6.25		
4	larvae	RG_GHNF_BIC-3_2021-09-10	Brillia	6.25		

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	*Text(20)*	*Text(40)*	*Text(255)*	*Numeric*	*Text(255)*	*Text(255)*
1	larvae	RG_GHNF_BIC-3_2021-09-10	Corynoneura	6.25		
3	larvae	RG_GHNF_BIC-3_2021-09-10	Cricotopus/Orthocladius	6.25		
1	larvae	RG_GHNF_BIC-3_2021-09-10	Diplocladius	6.25		
1	larvae	RG_GHNF_BIC-3_2021-09-10	Heleniella	6.25		
151	larvae	RG_GHNF_BIC-3_2021-09-10	Tvetenia	6.25		
		RG_GHNF_BIC-3_2021-09-10	Empididae	6.25	0.0015	
1	larvae	RG_GHNF_BIC-3_2021-09-10	Chelifera/Metachela	6.25		
1	larvae	RG_GHNF_BIC-3_2021-09-10	Clinocera	6.25		
1	pupae	RG_GHNF_BIC-3_2021-09-10	Empididae	6.25		
		RG_GHNF_BIC-3_2021-09-10	Psychodidae	6.25	0.0032	
9	larvae	RG_GHNF_BIC-3_2021-09-10	Pericoma	6.25		
		RG_GHNF_BIC-3_2021-09-10	Tipulidae	6.25	0.0043	
12	larvae	RG_GHNF_BIC-3_2021-09-10	Dicranota	6.25		
		RG_GHNF_BIC-4_2021-09-10	Planariidae	12.5	0.0066	
2	none	RG_GHNF_BIC-4_2021-09-10	Polycelis	12.5		
		RG_GHNF_BIC-4_2021-09-10	Lebertiidae	12.5	0.0006	
1	Adult	RG_GHNF_BIC-4_2021-09-10	Lebertia	12.5		
5	none	RG_GHNF_BIC-4_2021-09-10	Ostracoda	12.5	0.0008	
2	none	RG_GHNF_BIC-4_2021-09-10	Collembola	12.5	0.0003	
		RG_GHNF_BIC-4_2021-09-10	Capniidae	12.5	0.0023	
1	Nymph	RG_GHNF_BIC-4_2021-09-10	Mesocapnia/Capnia	12.5		
2	Nymph	RG_GHNF_BIC-4_2021-09-10	Paracapnia	12.5		
2	Nymph/immature	RG_GHNF_BIC-4_2021-09-10	Capniidae	12.5		
		RG_GHNF_BIC-4_2021-09-10	Chloroperlidae	12.5	0.0018	
1	Nymph	RG_GHNF_BIC-4_2021-09-10	Sweltsa	12.5		
		RG_GHNF_BIC-4_2021-09-10	Nemouridae	12.5	0.0029	
7	Nymph	RG_GHNF_BIC-4_2021-09-10	Zapada	12.5		
15	Nymph/immature	RG_GHNF_BIC-4_2021-09-10	Nemouridae	12.5		
		RG_GHNF_BIC-4_2021-09-10	Perlodidae	12.5	0.0046	
5	Nymph	RG_GHNF_BIC-4_2021-09-10	Isoperla	12.5		
		RG_GHNF_BIC-4_2021-09-10	Taeniopterygidae	12.5	0.0002	
2	Nymph/immature	RG_GHNF_BIC-4_2021-09-10	Taeniopterygidae	12.5		
		RG_GHNF_BIC-4_2021-09-10	Limnephilidae	12.5	0.0028	
9	larvae/immature	RG_GHNF_BIC-4_2021-09-10	Limnephilidae	12.5		
		RG_GHNF_BIC-4_2021-09-10	Chironomidae	12.5	0.0080	
6	pupae	RG_GHNF_BIC-4_2021-09-10	Chironomidae	12.5		
2	larvae	RG_GHNF_BIC-4_2021-09-10	Pagastia	12.5		
1	larvae	RG_GHNF_BIC-4_2021-09-10	Brillia	12.5		
1	larvae	RG_GHNF_BIC-4_2021-09-10	Corynoneura	12.5		
1	larvae	RG_GHNF_BIC-4_2021-09-10	Cricotopus/Orthocladius	12.5		
1	larvae	RG_GHNF_BIC-4_2021-09-10	Eukiefferiella	12.5		
1	larvae	RG_GHNF_BIC-4_2021-09-10	Limnophyes	12.5		
25	larvae	RG_GHNF_BIC-4_2021-09-10	Tvetenia	12.5		
		RG_GHNF_BIC-4_2021-09-10	Empididae	12.5	0.0002	
1	larvae	RG_GHNF_BIC-4_2021-09-10	Chelifera/Metachela	12.5		
		RG_GHNF_BIC-4_2021-09-10	Psychodidae	12.5	0.0017	
6	larvae	RG_GHNF_BIC-4_2021-09-10	Pericoma	12.5		
		RG_GHNF_BIC-4_2021-09-10	Tipulidae	12.5	0.0003	
2	larvae	RG_GHNF_BIC-4_2021-09-10	Dicranota	12.5		
		RG_GHNF_BIC-5_2021-09-11	Planariidae	25	0.0098	
7	none	RG_GHNF_BIC-5_2021-09-11	Polycelis	25		
4	none	RG_GHNF_BIC-5_2021-09-11	Enchytraeidae	25	0.0010	
13	none	RG_GHNF_BIC-5_2021-09-11	Ostracoda	25	0.0024	
1	none	RG_GHNF_BIC-5_2021-09-11	Collembola	25	0.0001	
		RG_GHNF_BIC-5_2021-09-11	Capniidae	25	0.0225	
8	Nymph	RG_GHNF_BIC-5_2021-09-11	Mesocapnia/Capnia	25		
11	Nymph	RG_GHNF_BIC-5_2021-09-11	Paracapnia	25		
14	Nymph/immature	RG_GHNF_BIC-5_2021-09-11	Capniidae	25		
		RG_GHNF_BIC-5_2021-09-11	Nemouridae	25	0.0113	
2	Nymph	RG_GHNF_BIC-5_2021-09-11	Malenka	25		
18	Nymph	RG_GHNF_BIC-5_2021-09-11	Zapada	25		
14	Nymph/immature	RG_GHNF_BIC-5_2021-09-11	Nemouridae	25		
		RG_GHNF_BIC-5_2021-09-11	Perlodidae	25	0.0555	
1	Nymph	RG_GHNF_BIC-5_2021-09-11	Isoperla	25		
16	Nymph	RG_GHNF_BIC-5_2021-09-11	Megarcys	25		
1	Nymph/immature	RG_GHNF_BIC-5_2021-09-11	Perlodidae	25		
		RG_GHNF_BIC-5_2021-09-11	Taeniopterygidae	25	0.0005	
6	Nymph/immature	RG_GHNF_BIC-5_2021-09-11	Taeniopterygidae	25		
		RG_GHNF_BIC-5_2021-09-11	Limnephilidae	25	0.0007	
5	larvae/immature	RG_GHNF_BIC-5_2021-09-11	Limnephilidae	25		
		RG_GHNF_BIC-5_2021-09-11	Chironomidae	25	0.0238	
9	pupae	RG_GHNF_BIC-5_2021-09-11	Chironomidae	25		
51	larvae	RG_GHNF_BIC-5_2021-09-11	Pagastia	25		
1	larvae	RG_GHNF_BIC-5_2021-09-11	Pseudodiamesa	25		
2	larvae	RG_GHNF_BIC-5_2021-09-11	Corynoneura	25		
3	larvae	RG_GHNF_BIC-5_2021-09-11	Cricotopus/Orthocladius	25		
31	larvae	RG_GHNF_BIC-5_2021-09-11	Tvetenia	25		
		RG_GHNF_BIC-5_2021-09-11	Empididae	25	0.0165	
7	larvae	RG_GHNF_BIC-5_2021-09-11	Chelifera/Metachela	25		
4	pupae	RG_GHNF_BIC-5_2021-09-11	Empididae	25		
		RG_GHNF_BIC-5_2021-09-11	Psychodidae	25	0.0012	
4	larvae	RG_GHNF_BIC-5_2021-09-11	Pericoma	25		
		RG_GHNF_BIC-5_2021-09-11	Tipulidae	25	0.0047	
11	larvae	RG_GHNF_BIC-5_2021-09-11	Dicranota	25		
		RG_GHNF_BIC-6_2021-09-11	Planariidae	12.5	0.0030	

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	Text(20)	Text(40)	Text(255)	Numeric	Text(255)	Text(255)
2	none	RG_GHNF_BIC-6_2021-09-11	Polycelis	12.5		
2	none	RG_GHNF_BIC-6_2021-09-11	Enchytraeidae	12.5	0.0001	
2	none	RG_GHNF_BIC-6_2021-09-11	Ostracoda	12.5	0.0001	
1	none	RG_GHNF_BIC-6_2021-09-11	Collembola	12.5	0.0001	
		RG_GHNF_BIC-6_2021-09-11	Capniidae	12.5	0.0327	
6	Nymph	RG_GHNF_BIC-6_2021-09-11	Mesocapnia/Capnia	12.5		
7	Nymph	RG_GHNF_BIC-6_2021-09-11	Paracapnia	12.5		
132	Nymph/immature	RG_GHNF_BIC-6_2021-09-11	Capniidae	12.5		
		RG_GHNF_BIC-6_2021-09-11	Nemouridae	12.5	0.0031	
4	Nymph	RG_GHNF_BIC-6_2021-09-11	Zapada	12.5		
28	Nymph/immature	RG_GHNF_BIC-6_2021-09-11	Nemouridae	12.5		
		RG_GHNF_BIC-6_2021-09-11	Perlodidae	12.5	0.0309	
12	Nymph	RG_GHNF_BIC-6_2021-09-11	Isoperla	12.5		
1	Nymph	RG_GHNF_BIC-6_2021-09-11	Megarcys	12.5		
		RG_GHNF_BIC-6_2021-09-11	Taeniopterygidae	12.5	0.0004	
7	Nymph/immature	RG_GHNF_BIC-6_2021-09-11	Taeniopterygidae	12.5		
		RG_GHNF_BIC-6_2021-09-11	Chironomidae	12.5	0.0694	
32	pupae	RG_GHNF_BIC-6_2021-09-11	Chironomidae	12.5		
14	larvae	RG_GHNF_BIC-6_2021-09-11	Micropsectra	12.5		
27	larvae	RG_GHNF_BIC-6_2021-09-11	Pagastia	12.5		
3	larvae	RG_GHNF_BIC-6_2021-09-11	Pseudodiamesa	12.5		
1	larvae	RG_GHNF_BIC-6_2021-09-11	Brillia	12.5		
7	larvae	RG_GHNF_BIC-6_2021-09-11	Chaetocladius	12.5		
7	larvae	RG_GHNF_BIC-6_2021-09-11	Corynoneura	12.5		
8	larvae	RG_GHNF_BIC-6_2021-09-11	Cricotopus/Orthocladius	12.5		
3	larvae	RG_GHNF_BIC-6_2021-09-11	Heleniella	12.5		
5	larvae	RG_GHNF_BIC-6_2021-09-11	Hydrobaenus	12.5		
236	larvae	RG_GHNF_BIC-6_2021-09-11	Tvetenia	12.5		
		RG_GHNF_BIC-6_2021-09-11	Empididae	12.5	0.0064	
4	larvae	RG_GHNF_BIC-6_2021-09-11	Chelifera/Metachela	12.5		
		RG_GHNF_BIC-6_2021-09-11	Psychodidae	12.5	0.0089	
22	larvae	RG_GHNF_BIC-6_2021-09-11	Pericoma	12.5		
		RG_GHNF_BIC-6_2021-09-11	Tipulidae	12.5	0.0130	
27	larvae	RG_GHNF_BIC-6_2021-09-11	Dicranota	12.5		
		RG_GHFF_BIC-1_2021-09-09	Lebertiidae	25	0.0008	
3	Adult	RG_GHFF_BIC-1_2021-09-09	Lebertia	25		
5	none	RG_GHFF_BIC-1_2021-09-09	Ostracoda	25	0.0010	
		RG_GHFF_BIC-1_2021-09-09	Nemouridae	25	0.0037	
11	Nymph	RG_GHFF_BIC-1_2021-09-09	Zapada	25		
9	Nymph/immature	RG_GHFF_BIC-1_2021-09-09	Nemouridae	25		
		RG_GHFF_BIC-1_2021-09-09	Perlodidae	25	0.0003	
1	Nymph/immature	RG_GHFF_BIC-1_2021-09-09	Perlodidae	25		
		RG_GHFF_BIC-1_2021-09-09	Taeniopterygidae	25	0.0010	
4	Nymph/immature	RG_GHFF_BIC-1_2021-09-09	Taeniopterygidae	25		
		RG_GHFF_BIC-1_2021-09-09	Rhyacophilidae	25	0.0036	
1	larvae	RG_GHFF_BIC-1_2021-09-09	Rhyacophila	25		
		RG_GHFF_BIC-1_2021-09-09	Chironomidae	25	0.1128	
33	pupae	RG_GHFF_BIC-1_2021-09-09	Chironomidae	25		
83	larvae	RG_GHFF_BIC-1_2021-09-09	Pagastia	25		
26	larvae	RG_GHFF_BIC-1_2021-09-09	Cricotopus/Orthocladius	25		
90	larvae	RG_GHFF_BIC-1_2021-09-09	Eukiefferiella	25		
		RG_GHFF_BIC-1_2021-09-09	Empididae	25	0.0204	
17	larvae	RG_GHFF_BIC-1_2021-09-09	Chelifera/Metachela	25		
2	pupae	RG_GHFF_BIC-1_2021-09-09	Empididae	25		
		RG_GHFF_BIC-2_2021-09-09	Planariidae	100	0.0098	
8	none	RG_GHFF_BIC-2_2021-09-09	Polycelis	100		
2	none	RG_GHFF_BIC-2_2021-09-09	Enchytraeidae	100	0.0007	
		RG_GHFF_BIC-2_2021-09-09	Lebertiidae	100	0.0005	
2	Adult	RG_GHFF_BIC-2_2021-09-09	Lebertia	100		
40	none	RG_GHFF_BIC-2_2021-09-09	Ostracoda	100	0.0090	
1	none	RG_GHFF_BIC-2_2021-09-09	Collembola	100	0.0002	
		RG_GHFF_BIC-2_2021-09-09	Capniidae	100	0.0002	
2	Nymph	RG_GHFF_BIC-2_2021-09-09	Paracapnia	100		
		RG_GHFF_BIC-2_2021-09-09	Nemouridae	100	0.0104	
3	Nymph	RG_GHFF_BIC-2_2021-09-09	Malenka	100		
15	Nymph	RG_GHFF_BIC-2_2021-09-09	Zapada	100		
		RG_GHFF_BIC-2_2021-09-09	Perlodidae	100	0.0160	
1	Nymph	RG_GHFF_BIC-2_2021-09-09	Megarcys	100		
1	Nymph/immature	RG_GHFF_BIC-2_2021-09-09	Perlodidae	100		
		RG_GHFF_BIC-2_2021-09-09	Taeniopterygidae	100	0.0009	
8	Nymph/immature	RG_GHFF_BIC-2_2021-09-09	Taeniopterygidae	100		
		RG_GHFF_BIC-2_2021-09-09	Limnephilidae	100	0.0009	
6	larvae/immature	RG_GHFF_BIC-2_2021-09-09	Limnephilidae	100		
		RG_GHFF_BIC-2_2021-09-09	Rhyacophilidae	100	0.0011	
1	larvae	RG_GHFF_BIC-2_2021-09-09	Rhyacophila	100		
		RG_GHFF_BIC-2_2021-09-09	Chironomidae	100	0.2576	
85	pupae	RG_GHFF_BIC-2_2021-09-09	Chironomidae	100		
48	larvae	RG_GHFF_BIC-2_2021-09-09	Micropsectra	100		
72	larvae	RG_GHFF_BIC-2_2021-09-09	Pagastia	100		
8	larvae	RG_GHFF_BIC-2_2021-09-09	Cricotopus/Orthocladius	100		
237	larvae	RG_GHFF_BIC-2_2021-09-09	Eukiefferiella	100		
4	larvae	RG_GHFF_BIC-2_2021-09-09	Hydrobaenus	100		
4	larvae	RG_GHFF_BIC-2_2021-09-09	Tvetenia	100		
		RG_GHFF_BIC-2_2021-09-09	Dixidae	100	0.0005	
1	larvae	RG_GHFF_BIC-2_2021-09-09	Dixa	100		

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	Text(20)	Text(40)	Text(255)	Numeric	Text(255)	Text(255)
		RG_GHFF_BIC-2_2021-09-09	Empididae	100	0.0138	
4	larvae	RG_GHFF_BIC-2_2021-09-09	Chelifera/Metachela	100		
4	pupae	RG_GHFF_BIC-2_2021-09-09	Empididae	100		
		RG_GHFF_BIC-2_2021-09-09	Pelecorhyncidae	100	0.0002	
2	larvae	RG_GHFF_BIC-2_2021-09-09	Glutops	100		
		RG_GHFF_BIC-2_2021-09-09	Psychodidae	100	0.0054	
18	larvae	RG_GHFF_BIC-2_2021-09-09	Pericoma	100		
1	larvae/indeterminate	RG_GHFF_BIC-2_2021-09-09	Sciomyzidae	100	0.0069	
		RG_GHFF_BIC-2_2021-09-09	Tipulidae	100	0.0009	
1	larvae	RG_GHFF_BIC-2_2021-09-09	Dicranota	100		
		RG_GHFF_BIC-3_2021-09-09	Planariidae	50	0.0092	
5	none	RG_GHFF_BIC-3_2021-09-09	Polycelis	50		
1	none	RG_GHFF_BIC-3_2021-09-09	Enchytraeidae	50	0.0001	
		RG_GHFF_BIC-3_2021-09-09	Lebertiidae	50	0.0009	
4	Adult	RG_GHFF_BIC-3_2021-09-09	Lebertia	50		
5	none	RG_GHFF_BIC-3_2021-09-09	Ostracoda	50	0.0012	
1	Nymph/immature	RG_GHFF_BIC-3_2021-09-09	Ephemerellidae	50	0.0001	
		RG_GHFF_BIC-3_2021-09-09	Capniidae	50	0.0033	
1	Nymph	RG_GHFF_BIC-3_2021-09-09	Mesocapnia/Capnia	50		
1	Nymph/immature	RG_GHFF_BIC-3_2021-09-09	Capniidae	50		
		RG_GHFF_BIC-3_2021-09-09	Chloroperlidae	50	0.0035	
1	Nymph	RG_GHFF_BIC-3_2021-09-09	Sweltsa	50		
		RG_GHFF_BIC-3_2021-09-09	Nemouridae	50	0.0146	
19	Nymph	RG_GHFF_BIC-3_2021-09-09	Zapada	50		
19	Nymph/immature	RG_GHFF_BIC-3_2021-09-09	Nemouridae	50		
		RG_GHFF_BIC-3_2021-09-09	Perlodidae	50	0.0004	
1	Nymph/immature	RG_GHFF_BIC-3_2021-09-09	Perlodidae	50		
		RG_GHFF_BIC-3_2021-09-09	Taeniopterygidae	50	0.0001	
2	Nymph/immature	RG_GHFF_BIC-3_2021-09-09	Taeniopterygidae	50		
		RG_GHFF_BIC-3_2021-09-09	Limnephilidae	50	0.0002	
3	larvae/immature	RG_GHFF_BIC-3_2021-09-09	Limnephilidae	50		
		RG_GHFF_BIC-3_2021-09-09	Rhyacophilidae	50	0.0124	
5	larvae	RG_GHFF_BIC-3_2021-09-09	Rhyacophila	50		
		RG_GHFF_BIC-3_2021-09-09	Chironomidae	50	0.0331	
12	pupae	RG_GHFF_BIC-3_2021-09-09	Chironomidae	50		
1	larvae	RG_GHFF_BIC-3_2021-09-09	Micropsectra	50		
31	larvae	RG_GHFF_BIC-3_2021-09-09	Pagastia	50		
6	larvae	RG_GHFF_BIC-3_2021-09-09	Cricotopus/Orthocladius	50		
55	larvae	RG_GHFF_BIC-3_2021-09-09	Eukiefferiella	50		
		RG_GHFF_BIC-3_2021-09-09	Empididae	50	0.0216	
20	larvae	RG_GHFF_BIC-3_2021-09-09	Chelifera/Metachela	50		
1	pupae	RG_GHFF_BIC-3_2021-09-09	Empididae	50		
		RG_GHFF_BIC-3_2021-09-09	Psychodidae	50	0.0008	
3	larvae	RG_GHFF_BIC-3_2021-09-09	Pericoma	50		
		RG_GHFF_BIC-3_2021-09-09	Tipulidae	50	0.0001	
1	larvae	RG_GHFF_BIC-3_2021-09-09	Dicranota	50		
		RG_GHFF_BIC-4_2021-09-09	Planariidae	50	0.0152	
7	none	RG_GHFF_BIC-4_2021-09-09	Polycelis	50		
1	none	RG_GHFF_BIC-4_2021-09-09	Enchytraeidae	50	0.0003	
		RG_GHFF_BIC-4_2021-09-09	Lebertiidae	50	0.0007	
2	Adult	RG_GHFF_BIC-4_2021-09-09	Lebertia	50		
4	none	RG_GHFF_BIC-4_2021-09-09	Ostracoda	50	0.0008	
		RG_GHFF_BIC-4_2021-09-09	Nemouridae	50	0.0065	
2	Nymph	RG_GHFF_BIC-4_2021-09-09	Malenka	50		
11	Nymph	RG_GHFF_BIC-4_2021-09-09	Zapada	50		
6	Nymph/immature	RG_GHFF_BIC-4_2021-09-09	Nemouridae	50		
		RG_GHFF_BIC-4_2021-09-09	Perlodidae	100	0.0007	
2	Nymph	RG_GHFF_BIC-4_2021-09-09	Megarcys	100		
		RG_GHFF_BIC-4_2021-09-09	Taeniopterygidae	50	0.0013	
12	Nymph/immature	RG_GHFF_BIC-4_2021-09-09	Taeniopterygidae	50		
		RG_GHFF_BIC-4_2021-09-09	Rhyacophilidae	50	0.0001	
1	larvae	RG_GHFF_BIC-4_2021-09-09	Rhyacophila	50		
		RG_GHFF_BIC-4_2021-09-09	Chironomidae	50	0.1241	
36	pupae	RG_GHFF_BIC-4_2021-09-09	Chironomidae	50		
68	larvae	RG_GHFF_BIC-4_2021-09-09	Pagastia	50		
17	larvae	RG_GHFF_BIC-4_2021-09-09	Cricotopus/Orthocladius	50		
131	larvae	RG_GHFF_BIC-4_2021-09-09	Eukiefferiella	50		
		RG_GHFF_BIC-4_2021-09-09	Empididae	50	0.0174	
7	larvae	RG_GHFF_BIC-4_2021-09-09	Chelifera/Metachela	50		
7	pupae	RG_GHFF_BIC-4_2021-09-09	Empididae	50		
		RG_GHFF_BIC-4_2021-09-09	Psychodidae	50	0.0009	
3	larvae	RG_GHFF_BIC-4_2021-09-09	Pericoma	50		
		RG_GHFF_BIC-4_2021-09-09	Simuliidae	50	0.0001	
1	larvae/indeterminate	RG_GHFF_BIC-4_2021-09-09	Simuliidae	50		
		RG_GHFF_BIC-5_2021-09-10	Planariidae	25	0.0082	
6	none	RG_GHFF_BIC-5_2021-09-10	Polycelis	25		
2	none	RG_GHFF_BIC-5_2021-09-10	Enchytraeidae	25	0.0005	
		RG_GHFF_BIC-5_2021-09-10	Hygrobatidae	25	0.0002	
1	Adult	RG_GHFF_BIC-5_2021-09-10	Hygrobates	25		
		RG_GHFF_BIC-5_2021-09-10	Lebertiidae	25	0.0007	
2	Adult	RG_GHFF_BIC-5_2021-09-10	Lebertia	25		
6	none	RG_GHFF_BIC-5_2021-09-10	Ostracoda	25	0.0014	
		RG_GHFF_BIC-5_2021-09-10	Capniidae	25	0.0001	
1	Nymph/immature	RG_GHFF_BIC-5_2021-09-10	Capniidae	25		
		RG_GHFF_BIC-5_2021-09-10	Nemouridae	25	0.0085	

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	Text(20)	Text(40)	Text(255)	Numeric	Text(255)	Text(255)
23	Nymph	RG_GHFF_BIC-5_2021-09-10	Zapada	25		
2	Nymph/immature	RG_GHFF_BIC-5_2021-09-10	Nemouridae	25		
		RG_GHFF_BIC-5_2021-09-10	Perlodidae	25	0.0011	
1	Nymph	RG_GHFF_BIC-5_2021-09-10	Isoperla	25		
		RG_GHFF_BIC-5_2021-09-10	Taeniopterygidae	25	0.0005	
4	Nymph/immature	RG_GHFF_BIC-5_2021-09-10	Taeniopterygidae	25		
		RG_GHFF_BIC-5_2021-09-10	Limnephilidae	25	0.0010	
4	larvae/immature	RG_GHFF_BIC-5_2021-09-10	Limnephilidae	25		
		RG_GHFF_BIC-5_2021-09-10	Rhyacophilidae	25	0.0118	
1	larvae	RG_GHFF_BIC-5_2021-09-10	Rhyacophila	25		
		RG_GHFF_BIC-5_2021-09-10	Chironomidae	25	0.0766	
28	pupae	RG_GHFF_BIC-5_2021-09-10	Chironomidae	25		
3	larvae	RG_GHFF_BIC-5_2021-09-10	Micropsectra	25		
39	larvae	RG_GHFF_BIC-5_2021-09-10	Pagastia	25		
8	larvae	RG_GHFF_BIC-5_2021-09-10	Cricotopus/Orthocladius	25		
107	larvae	RG_GHFF_BIC-5_2021-09-10	Eukiefferiella	25		
		RG_GHFF_BIC-5_2021-09-10	Empididae	25	0.0168	
10	larvae	RG_GHFF_BIC-5_2021-09-10	Chelifera/Metachela	25		
3	pupae	RG_GHFF_BIC-5_2021-09-10	Empididae	25		
		RG_GHFF_BIC-5_2021-09-10	Psychodidae	25	0.0018	
7	larvae	RG_GHFF_BIC-5_2021-09-10	Pericoma	25		
		RG_GHFF_BIC-5_2021-09-10	Tipulidae	25	0.0002	
1	larvae	RG_GHFF_BIC-5_2021-09-10	Dicranota	25		
		RG_GHFF_BIC-6_2021-09-10	Planariidae	25	0.0268	
17	none	RG_GHFF_BIC-6_2021-09-10	Polycelis	25		
8	none	RG_GHFF_BIC-6_2021-09-10	Enchytraeidae	25	0.0015	
		RG_GHFF_BIC-6_2021-09-10	Lebertiidae	25	0.0009	
3	Adult	RG_GHFF_BIC-6_2021-09-10	Lebertia	25		
33	none	RG_GHFF_BIC-6_2021-09-10	Ostracoda	25	0.0065	
		RG_GHFF_BIC-6_2021-09-10	Ephemerellidae	25	0.0001	
1	Nymph/immature	RG_GHFF_BIC-6_2021-09-10	Ephemerellidae	25		
		RG_GHFF_BIC-6_2021-09-10	Capniidae	25	0.0017	
1	Nymph	RG_GHFF_BIC-6_2021-09-10	Mesocapnia/Capnia	25		
2	Nymph/immature	RG_GHFF_BIC-6_2021-09-10	Capniidae	25		
		RG_GHFF_BIC-6_2021-09-10	Nemouridae	25	0.0292	
5	Nymph	RG_GHFF_BIC-6_2021-09-10	Malenka	25		
26	Nymph	RG_GHFF_BIC-6_2021-09-10	Zapada	25		
11	Nymph/immature	RG_GHFF_BIC-6_2021-09-10	Nemouridae	25		
		RG_GHFF_BIC-6_2021-09-10	Perlodidae	25	0.0008	
1	Nymph	RG_GHFF_BIC-6_2021-09-10	Isoperla	25		
2	Nymph/immature	RG_GHFF_BIC-6_2021-09-10	Perlodidae	25		
		RG_GHFF_BIC-6_2021-09-10	Taeniopterygidae	25	0.0011	
10	Nymph/immature	RG_GHFF_BIC-6_2021-09-10	Taeniopterygidae	25		
		RG_GHFF_BIC-6_2021-09-10	Chironomidae	25	0.1460	
40	pupae	RG_GHFF_BIC-6_2021-09-10	Chironomidae	25		
8	larvae	RG_GHFF_BIC-6_2021-09-10	Micropsectra	25		
126	larvae	RG_GHFF_BIC-6_2021-09-10	Pagastia	25		
2	larvae	RG_GHFF_BIC-6_2021-09-10	Pseudodiamesa	25		
48	larvae	RG_GHFF_BIC-6_2021-09-10	Cricotopus/Orthocladius	25		
112	larvae	RG_GHFF_BIC-6_2021-09-10	Eukiefferiella	25		
7	larvae	RG_GHFF_BIC-6_2021-09-10	Hydrobaenus	25		
		RG_GHFF_BIC-6_2021-09-10	Empididae	25	0.0367	
35	larvae	RG_GHFF_BIC-6_2021-09-10	Chelifera/Metachela	25		
1	pupae	RG_GHFF_BIC-6_2021-09-10	Empididae	25		
		RG_GHFF_BIC-6_2021-09-10	Psychodidae	25	0.0037	
12	larvae	RG_GHFF_BIC-6_2021-09-10	Pericoma	25		
18	none	RG_GHUT_BIC-1_2021-09-13	Enchytraeidae	12.5	0.0039	
		RG_GHUT_BIC-1_2021-09-13	Lebertiidae	12.5	0.0001	
1	Adult	RG_GHUT_BIC-1_2021-09-13	Lebertia	12.5		
6	none	RG_GHUT_BIC-1_2021-09-13	Ostracoda	12.5	0.0015	
		RG_GHUT_BIC-1_2021-09-13	Elmidae	12.5	0.0012	
1	larvae	RG_GHUT_BIC-1_2021-09-13	Heterlimnius	12.5		
		RG_GHUT_BIC-1_2021-09-13	Capniidae	12.5	0.0327	
1	Nymph	RG_GHUT_BIC-1_2021-09-13	Eucapnopsis	12.5		
11	Nymph	RG_GHUT_BIC-1_2021-09-13	Mesocapnia/Capnia	12.5		
15	Nymph	RG_GHUT_BIC-1_2021-09-13	Paracapnia	12.5		
19	Nymph/immature	RG_GHUT_BIC-1_2021-09-13	Capniidae	12.5		
		RG_GHUT_BIC-1_2021-09-13	Nemouridae	12.5	0.0162	
2	Nymph	RG_GHUT_BIC-1_2021-09-13	Malenka	12.5		
2	Nymph	RG_GHUT_BIC-1_2021-09-13	Visoka	12.5		
16	Nymph	RG_GHUT_BIC-1_2021-09-13	Zapada	12.5		
20	Nymph/immature	RG_GHUT_BIC-1_2021-09-13	Nemouridae	12.5		
		RG_GHUT_BIC-1_2021-09-13	Peltoperlidae	12.5	0.0001	
1	Nymph	RG_GHUT_BIC-1_2021-09-13	Yoraperla	12.5		
		RG_GHUT_BIC-1_2021-09-13	Perlodidae	12.5	0.0130	
6	Nymph	RG_GHUT_BIC-1_2021-09-13	Isoperla	12.5		
1	Nymph	RG_GHUT_BIC-1_2021-09-13	Megarcys	12.5		
		RG_GHUT_BIC-1_2021-09-13	Taeniopterygidae	12.5	0.0003	
2	Nymph/immature	RG_GHUT_BIC-1_2021-09-13	Taeniopterygidae	12.5		
		RG_GHUT_BIC-1_2021-09-13	Limnephilidae	12.5	0.0002	
2	larvae/immature	RG_GHUT_BIC-1_2021-09-13	Limnephilidae	12.5		
		RG_GHUT_BIC-1_2021-09-13	Rhyacophilidae	12.5	0.0507	
2	larvae	RG_GHUT_BIC-1_2021-09-13	Rhyacophila	12.5		
		RG_GHUT_BIC-1_2021-09-13	Chironomidae	12.5	0.1149	
59	pupae	RG_GHUT_BIC-1_2021-09-13	Chironomidae	12.5		

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	*Text(20)*	*Text(40)*	*Text(255)*	*Numeric*	*Text(255)*	*Text(255)*
2	larvae	RG_GHUT_BIC-1_2021-09-13	Micropsectra	12.5		
39	larvae	RG_GHUT_BIC-1_2021-09-13	Pagastia	12.5		
4	larvae	RG_GHUT_BIC-1_2021-09-13	Brillia	12.5		
2	larvae	RG_GHUT_BIC-1_2021-09-13	Corynoneura	12.5		
12	larvae	RG_GHUT_BIC-1_2021-09-13	Cricotopus/Orthocladius	12.5		
219	larvae	RG_GHUT_BIC-1_2021-09-13	Eukiefferiella	12.5		
12	larvae	RG_GHUT_BIC-1_2021-09-13	Tvetenia	12.5		
		RG_GHUT_BIC-1_2021-09-13	Empididae	12.5	0.0055	
1	larvae	RG_GHUT_BIC-1_2021-09-13	Clinocera	12.5		
2	pupae	RG_GHUT_BIC-1_2021-09-13	Empididae	12.5		
5	larvae/indeterminate	RG_GHUT_BIC-1_2021-09-13	Muscidae	12.5	0.0455	
		RG_GHUT_BIC-1_2021-09-13	Psychodidae	12.5	0.0060	
13	larvae	RG_GHUT_BIC-1_2021-09-13	Pericoma	12.5		
		RG_GHUT_BIC-1_2021-09-13	Tipulidae	12.5	0.0057	
8	larvae	RG_GHUT_BIC-1_2021-09-13	Dicranota	12.5		
		RG_GHUT_BIC-2_2021-09-13	Planariidae	25	0.0124	
6	none	RG_GHUT_BIC-2_2021-09-13	Polycelis	25		
11	none	RG_GHUT_BIC-2_2021-09-13	Enchytraeidae	25	0.0013	
1	none	RG_GHUT_BIC-2_2021-09-13	Ostracoda	25	0.0006	
		RG_GHUT_BIC-2_2021-09-13	Elmidae	25	0.0078	
8	larvae	RG_GHUT_BIC-2_2021-09-13	Heterlimnius	25		
2	larvae/immature	RG_GHUT_BIC-2_2021-09-13	Elmidae	25		
		RG_GHUT_BIC-2_2021-09-13	Capniidae	25	0.0136	
7	Nymph	RG_GHUT_BIC-2_2021-09-13	Mesocapnia/Capnia	25		
2	Nymph	RG_GHUT_BIC-2_2021-09-13	Paracapnia	25		
		RG_GHUT_BIC-2_2021-09-13	Nemouridae	25	0.0010	
3	Nymph	RG_GHUT_BIC-2_2021-09-13	Zapada	25		
1	Nymph/immature	RG_GHUT_BIC-2_2021-09-13	Nemouridae	25		
		RG_GHUT_BIC-2_2021-09-13	Peltoperlidae	25	0.0005	
1	Nymph	RG_GHUT_BIC-2_2021-09-13	Yoraperla	25		
		RG_GHUT_BIC-2_2021-09-13	Perlodidae	25	0.0049	
6	Nymph	RG_GHUT_BIC-2_2021-09-13	Isoperla	25		
		RG_GHUT_BIC-2_2021-09-13	Lepidostomatidae	25	0.0008	
3	larvae	RG_GHUT_BIC-2_2021-09-13	Lepidostoma	25		
		RG_GHUT_BIC-2_2021-09-13	Limnephilidae	25	0.0014	
7	larvae/immature	RG_GHUT_BIC-2_2021-09-13	Limnephilidae	25		
		RG_GHUT_BIC-2_2021-09-13	Chironomidae	25	0.1255	
47	pupae	RG_GHUT_BIC-2_2021-09-13	Chironomidae	25		
51	larvae	RG_GHUT_BIC-2_2021-09-13	Pagastia	25		
5	larvae	RG_GHUT_BIC-2_2021-09-13	Pseudodiamesa	25		
36	larvae	RG_GHUT_BIC-2_2021-09-13	Cricotopus/Orthocladius	25		
176	larvae	RG_GHUT_BIC-2_2021-09-13	Eukiefferiella	25		
3	larvae	RG_GHUT_BIC-2_2021-09-13	Tvetenia	25		
		RG_GHUT_BIC-2_2021-09-13	Empididae	25	0.0125	
5	larvae	RG_GHUT_BIC-2_2021-09-13	Chelifera/Metachela	25		
		RG_GHUT_BIC-2_2021-09-13	Psychodidae	25	0.0079	
16	larvae	RG_GHUT_BIC-2_2021-09-13	Pericoma	25		
		RG_GHUT_BIC-2_2021-09-13	Tipulidae	25	0.0350	
13	larvae	RG_GHUT_BIC-2_2021-09-13	Dicranota	25		
		RG_GHUT_BIC-3_2021-09-13	Planariidae	12.5	0.0228	
4	none	RG_GHUT_BIC-3_2021-09-13	Polycelis	12.5		
9	none	RG_GHUT_BIC-3_2021-09-13	Enchytraeidae	12.5	0.0015	
		RG_GHUT_BIC-3_2021-09-13	Lebertiidae	12.5	0.0004	
2	Adult	RG_GHUT_BIC-3_2021-09-13	Lebertia	12.5		
13	none	RG_GHUT_BIC-3_2021-09-13	Ostracoda	12.5	0.0036	
		RG_GHUT_BIC-3_2021-09-13	Dytiscidae	12.5	0.0029	
1	adult/indeterminate	RG_GHUT_BIC-3_2021-09-13	Dytiscidae	12.5		
		RG_GHUT_BIC-3_2021-09-13	Capniidae	12.5	0.0155	
6	Nymph	RG_GHUT_BIC-3_2021-09-13	Mesocapnia/Capnia	12.5		
3	Nymph	RG_GHUT_BIC-3_2021-09-13	Paracapnia	12.5		
12	Nymph/immature	RG_GHUT_BIC-3_2021-09-13	Capniidae	12.5		
		RG_GHUT_BIC-3_2021-09-13	Chloroperlidae	12.5	0.0003	
1	Nymph/immature	RG_GHUT_BIC-3_2021-09-13	Chloroperlidae	12.5		
		RG_GHUT_BIC-3_2021-09-13	Nemouridae	12.5	0.0027	
1	Nymph	RG_GHUT_BIC-3_2021-09-13	Malenka	12.5		
1	Nymph	RG_GHUT_BIC-3_2021-09-13	Visoka	12.5		
2	Nymph	RG_GHUT_BIC-3_2021-09-13	Zapada	12.5		
		RG_GHUT_BIC-3_2021-09-13	Perlodidae	12.5	0.0096	
9	Nymph	RG_GHUT_BIC-3_2021-09-13	Isoperla	12.5		
1	Nymph/immature	RG_GHUT_BIC-3_2021-09-13	Perlodidae	12.5		
		RG_GHUT_BIC-3_2021-09-13	Limnephilidae	12.5	0.1050	
1	larvae	RG_GHUT_BIC-3_2021-09-13	Homophylax	12.5		
11	larvae/immature	RG_GHUT_BIC-3_2021-09-13	Limnephilidae	12.5		
		RG_GHUT_BIC-3_2021-09-13	Chironomidae	12.5	0.0654	
29	pupae	RG_GHUT_BIC-3_2021-09-13	Chironomidae	12.5		
20	larvae	RG_GHUT_BIC-3_2021-09-13	Pagastia	12.5		
12	larvae	RG_GHUT_BIC-3_2021-09-13	Pseudodiamesa	12.5		
1	larvae	RG_GHUT_BIC-3_2021-09-13	Brillia	12.5		
2	larvae	RG_GHUT_BIC-3_2021-09-13	Corynoneura	12.5		
20	larvae	RG_GHUT_BIC-3_2021-09-13	Cricotopus/Orthocladius	12.5		
80	larvae	RG_GHUT_BIC-3_2021-09-13	Eukiefferiella	12.5		
1	larvae	RG_GHUT_BIC-3_2021-09-13	Hydrobaenus	12.5		
2	larvae	RG_GHUT_BIC-3_2021-09-13	Tvetenia	12.5		
		RG_GHUT_BIC-3_2021-09-13	Empididae	12.5	0.0033	
1	larvae	RG_GHUT_BIC-3_2021-09-13	Clinocera	12.5		

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	Text(20)	Text(40)	Text(255)	Numeric	Text(255)	Text(255)
1	pupae	RG_GHUT_BIC-3_2021-09-13	Empididae	12.5		
	larvae/indeterminate	RG_GHUT_BIC-3_2021-09-13	Muscidae	12.5	0.0005	
		RG_GHUT_BIC-3_2021-09-13	Psychodidae	12.5	0.0052	
15	larvae	RG_GHUT_BIC-3_2021-09-13	Pericoma	12.5		
		RG_GHUT_BIC-3_2021-09-13	Tipulidae	12.5	0.0054	
8	larvae	RG_GHUT_BIC-3_2021-09-13	Dicranota	12.5		
		RG_GHUT_BIC-4_2021-09-13	Planariidae	12.5	0.0202	
4	none	RG_GHUT_BIC-4_2021-09-13	Polycelis	12.5		
5	none	RG_GHUT_BIC-4_2021-09-13	Enchytraeidae	12.5	0.0007	
		RG_GHUT_BIC-4_2021-09-13	Sperchonidae	12.5	0.0006	
1	Adult	RG_GHUT_BIC-4_2021-09-13	Sperchon	12.5		
3	none	RG_GHUT_BIC-4_2021-09-13	Ostracoda	12.5	0.0008	
		RG_GHUT_BIC-4_2021-09-13	Capniidae	12.5	0.0060	
3	Nymph	RG_GHUT_BIC-4_2021-09-13	Mesocapnia/Capnia	12.5		
1	Nymph	RG_GHUT_BIC-4_2021-09-13	Paracapnia	12.5		
3	Nymph/immature	RG_GHUT_BIC-4_2021-09-13	Capniidae	12.5		
		RG_GHUT_BIC-4_2021-09-13	Nemouridae	12.5	0.0009	
3	Nymph	RG_GHUT_BIC-4_2021-09-13	Zapada	12.5		
4	Nymph/immature	RG_GHUT_BIC-4_2021-09-13	Nemouridae	12.5		
		RG_GHUT_BIC-4_2021-09-13	Perlodidae	12.5	0.0139	
1	Nymph	RG_GHUT_BIC-4_2021-09-13	Isoperla	12.5		
1	Nymph	RG_GHUT_BIC-4_2021-09-13	Megarcys	12.5		
		RG_GHUT_BIC-4_2021-09-13	Limnephilidae	12.5	0.0022	
16	larvae/immature	RG_GHUT_BIC-4_2021-09-13	Limnephilidae	12.5		
		RG_GHUT_BIC-4_2021-09-13	Rhyacophilidae	12.5	0.0309	
1	larvae	RG_GHUT_BIC-4_2021-09-13	Rhyacophila	12.5		
		RG_GHUT_BIC-4_2021-09-13	Chironomidae	12.5	0.0838	
26	pupae	RG_GHUT_BIC-4_2021-09-13	Chironomidae	12.5		
33	larvae	RG_GHUT_BIC-4_2021-09-13	Pagastia	12.5		
3	larvae	RG_GHUT_BIC-4_2021-09-13	Pseudodiamesa	12.5		
2	larvae	RG_GHUT_BIC-4_2021-09-13	Corynoneura	12.5		
28	larvae	RG_GHUT_BIC-4_2021-09-13	Cricotopus/Orthocladius	12.5		
154	larvae	RG_GHUT_BIC-4_2021-09-13	Eukiefferiella	12.5		
2	larvae	RG_GHUT_BIC-4_2021-09-13	Tvetenia	12.5		
		RG_GHUT_BIC-4_2021-09-13	Empididae	12.5	0.0029	
2	larvae	RG_GHUT_BIC-4_2021-09-13	Clinocera	12.5		
1	larvae/indeterminate	RG_GHUT_BIC-4_2021-09-13	Muscidae	12.5	0.0034	
		RG_GHUT_BIC-4_2021-09-13	Psychodidae	12.5	0.0016	
4	larvae	RG_GHUT_BIC-4_2021-09-13	Pericoma	12.5		
		RG_GHUT_BIC-4_2021-09-13	Tipulidae	12.5	0.0047	
6	larvae	RG_GHUT_BIC-4_2021-09-13	Dicranota	12.5		
		RG_GHUT_BIC-5_2021-09-13	Planariidae	12.5	0.0098	
8		RG_GHUT_BIC-5_2021-09-13	Polycelis	12.5		
1	none	RG_GHUT_BIC-5_2021-09-13	Enchytraeidae	12.5	0.0004	
		RG_GHUT_BIC-5_2021-09-13	Capniidae	12.5	0.0040	
2	Nymph	RG_GHUT_BIC-5_2021-09-13	Mesocapnia/Capnia	12.5		
2	Nymph	RG_GHUT_BIC-5_2021-09-13	Paracapnia	12.5		
		RG_GHUT_BIC-5_2021-09-13	Nemouridae	12.5	0.0011	
1	Nymph	RG_GHUT_BIC-5_2021-09-13	Malenka	12.5		
2	Nymph/immature	RG_GHUT_BIC-5_2021-09-13	Nemouridae	12.5		
		RG_GHUT_BIC-5_2021-09-13	Peltoperlidae	12.5	0.0002	
1	Nymph	RG_GHUT_BIC-5_2021-09-13	Yoraperla	12.5		
		RG_GHUT_BIC-5_2021-09-13	Perlodidae	12.5	0.0068	
6	Nymph	RG_GHUT_BIC-5_2021-09-13	Isoperla	12.5		
		RG_GHUT_BIC-5_2021-09-13	Taeniopterygidae	12.5	0.0003	
2	Nymph/immature	RG_GHUT_BIC-5_2021-09-13	Taeniopterygidae	12.5		
		RG_GHUT_BIC-5_2021-09-13	Limnephilidae	12.5	0.0027	
19	larvae/immature	RG_GHUT_BIC-5_2021-09-13	Limnephilidae	12.5		
		RG_GHUT_BIC-5_2021-09-13	Chironomidae	12.5	0.0672	
24	pupae	RG_GHUT_BIC-5_2021-09-13	Chironomidae	12.5		
12	larvae	RG_GHUT_BIC-5_2021-09-13	Pagastia	12.5		
1	larvae	RG_GHUT_BIC-5_2021-09-13	Pseudodiamesa	12.5		
7	larvae	RG_GHUT_BIC-5_2021-09-13	Cricotopus/Orthocladius	12.5		
124	larvae	RG_GHUT_BIC-5_2021-09-13	Eukiefferiella	12.5		
4	larvae	RG_GHUT_BIC-5_2021-09-13	Tvetenia	12.5		
		RG_GHUT_BIC-5_2021-09-13	Psychodidae	12.5	0.0045	
13	larvae	RG_GHUT_BIC-5_2021-09-13	Pericoma	12.5		
		RG_GHUT_BIC-5_2021-09-13	Tipulidae	12.5	0.0052	
7	larvae	RG_GHUT_BIC-5_2021-09-13	Dicranota	12.5		
2	none	RG_GHUT_BIC-6_2021-09-13	Nematoda	12.5	0.0004	
		RG_GHUT_BIC-6_2021-09-13	Planariidae	12.5	0.0294	
13	none	RG_GHUT_BIC-6_2021-09-13	Polycelis	12.5		
6	none	RG_GHUT_BIC-6_2021-09-13	Enchytraeidae	12.5	0.0010	
		RG_GHUT_BIC-6_2021-09-13	Lebertiidae	12.5	0.0001	
1	Adult	RG_GHUT_BIC-6_2021-09-13	Lebertia	12.5		
		RG_GHUT_BIC-6_2021-09-13	Sperchonidae	12.5	0.0006	
1	Adult	RG_GHUT_BIC-6_2021-09-13	Sperchon	12.5		
8	none	RG_GHUT_BIC-6_2021-09-13	Ostracoda	12.5	0.0019	
1	Nymph/immature	RG_GHUT_BIC-6_2021-09-13	Ephemerellidae	12.5	0.0001	
		RG_GHUT_BIC-6_2021-09-13	Capniidae	12.5	0.0282	
1	Nymph	RG_GHUT_BIC-6_2021-09-13	Eucapnopsis	12.5		
10	Nymph	RG_GHUT_BIC-6_2021-09-13	Mesocapnia/Capnia	12.5		
3	Nymph	RG_GHUT_BIC-6_2021-09-13	Paracapnia	12.5		
6	Nymph/immature	RG_GHUT_BIC-6_2021-09-13	Capniidae	12.5		
		RG_GHUT_BIC-6_2021-09-13	Nemouridae	12.5	0.0034	

quantity	life_stage_code	observ_sample_code	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS
Numeric	*Text(20)*	*Text(40)*	*Text(255)*	*Numeric*	*Text(255)*	*Text(255)*
14	Nymph/immature	RG_GHUT_BIC-6_2021-09-13	Nemouridae	12.5		
		RG_GHUT_BIC-6_2021-09-13	Peltoperlidae	12.5	0.0005	
2	Nymph	RG_GHUT_BIC-6_2021-09-13	Yoraperla	12.5		
		RG_GHUT_BIC-6_2021-09-13	Perlodidae	12.5	0.0137	
12	Nymph	RG_GHUT_BIC-6_2021-09-13	Isoperla	12.5		
1	Nymph/immature	RG_GHUT_BIC-6_2021-09-13	Perlodidae	12.5		
		RG_GHUT_BIC-6_2021-09-13	Taeniopterygidae	12.5	0.0003	
3	Nymph/immature	RG_GHUT_BIC-6_2021-09-13	Taeniopterygidae	12.5		
		RG_GHUT_BIC-6_2021-09-13	Limnephilidae	12.5	0.0036	
15	larvae/immature	RG_GHUT_BIC-6_2021-09-13	Limnephilidae	12.5		
		RG_GHUT_BIC-6_2021-09-13	Rhyacophilidae	12.5	0.0211	
2	larvae	RG_GHUT_BIC-6_2021-09-13	Rhyacophila	12.5		
		RG_GHUT_BIC-6_2021-09-13	Chironomidae	12.5	0.0476	
15	pupae	RG_GHUT_BIC-6_2021-09-13	Chironomidae	12.5		
14	larvae	RG_GHUT_BIC-6_2021-09-13	Pagastia	12.5		
3	larvae	RG_GHUT_BIC-6_2021-09-13	Brillia	12.5		
7	larvae	RG_GHUT_BIC-6_2021-09-13	Cricotopus/Orthocladius	12.5		
117	larvae	RG_GHUT_BIC-6_2021-09-13	Eukiefferiella	12.5		
		RG_GHUT_BIC-6_2021-09-13	Empididae	12.5	0.0075	
2	larvae	RG_GHUT_BIC-6_2021-09-13	Clinocera	12.5		
2	larvae/pupae	RG_GHUT_BIC-6_2021-09-13	Empididae	12.5		
1	larvae/indeterminate	RG_GHUT_BIC-6_2021-09-13	Muscidae	12.5	0.0039	
		RG_GHUT_BIC-6_2021-09-13	Pelecorhyncidae	100	0.0211	large/rare search
1	larvae	RG_GHUT_BIC-6_2021-09-13	Glutops	100		large/rare search
		RG_GHUT_BIC-6_2021-09-13	Psychodidae	12.5	0.0079	
14	larvae	RG_GHUT_BIC-6_2021-09-13	Pericoma	12.5		
		RG_GHUT_BIC-6_2021-09-13	Tipulidae	12.5	0.0046	
6	larvae	RG_GHUT_BIC-6_2021-09-13	Dicranota	12.5		
1	larvae	RG_GHUT_BIC-6_2021-09-13	Molophilus	12.5		

quantity	**life_stage_code**	observ_sample_code	ITIS_TAXON_NAME_Y-N	ITIS_TSN	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS	
	Nymph	RG_GHP_BIC-01_2021-09-22	Y	101467	Caenidae	12.5	0.0001		0.0001
1		RG_GHP_BIC-03_2021-09-21	Y	68510	Enchytraeidae	100	0.0001		1.0001
1	none	RG_GHP_BIC-05_2021-09-23	N		Nemata	100	0.0001		1.0001
1	none	RG_GHP_BIC-01_2021-09-22	N		Nemata	12.5	0.0002		1.0002
1	none	RG_GHP_BIC-06_2021-09-22	N		Nemata	100	0.0002		1.0002
	Adult	RG_GHP_BIC-06_2021-09-22	Y	83330	Pionidae	100	0.0002		0.0002
		RG_GHP_BIC-03_2021-09-21	Y	76591	Planorbidae	100	0.0004		0.0004
	Nymph	RG_GHP_BIC-06_2021-09-22	Y	100755	Baetidae	100	0.0004		0.0004
	larvae	RG_GHP_BIC-01_2021-09-22	Y	127076	Ceratopogonidae	12.5	0.0007		0.0007
	Nymph	RG_GHP_BIC-02_2021-09-23	Y	102077	Coenagrionidae	12.5	0.0007		0.0007
	Adult	RG_GHP_BIC-06_2021-09-22	Y	83033	Lebertiidae	100	0.0008		0.0008
	none	RG_GHP_BIC-02_2021-09-23	Y	111857	Haliplidae	12.5	0.0009		0.0009
	none	RG_GHP_BIC-01_2021-09-22	N		Hyalellidae	12.5	0.0011		0.0011
	Nymph	RG_GHP_BIC-01_2021-09-22	Y	100755	Baetidae	12.5	0.0016		0.0016
	none	RG_GHP_BIC-04_2021-09-21	N		Hyalellidae	50	0.0016		0.0016
	Adult	RG_GHP_BIC-06_2021-09-22	Y	83476	Mideopsidae	100	0.0018		0.0018
	none	RG_GHP_BIC-01_2021-09-22	N		Gammaridae	12.5	0.0025		0.0025
		RG_GHP_BIC-06_2021-09-22	Y	68854	Naididae	100	0.0028		0.0028
	none	RG_GHP_BIC-06_2021-09-22	N		Hyalellidae	100	0.0028		0.0028
	Nymph	RG_GHP_BIC-02_2021-09-23	Y	100755	Baetidae	12.5	0.0032		0.0032
	larvae	RG_GHP_BIC-03_2021-09-21	Y	125886	Chaoboridae	100	0.0039		0.0039
		RG_GHP_BIC-01_2021-09-22	Y	68854	Naididae	12.5	0.0050		0.005
	Nymph	RG_GHP_BIC-04_2021-09-21	Y	100755	Baetidae	50	0.0053		0.0053
25	none	RG_GHP_BIC-04_2021-09-21	Y	84195	Ostracoda	50	0.0057		25.0057
		RG_GHP_BIC-06_2021-09-22	Y	76591	Planorbidae	100	0.0078		0.0078
35	none	RG_GHP_BIC-03_2021-09-21	Y	84195	Ostracoda	100	0.0079		35.0079
42	none	RG_GHP_BIC-02_2021-09-23	Y	84195	Ostracoda	12.5	0.0087		42.0087
99	none	RG_GHP_BIC-01_2021-09-22	Y	84195	Ostracoda	12.5	0.0174		99.0174
		RG_GHP_BIC-01_2021-09-22	Y	76591	Planorbidae	12.5	0.0279		0.0279
	none	RG_GHP_BIC-02_2021-09-23	N		Hyalellidae	12.5	0.0302		0.0302
	Nymph	RG_GHP_BIC-01_2021-09-22	Y	102077	Coenagrionidae	12.5	0.0342		0.0342
	larvae	RG_GHP_BIC-04_2021-09-21	Y	125886	Chaoboridae	50	0.0370		0.037
	none	RG_GHP_BIC-01_2021-09-22	Y	127917	Chironomidae	12.5	0.0383		0.0383
	Nymph	RG_GHP_BIC-02_2021-09-23	Y	102077	Coenagrionidae	100	0.0440		0.044
	none	RG_GHP_BIC-03_2021-09-21	Y	103364	Corixidae	100	0.0467		0.0467
	none	RG_GHP_BIC-02_2021-09-23	N		Gammaridae	12.5	0.0476		0.0476
	none	RG_GHP_BIC-04_2021-09-21	Y	127917	Chironomidae	50	0.0583		0.0583
294	none	RG_GHP_BIC-06_2021-09-22	Y	84195	Ostracoda	100	0.0625		294.0625
	larvae	RG_GHP_BIC-05_2021-09-23	Y	125886	Chaoboridae	100	0.0682		0.0682
307	none	RG_GHP_BIC-05_2021-09-23	Y	84195	Ostracoda	100	0.0693		307.0693
	none	RG_GHP_BIC-03_2021-09-21	Y	127917	Chironomidae	100	0.0776		0.0776
	larvae	RG_GHP_BIC-06_2021-09-22	Y	125886	Chaoboridae	100	0.0839		0.0839
	larvae	RG_GHP_BIC-06_2021-09-22	Y	115867	Phryganeidae	100	0.1081		0.1081
	none	RG_GHP_BIC-02_2021-09-23	Y	127917	Chironomidae	12.5	0.1192		0.1192
	none	RG_GHP_BIC-02_2021-09-23	N		Gammaridae	100	0.1630		0.163
	none	RG_GHP_BIC-01_2021-09-22	N		Sphaeriidae	12.5	0.2402		0.2402
	none	RG_GHP_BIC-05_2021-09-23	Y	127917	Chironomidae	100	0.2549		0.2549
	none	RG_GHP_BIC-06_2021-09-22	Y	127917	Chironomidae	100	0.2842		0.2842
	larvae	RG_GHP_BIC-01_2021-09-22	Y	115867	Phryganeidae	100	0.2930		0.293
	none	RG_GHP_BIC-02_2021-09-23	N		Sphaeriidae	12.5	0.3210		0.321
		RG_GHP_BIC-02_2021-09-23	Y	76591	Planorbidae	12.5	0.3516		0.3516
	none	RG_GHP_BIC-03_2021-09-21	N		Gammaridae	100	0.4019		0.4019
	none	RG_GHP_BIC-06_2021-09-22	N		Gammaridae	100	0.4481		0.4481
	none	RG_GHP_BIC-04_2021-09-21	N		Gammaridae	50	0.5275		0.5275
	none	RG_GHP_BIC-05_2021-09-23	N		Gammaridae	100	0.5726		0.5726
	none	RG_GHP_BIC-04_2021-09-21	N		Sphaeriidae	50	0.9012		0.9012
	none	RG_GHP_BIC-03_2021-09-21	N		Sphaeriidae	100	1.6352		1.6352
	none	RG_GHP_BIC-06_2021-09-22	N		Sphaeriidae	100	2.2342		2.2342
	none	RG_GHP_BIC-05_2021-09-23	N		Sphaeriidae	100	2.9092		2.9092
Numeric	*Text(20)*	*Text(40)*	*Text(255)*	*Text(255)*	*Text(255)*	*Numeric*	*Text(255)*	*Text(255)*	
8		RG_GHP_BIC-01_2021-09-22	Y	974289	Tubificinae	12.5		immature with hair chaetae	8
1	none	RG_GHP_BIC-01_2021-09-22	N		Hyalella	12.5			1
1	none/immature	RG_GHP_BIC-01_2021-09-22	N		Gammarus	12.5			1
6	Nymph	RG_GHP_BIC-01_2021-09-22	Y	100903	Callibaetis	12.5			6
1	Nymph	RG_GHP_BIC-01_2021-09-22	Y	101478	Caenis	12.5			1
1	Nymph/immature	RG_GHP_BIC-01_2021-09-22	Y	102077	Coenagrionidae	12.5			1
1	larvae	RG_GHP_BIC-01_2021-09-22	Y	115892	Phryganea	100		large/rare sort	1
2	larvae	RG_GHP_BIC-01_2021-09-22	Y	127778	Bezzia	12.5			2
6	larvae	RG_GHP_BIC-01_2021-09-22	Y	129254	Chironomus	12.5			6
1	larvae	RG_GHP_BIC-01_2021-09-22	Y	129368	Cryptochironomus	12.5			1
2	larvae	RG_GHP_BIC-01_2021-09-22	Y	129978	Tanytarsus	12.5			2
3	larvae	RG_GHP_BIC-01_2021-09-22	Y	128079	Ablabesmyia	12.5			3
8	larvae	RG_GHP_BIC-01_2021-09-22	Y	128277	Procladius	12.5			8
8		RG_GHP_BIC-01_2021-09-22	Y	76592	Gyraulus	12.5			8
115	none	RG_GHP_BIC-01_2021-09-22	N		Pisidium (Cyclocalyx)	12.5			115
30	none	RG_GHP_BIC-02_2021-09-23	N		Hyalella	12.5			30
7	none	RG_GHP_BIC-02_2021-09-23	N		Gammarus lacustris	100			7
1	none	RG_GHP_BIC-02_2021-09-23	N		Gammarus lacustris	12.5			1
4	none/immature	RG_GHP_BIC-02_2021-09-23	N		Gammarus	12.5			4
1	none	RG_GHP_BIC-02_2021-09-23	Y	111858	Haliplus	12.5			1
9	Nymph	RG_GHP_BIC-02_2021-09-23	Y	100903	Callibaetis	12.5			9
1	Nymph	RG_GHP_BIC-02_2021-09-23	Y	102077	Coenagrionidae	100			1
1	Nymph/immature	RG_GHP_BIC-02_2021-09-23	Y	102077	Coenagrionidae	12.5			1
4	larvae	RG_GHP_BIC-02_2021-09-23	Y	129254	Chironomus	12.5			4
6	larvae	RG_GHP_BIC-02_2021-09-23	Y	129368	Cryptochironomus	12.5			6
1	larvae	RG_GHP_BIC-02_2021-09-23	Y	129935	Paratanytarsus	12.5			1
2	larvae	RG_GHP_BIC-02_2021-09-23	Y	129785	Stictochironomus	12.5			2
6	larvae	RG_GHP_BIC-02_2021-09-23	Y	128079	Ablabesmyia	12.5			6
2	larvae	RG_GHP_BIC-02_2021-09-23	Y	128277	Procladius	12.5			2
133		RG_GHP_BIC-02_2021-09-23	Y	76592	Gyraulus	12.5			133
140	none	RG_GHP_BIC-02_2021-09-23	N		Pisidium (Cyclocalyx)	12.5			140
13	none	RG_GHP_BIC-03_2021-09-21	N		Gammarus lacustris	100			13
4	none/immature	RG_GHP_BIC-03_2021-09-21	N		Gammarus	100			4
1	none	RG_GHP_BIC-03_2021-09-21	Y	103364	Corixidae	100			1
2	larvae	RG_GHP_BIC-03_2021-09-21	N		Chaoborus flavicans	100			2
10	larvae	RG_GHP_BIC-03_2021-09-21	Y	129254	Chironomus	100			10
8	larvae	RG_GHP_BIC-03_2021-09-21	Y	129368	Cryptochironomus	100			8
1	larvae	RG_GHP_BIC-03_2021-09-21	Y	129785	Stictochironomus	100			1
6	larvae	RG_GHP_BIC-03_2021-09-21	Y	129978	Tanytarsus	100			6
29	larvae	RG_GHP_BIC-03_2021-09-21	Y	128277	Procladius	100			29
1		RG_GHP_BIC-03_2021-09-21	Y	76592	Gyraulus	100			1
613	none	RG_GHP_BIC-03_2021-09-21	N		Pisidium (Cyclocalyx)	100			613
1	none	RG_GHP_BIC-04_2021-09-21	N		Hyalella	50			1
14	none	RG_GHP_BIC-04_2021-09-21	N		Gammarus lacustris	50			14
12	none/immature	RG_GHP_BIC-04_2021-09-21	N		Gammarus	50			12
18	Nymph	RG_GHP_BIC-04_2021-09-21	Y	100903	Callibaetis	50			18
13	larvae	RG_GHP_BIC-04_2021-09-21	N		Chaoborus flavicans	50			13
8	larvae	RG_GHP_BIC-04_2021-09-21	Y	129368	Cryptochironomus	50			8
3	larvae	RG_GHP_BIC-04_2021-09-21	Y	129978	Tanytarsus	50			3
1	larvae	RG_GHP_BIC-04_2021-09-21	Y	128079	Ablabesmyia	50			1
45	larvae	RG_GHP_BIC-04_2021-09-21	Y	128277	Procladius	50			45
279	none	RG_GHP_BIC-04_2021-09-21	N		Pisidium (Cyclocalyx)	50			279
13	none	RG_GHP_BIC-05_2021-09-23	N		Gammarus lacustris	100			13
3	none/immature	RG_GHP_BIC-05_2021-09-23	N		Gammarus	100			3
21	larvae	RG_GHP_BIC-05_2021-09-23	N		Chaoborus flavicans	100			21
58	larvae	RG_GHP_BIC-05_2021-09-23	Y	129254	Chironomus	100			58
5	larvae	RG_GHP_BIC-05_2021-09-23	Y	129368	Cryptochironomus	100			5
21	larvae	RG_GHP_BIC-05_2021-09-23	Y	129978	Tanytarsus	100			21
15	larvae	RG_GHP_BIC-05_2021-09-23	Y	128277	Procladius	100			15
783	none	RG_GHP_BIC-05_2021-09-23	N		Pisidium (Cyclocalyx)	100			783
1		RG_GHP_BIC-06_2021-09-22	Y	974289	Tubificinae	100		immature without hair chaetae	1
1	Adult	RG_GHP_BIC-06_2021-09-22	Y	83034	Lebertia	100			1
1	Adult	RG_GHP_BIC-06_2021-09-22	Y	83479	Mideopsis	100			1
1	Adult/indeterminate	RG_GHP_BIC-06_2021-09-22	Y	83330	Pionidae	100			1
3	none	RG_GHP_BIC-06_2021-09-22	N		Hyalella	100			3
16	none	RG_GHP_BIC-06_2021-09-22	N		Gammarus lacustris	100			16
4	none/immature	RG_GHP_BIC-06_2021-09-22	N		Gammarus	100			4
1	Nymph	RG_GHP_BIC-06_2021-09-22	Y	100903	Callibaetis	100			1
1	larvae	RG_GHP_BIC-06_2021-09-22	Y	115892	Phryganea	100			1
21	larvae	RG_GHP_BIC-06_2021-09-22	N		Chaoborus flavicans	100			21
1	larvae/immature	RG_GHP_BIC-06_2021-09-22	Y	125886	Chaoboridae	100			1

quantity	life_stage_code	observ_sample_code	ITIS_TAXON_NAME_Y-N	ITIS_TSN	BENCH_TAXON_NAME	PERCENT_SAMPLED	RAW_BIOMASS	QC_COMMENTS	
	Nymph	RG_GHP_BIC-01_2021-09-22	Y	101467	Caenidae	12.5	0.0001		0.0001
23	larvae	RG_GHP_BIC-06_2021-09-22	Y	129254	Chironomus	100			23
2	larvae	RG_GHP_BIC-06_2021-09-22	Y	129368	Cryptochironomus	100			2
53	larvae	RG_GHP_BIC-06_2021-09-22	Y	129978	Tanytarsus	100			53
145	larvae	RG_GHP_BIC-06_2021-09-22	Y	128277	Procladius	100			145
3		RG_GHP_BIC-06_2021-09-22	Y	76592	Gyraulus	100			3
803	none	RG_GHP_BIC-06_2021-09-22	N		Pisidium (Cyclocalyx)	100			803

APPENDIX C
WATER QUALITY

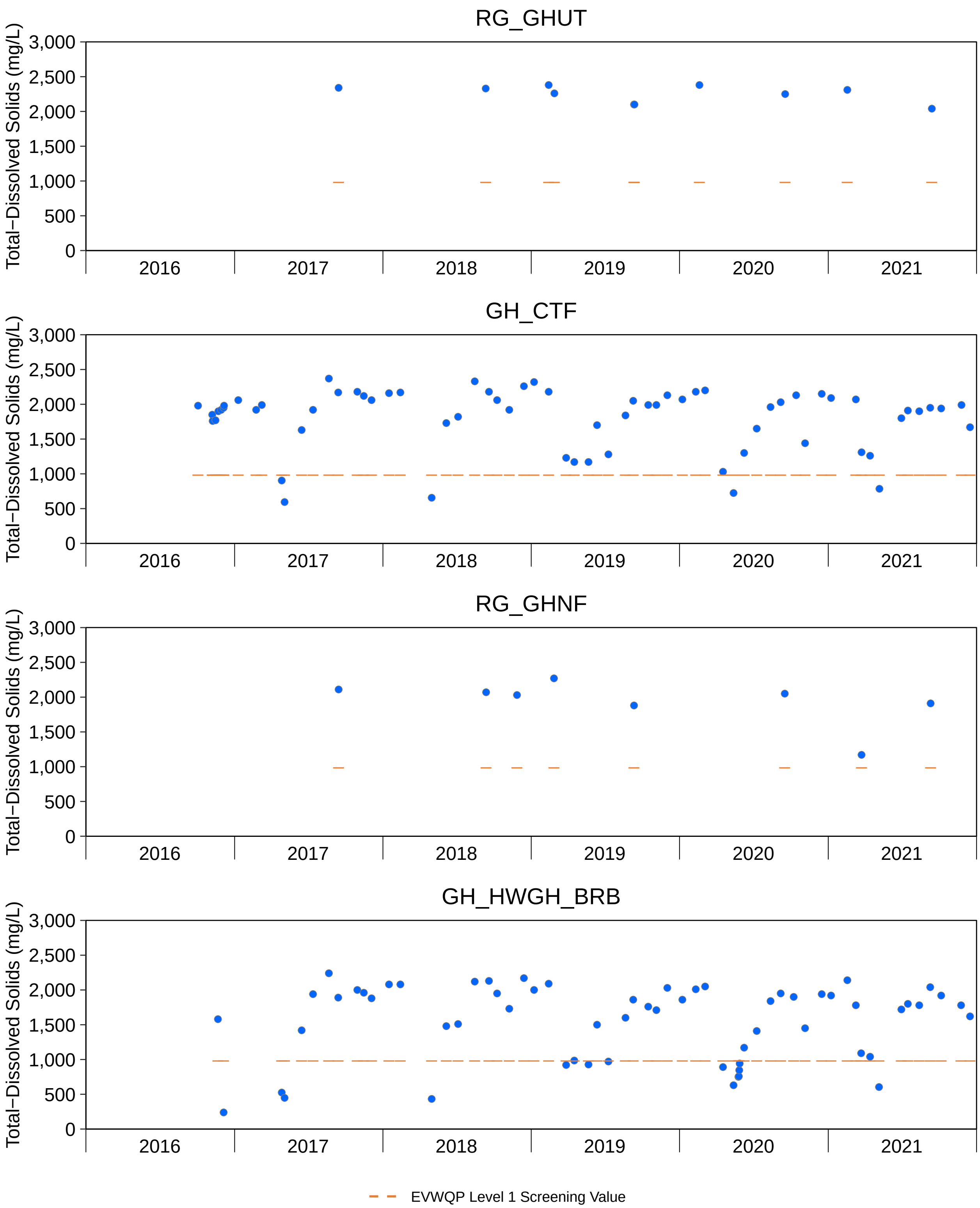


Figure C.1: Total Dissolved Solids (TDS) Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

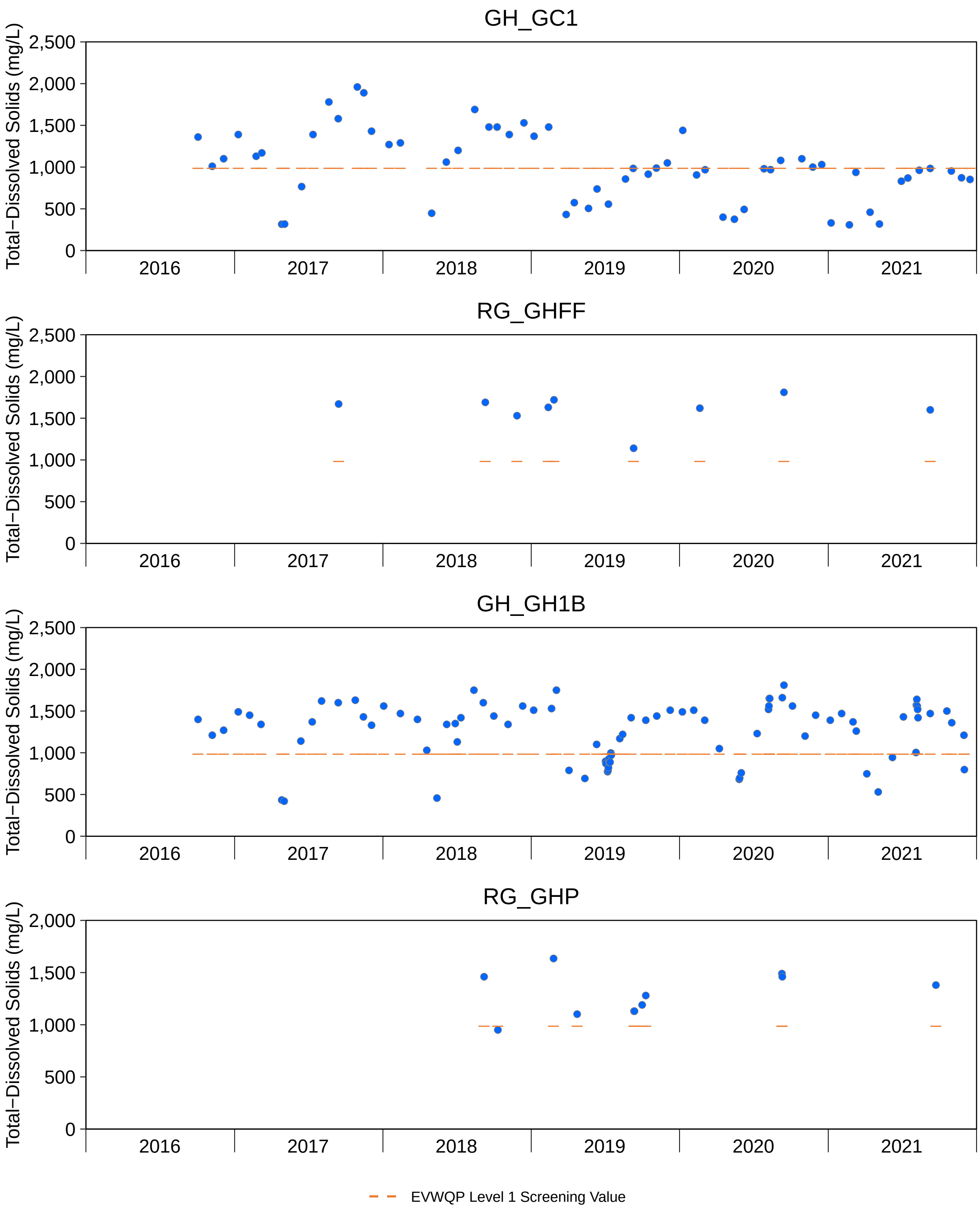


Figure C.1: Total Dissolved Solids (TDS) Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

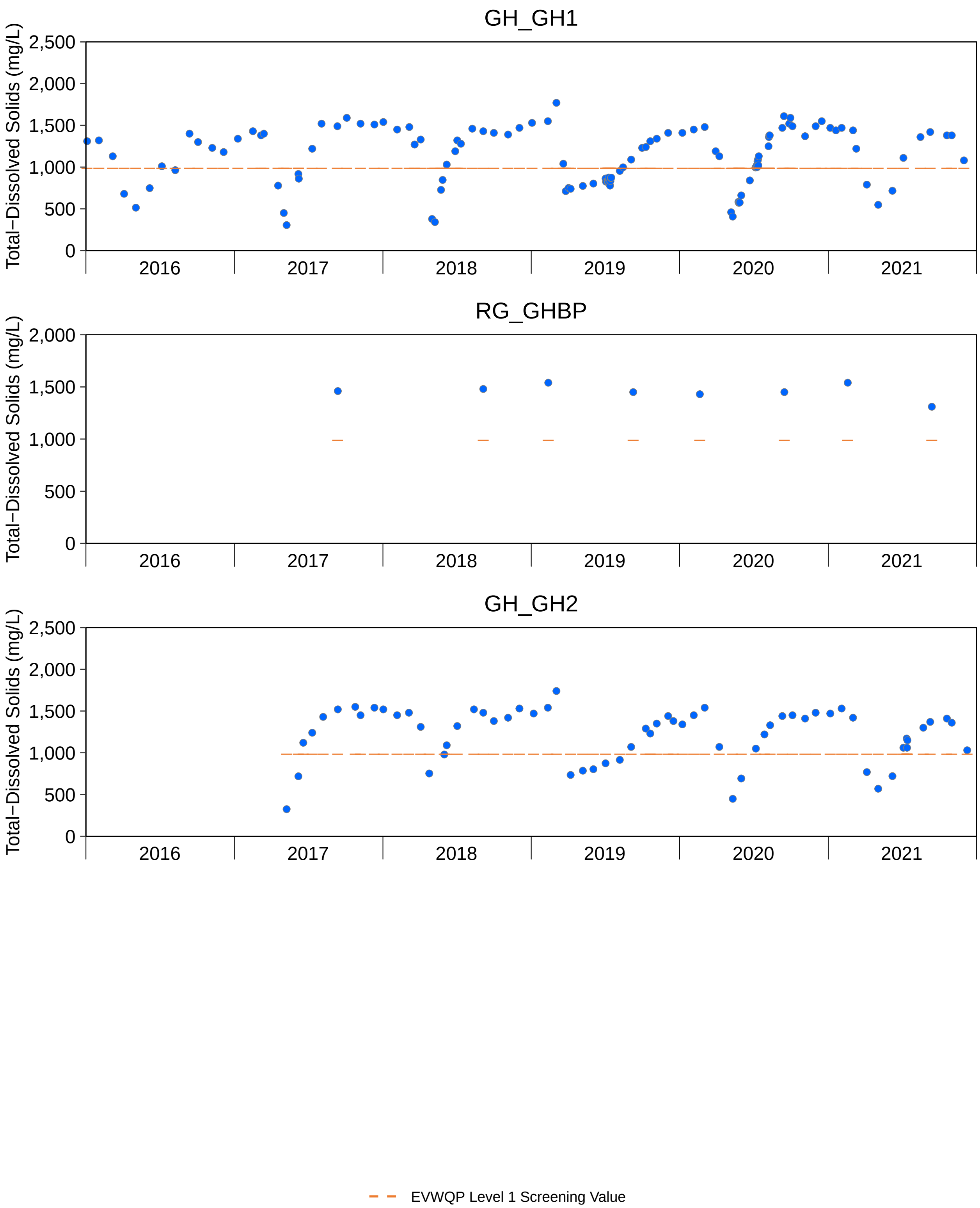


Figure C.1: Total Dissolved Solids (TDS) Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

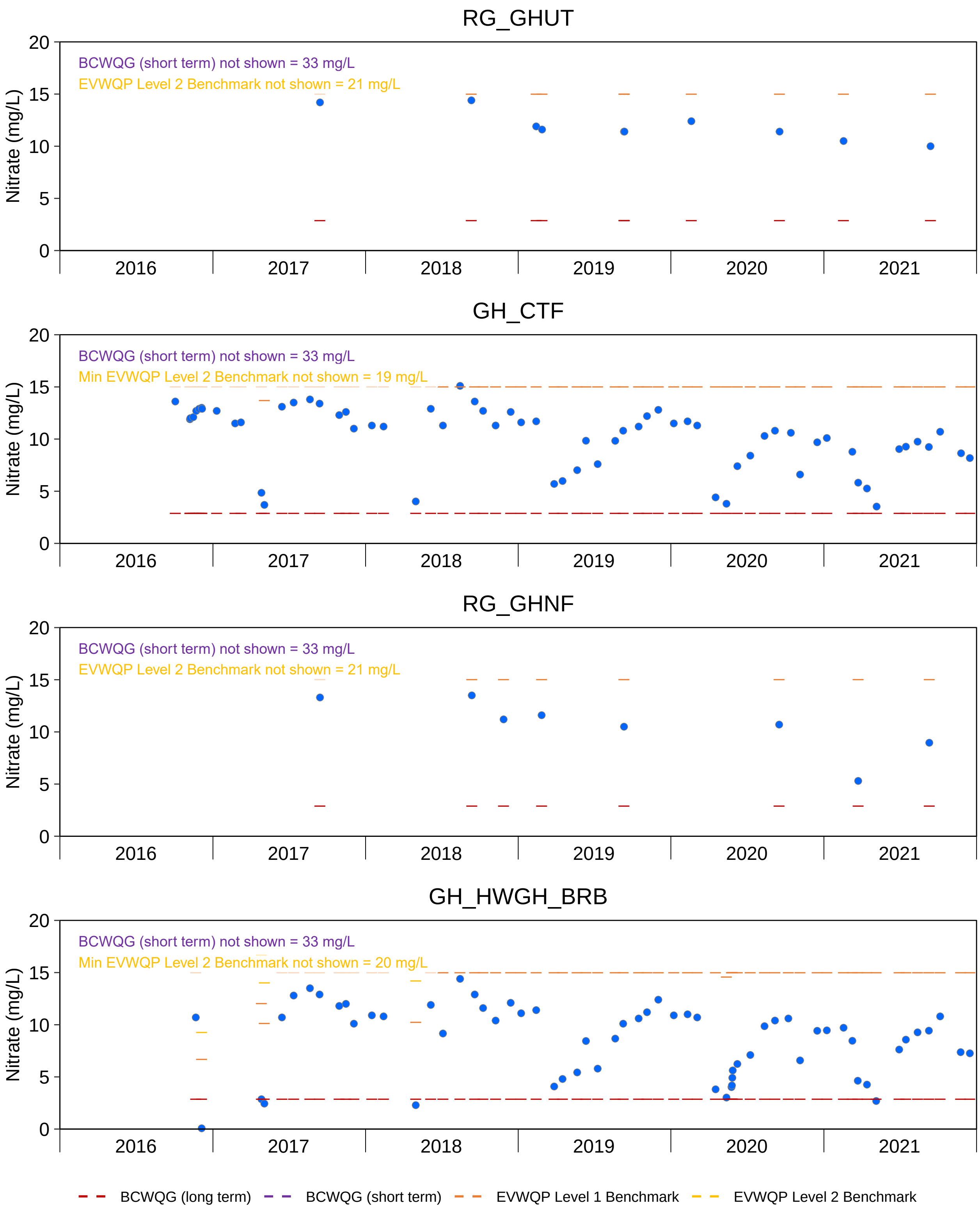


Figure C.2: Nitrate-N Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

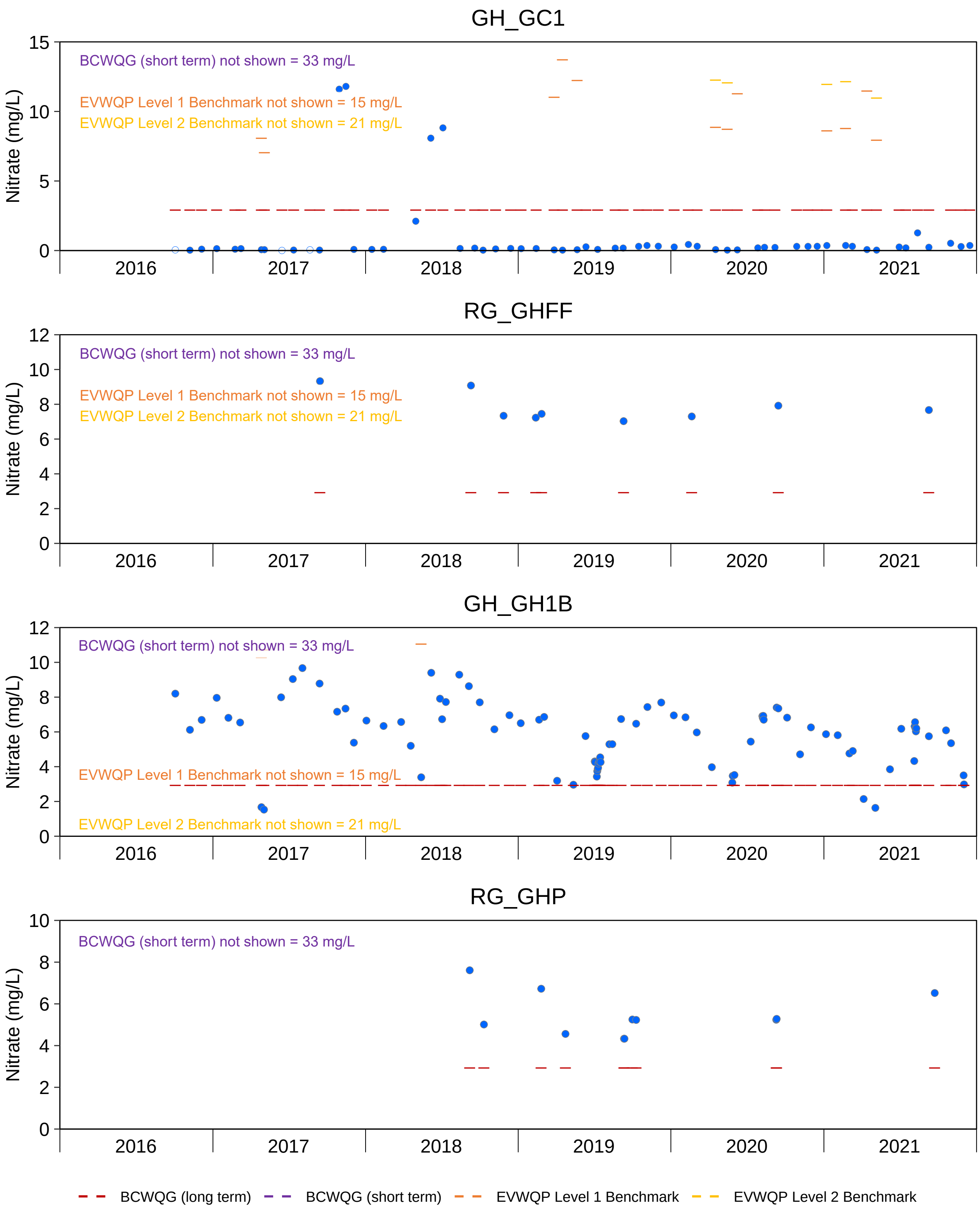


Figure C.2: Nitrate-N Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

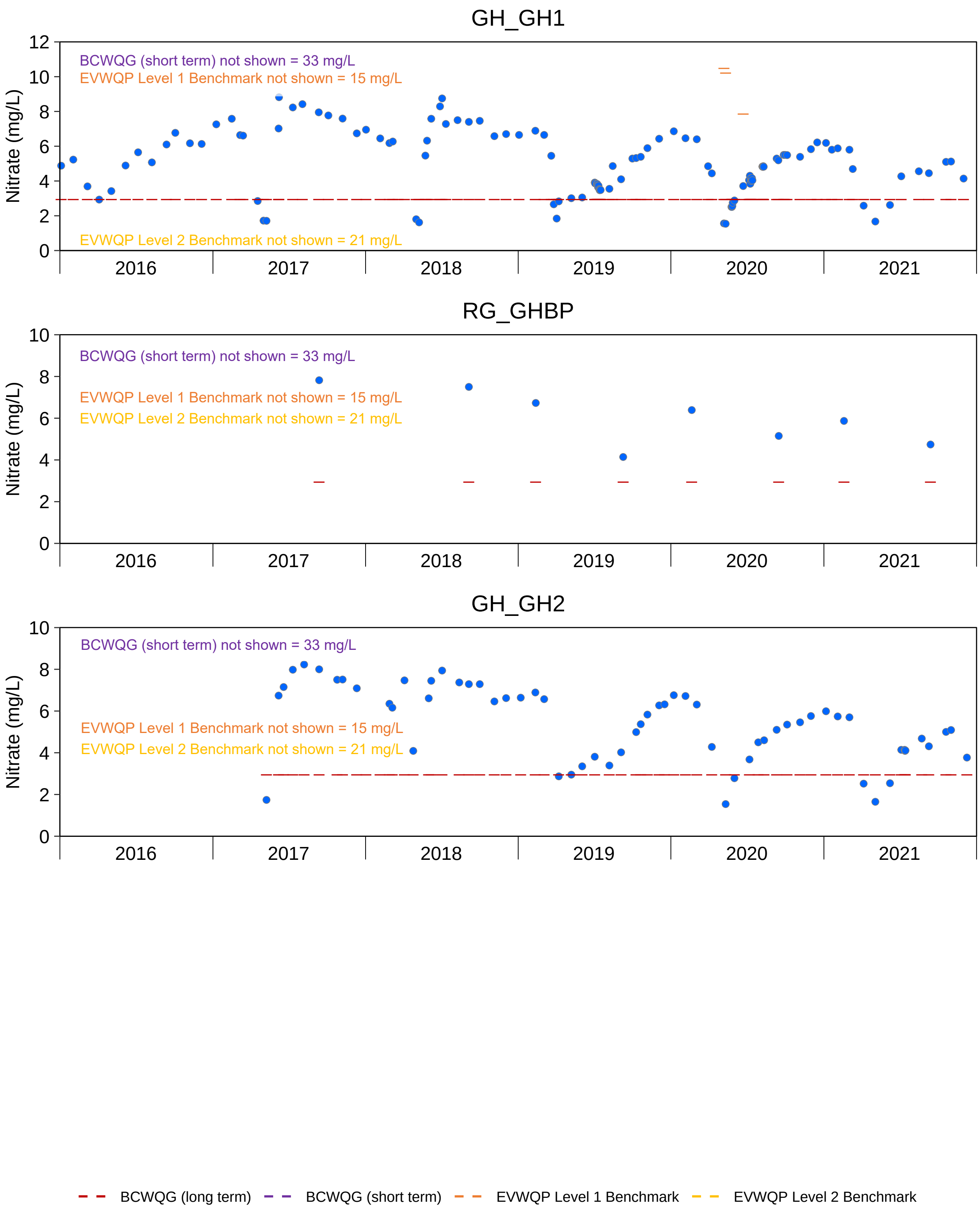


Figure C.2: Nitrate-N Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

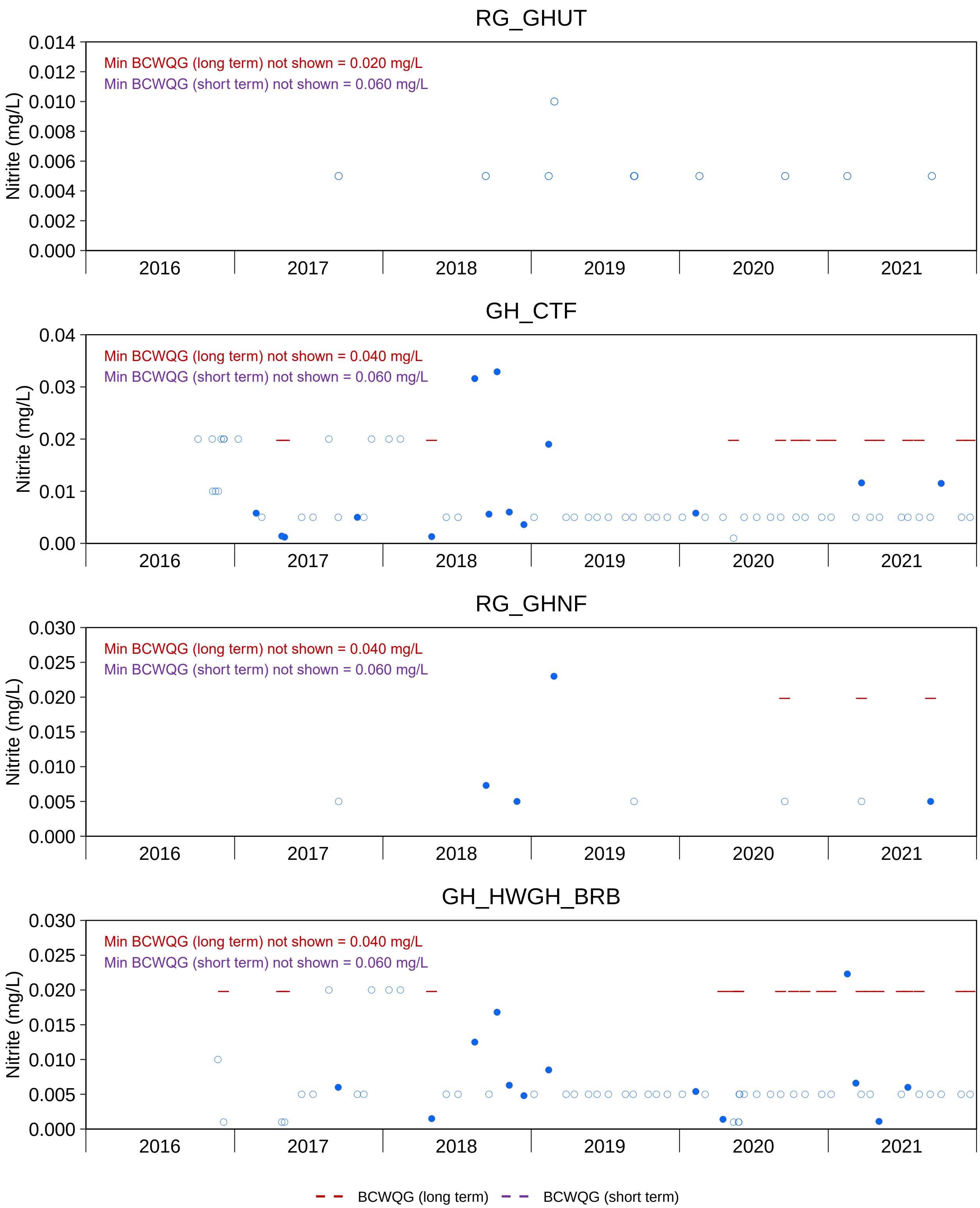


Figure C.3: Nitrite-N Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations.

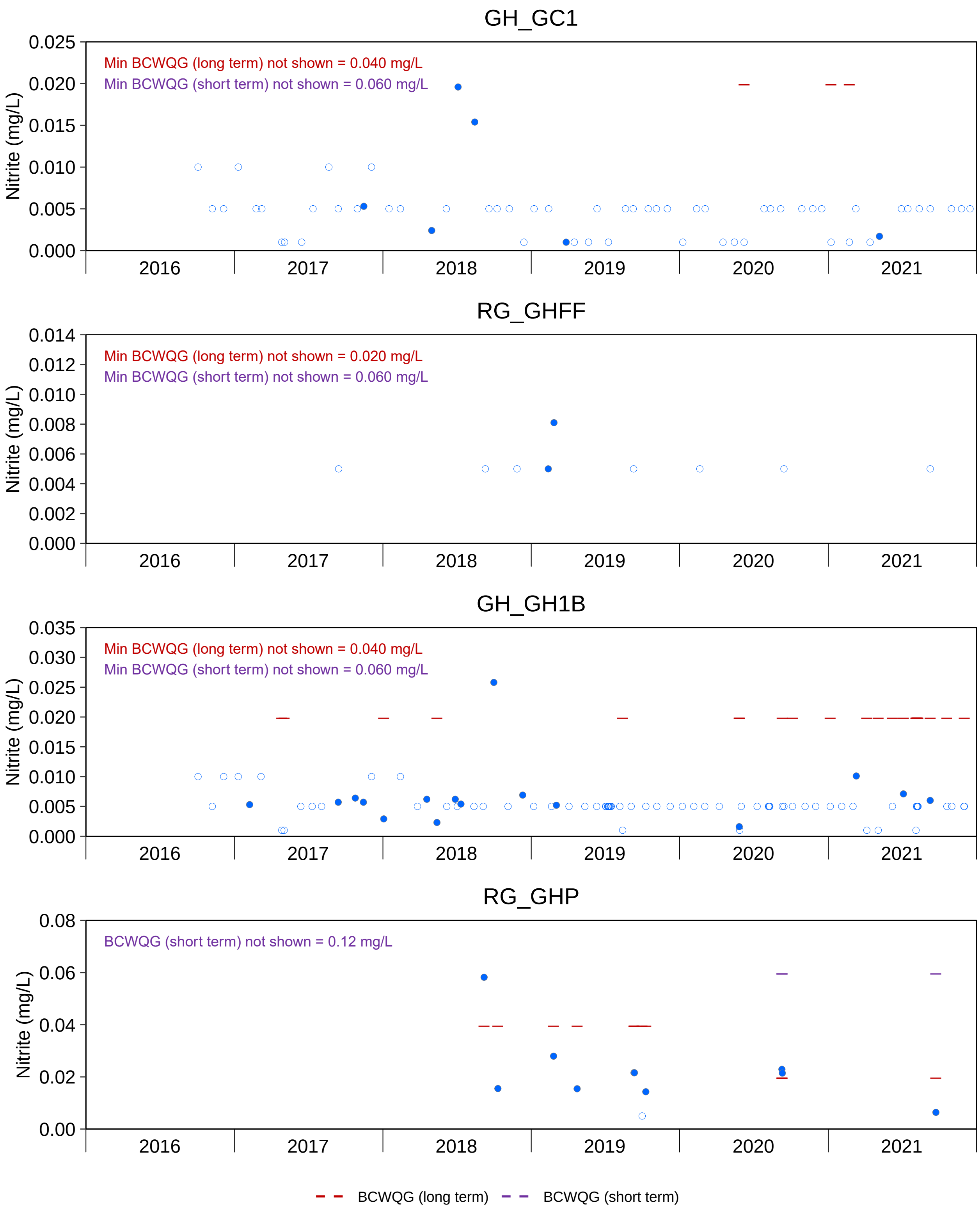


Figure C.3: Nitrite-N Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations.

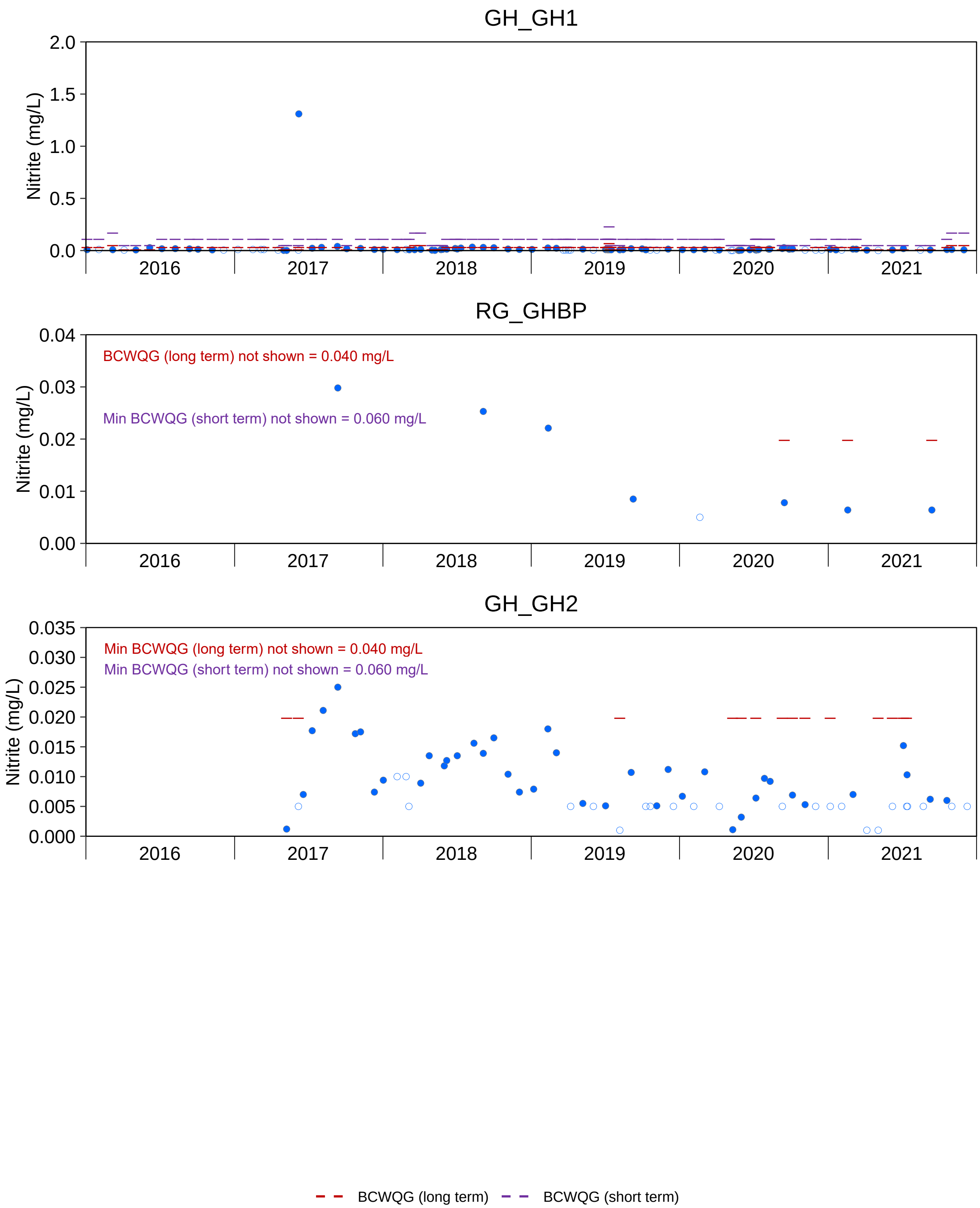


Figure C.3: Nitrite-N Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations.

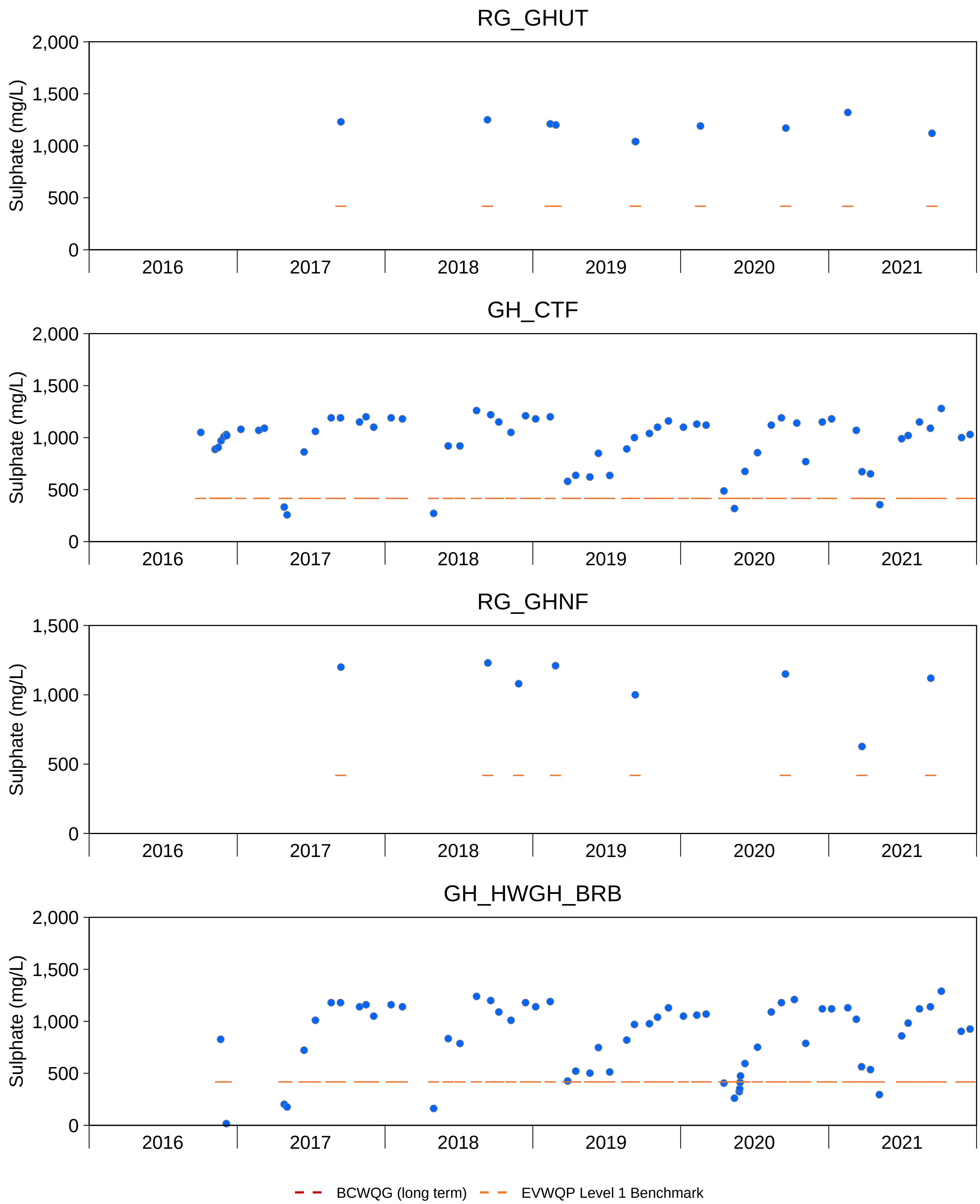


Figure C.4: Sulphate Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

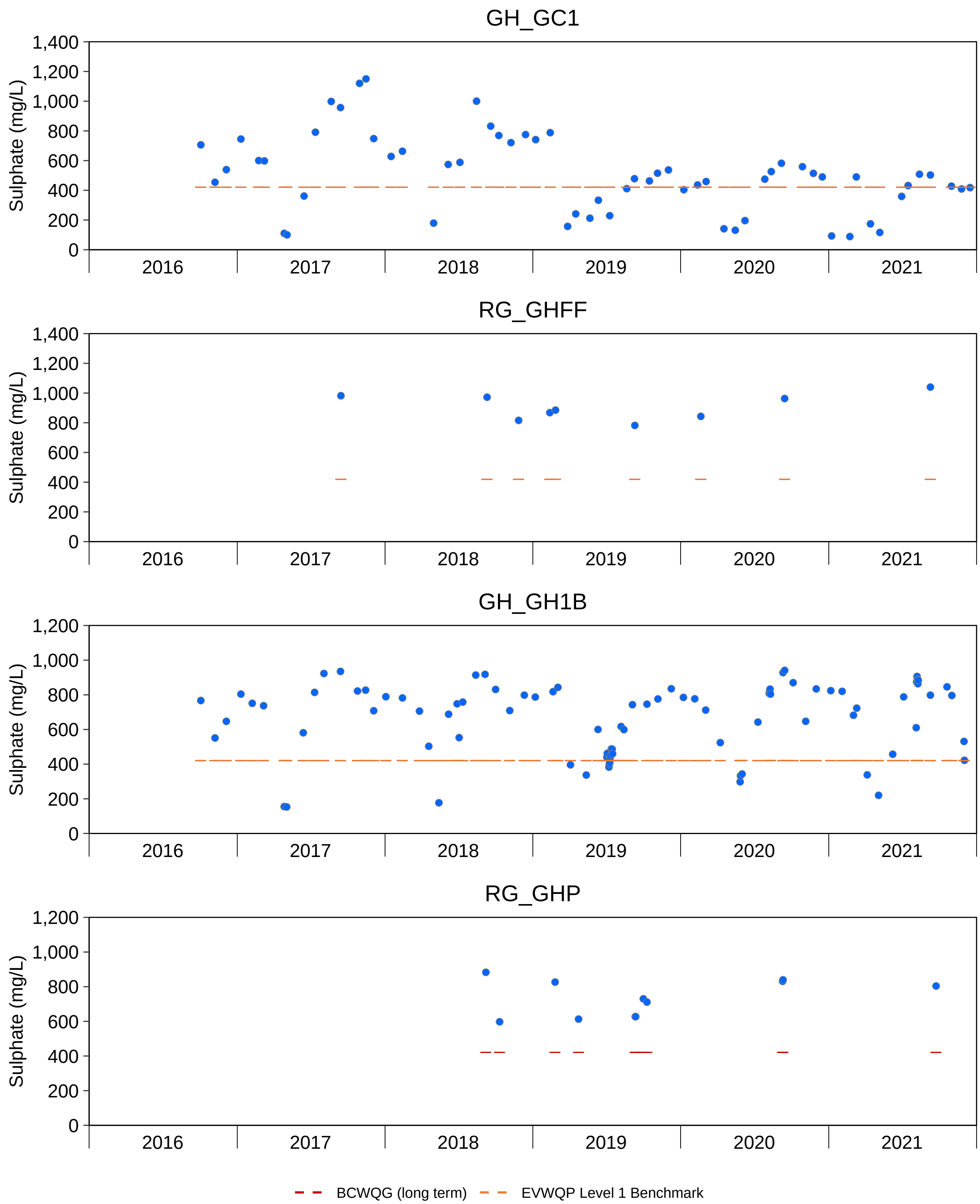


Figure C.4: Sulphate Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

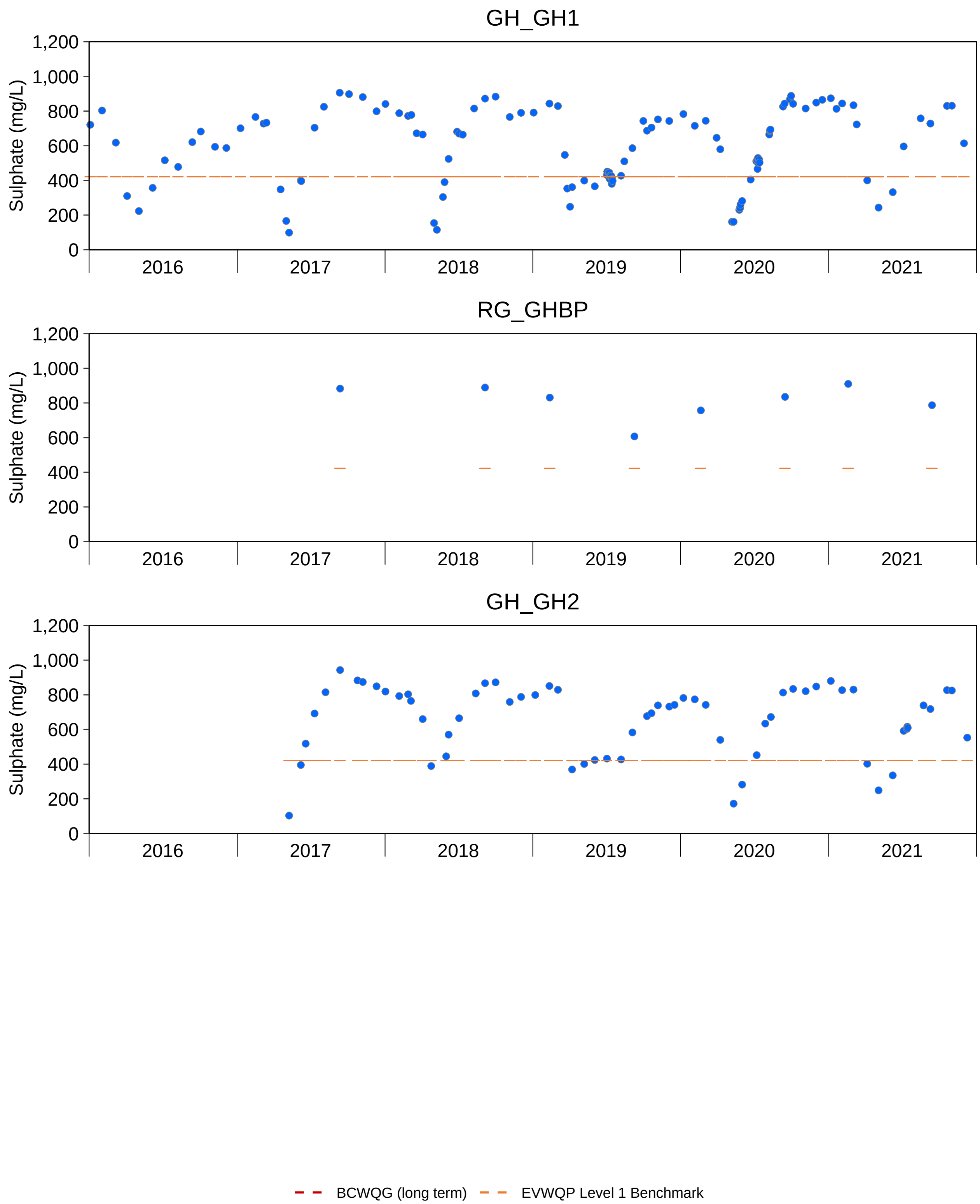


Figure C.4: Sulphate Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

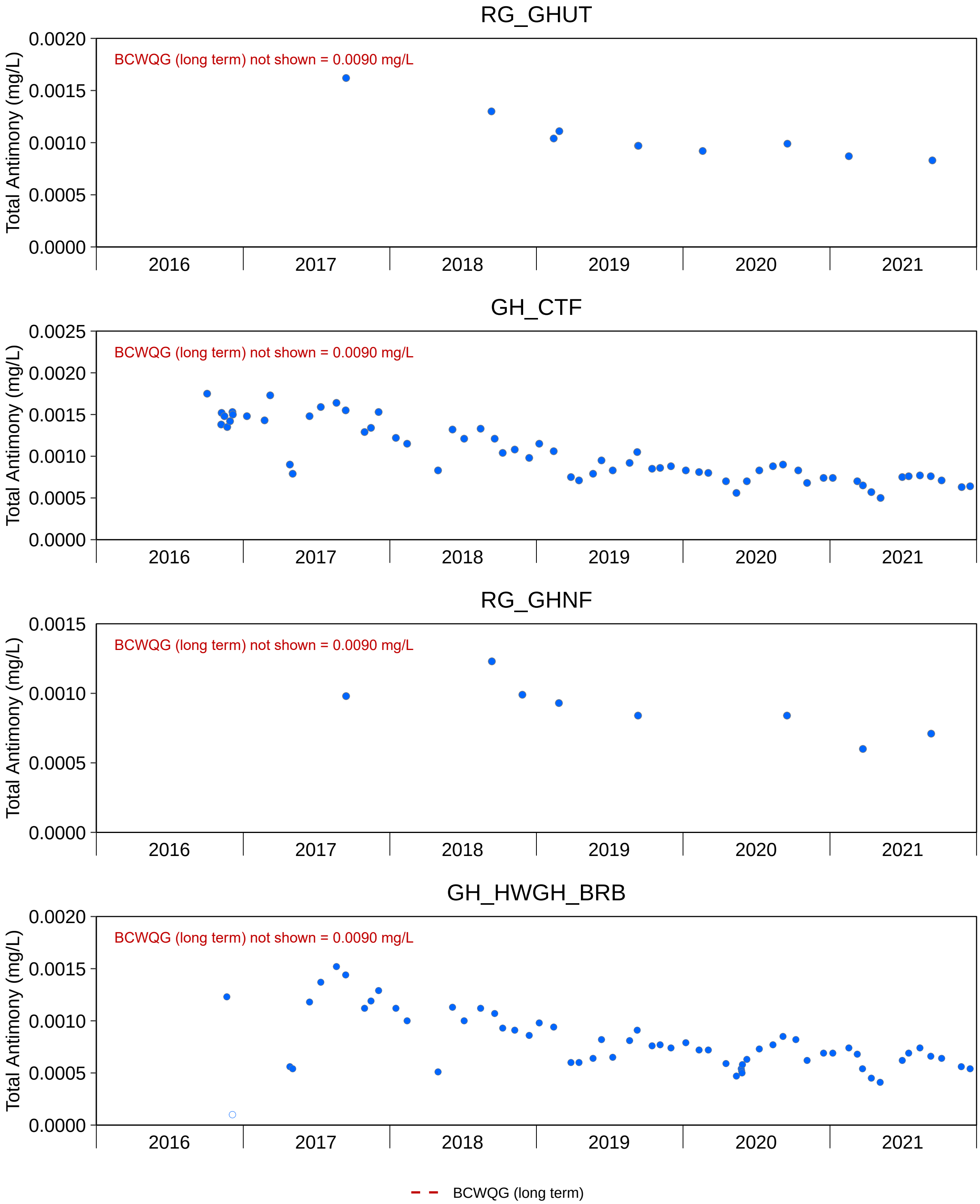


Figure C.5: Total Antimony Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

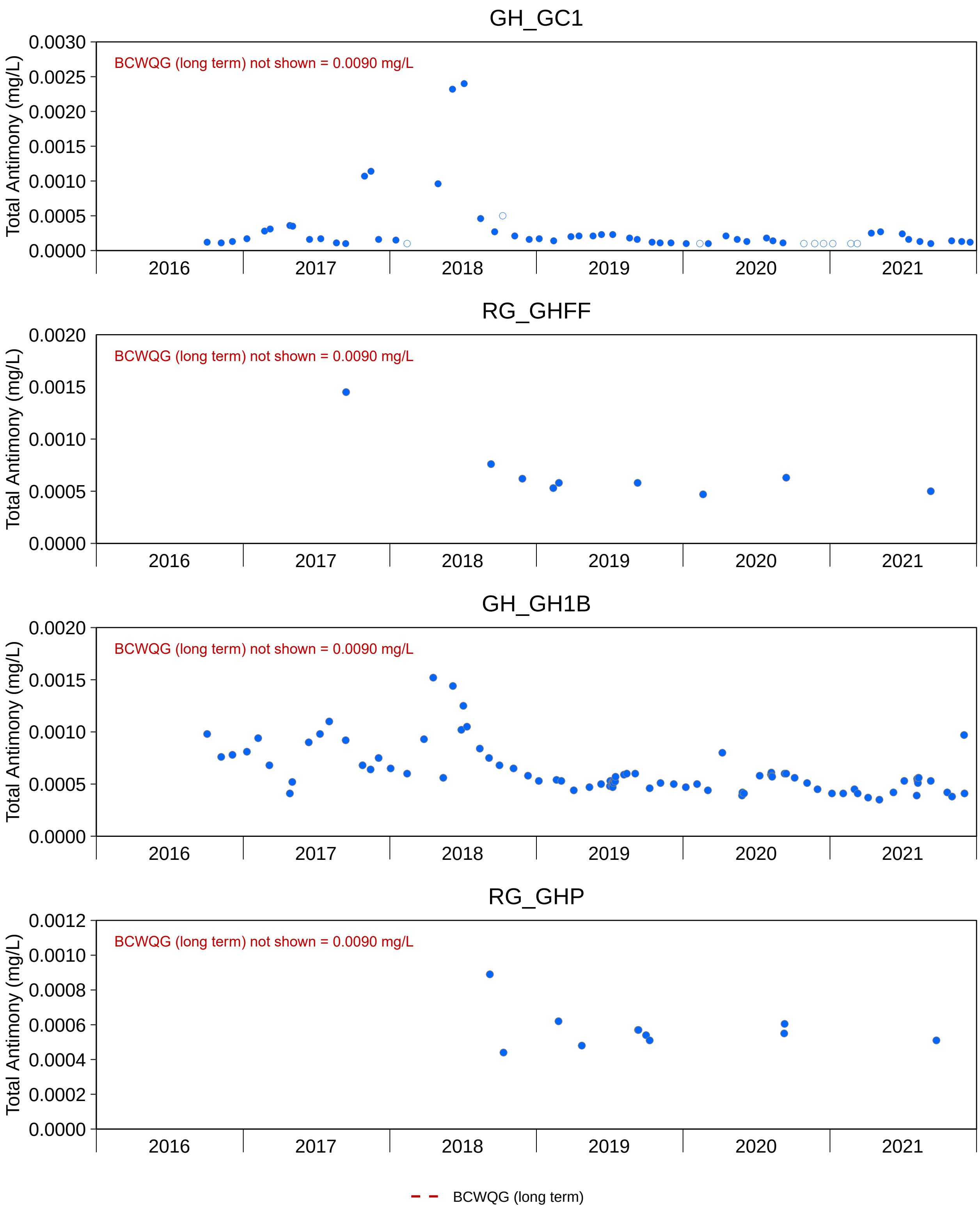


Figure C.5: Total Antimony Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

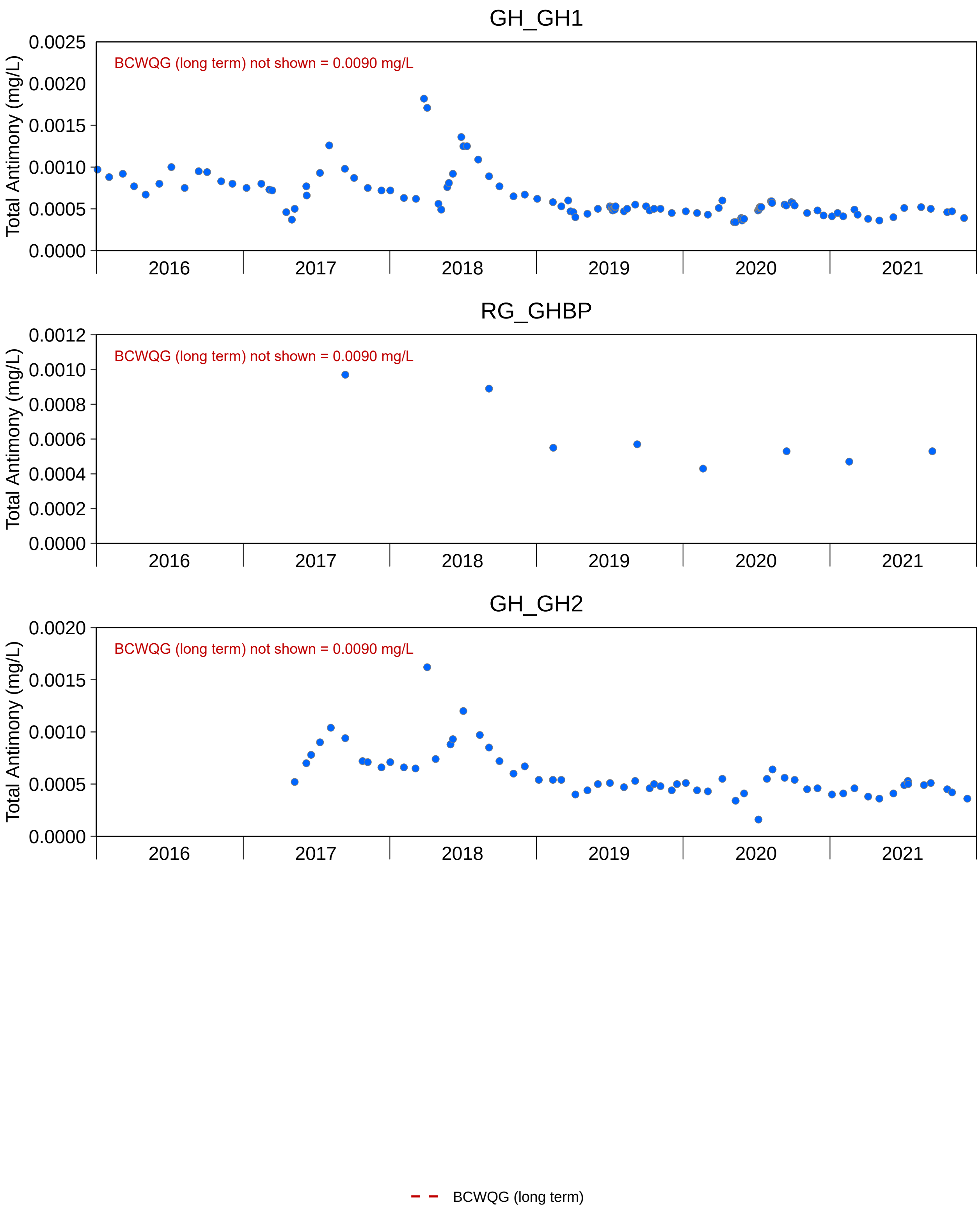


Figure C.5: Total Antimony Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

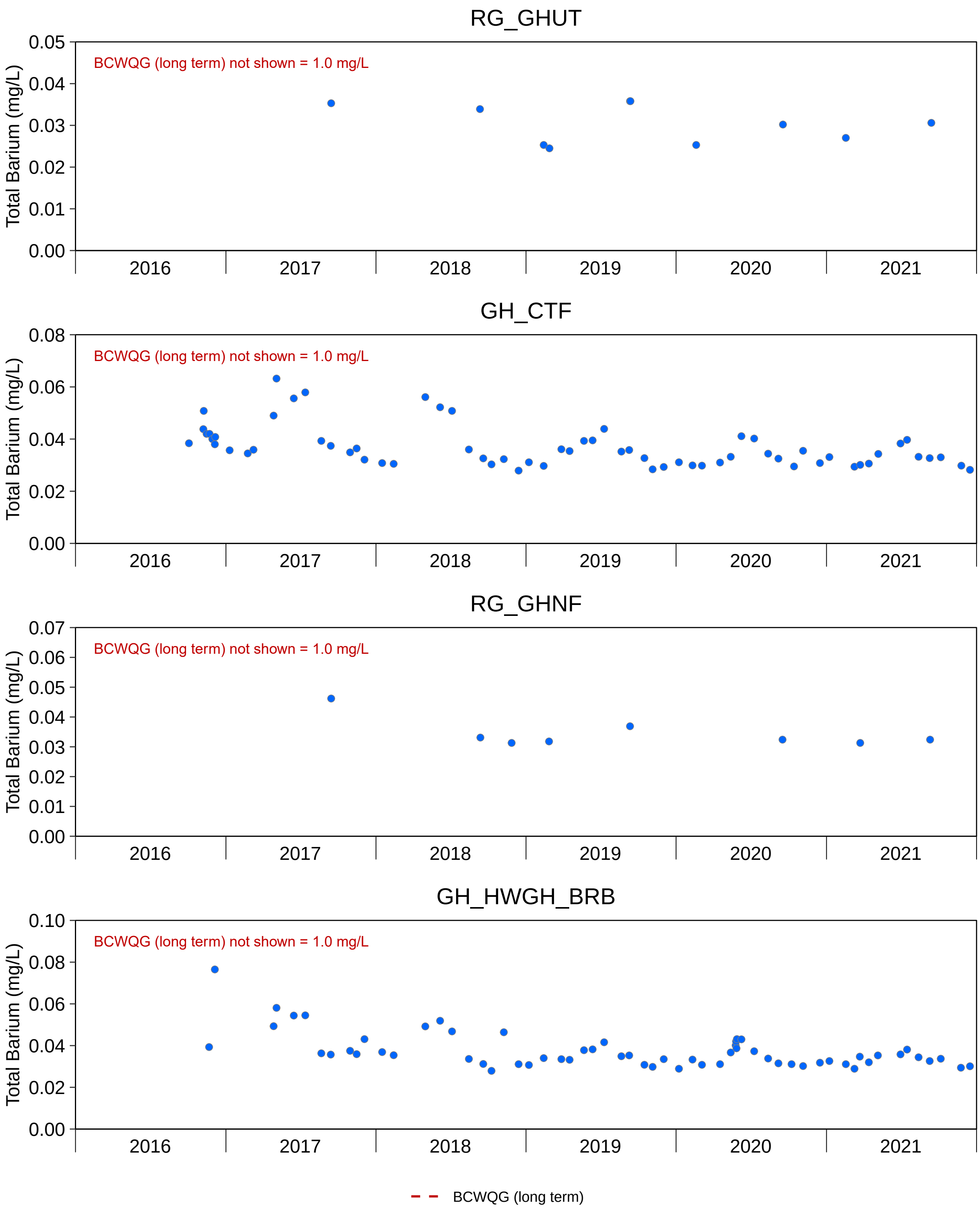


Figure C.6: Total Barium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

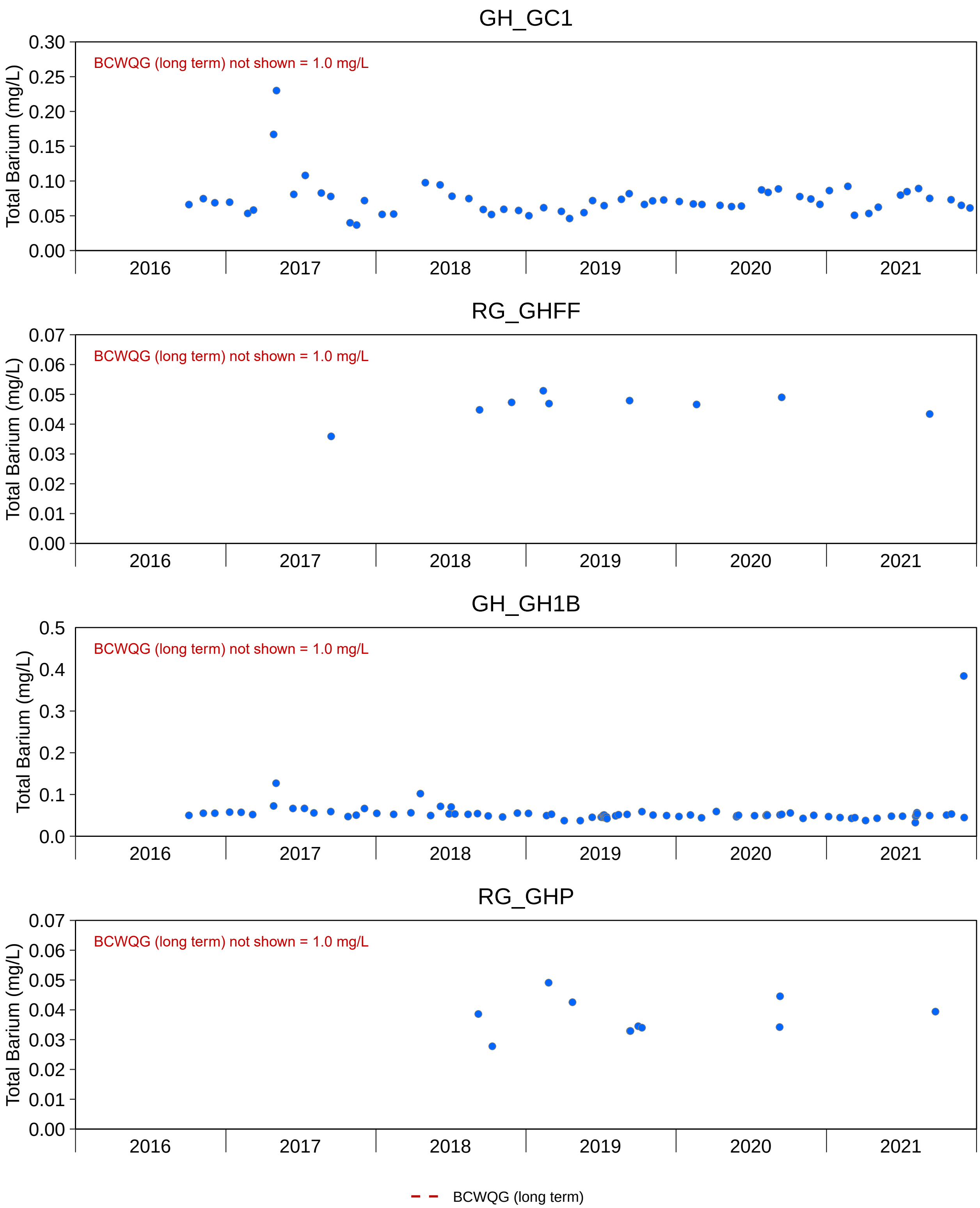


Figure C.6: Total Barium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

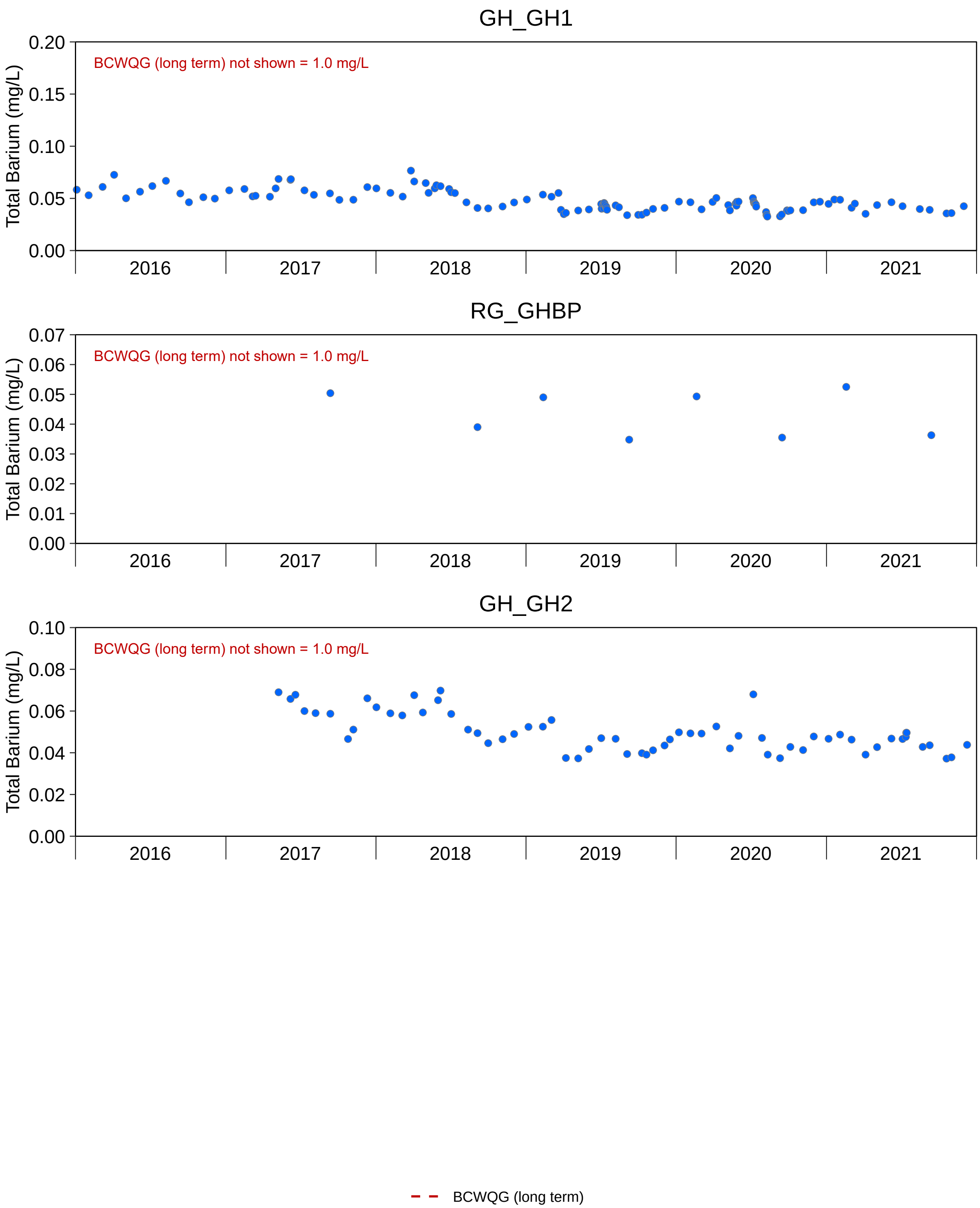


Figure C.6: Total Barium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

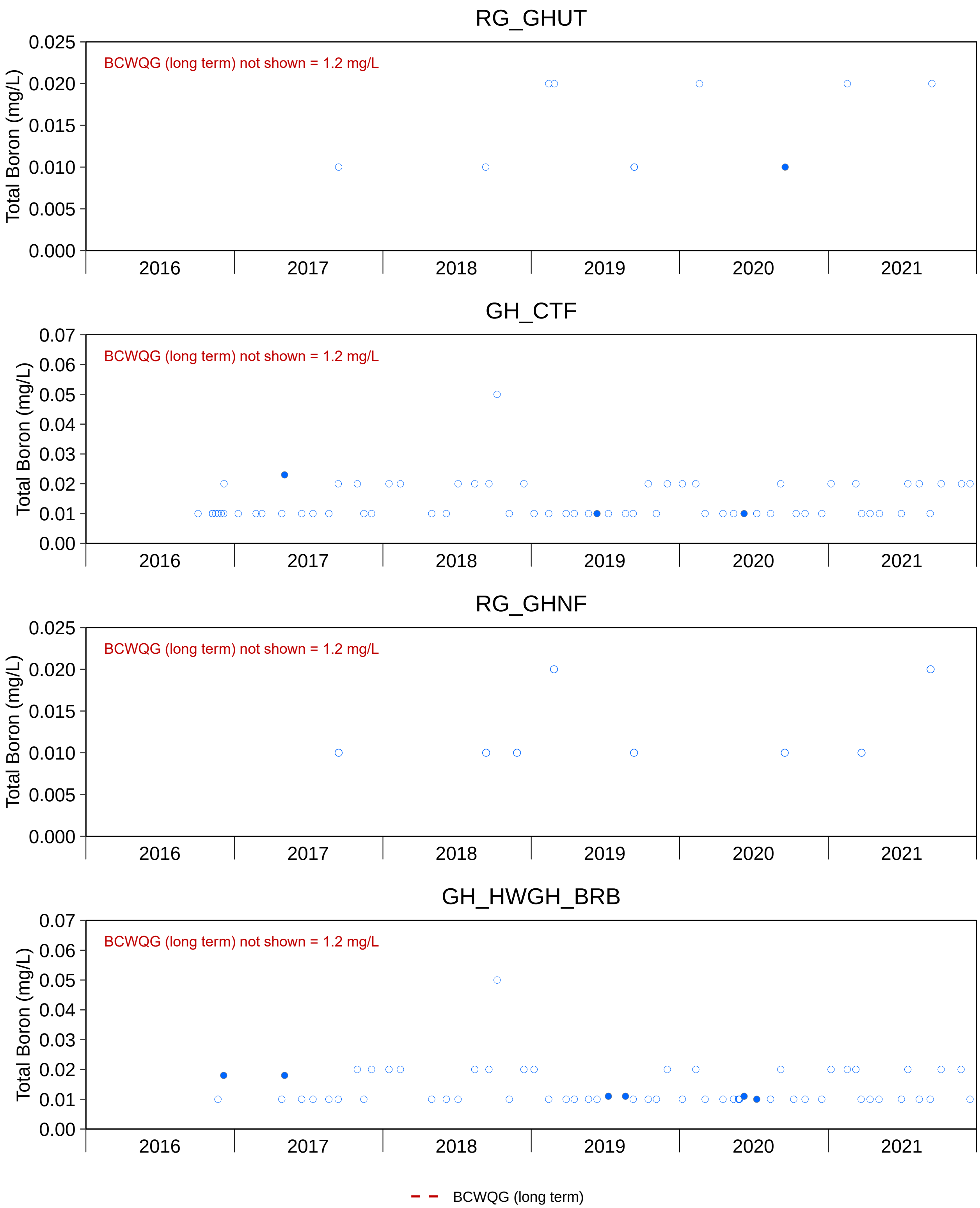


Figure C.7: Total Boron Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

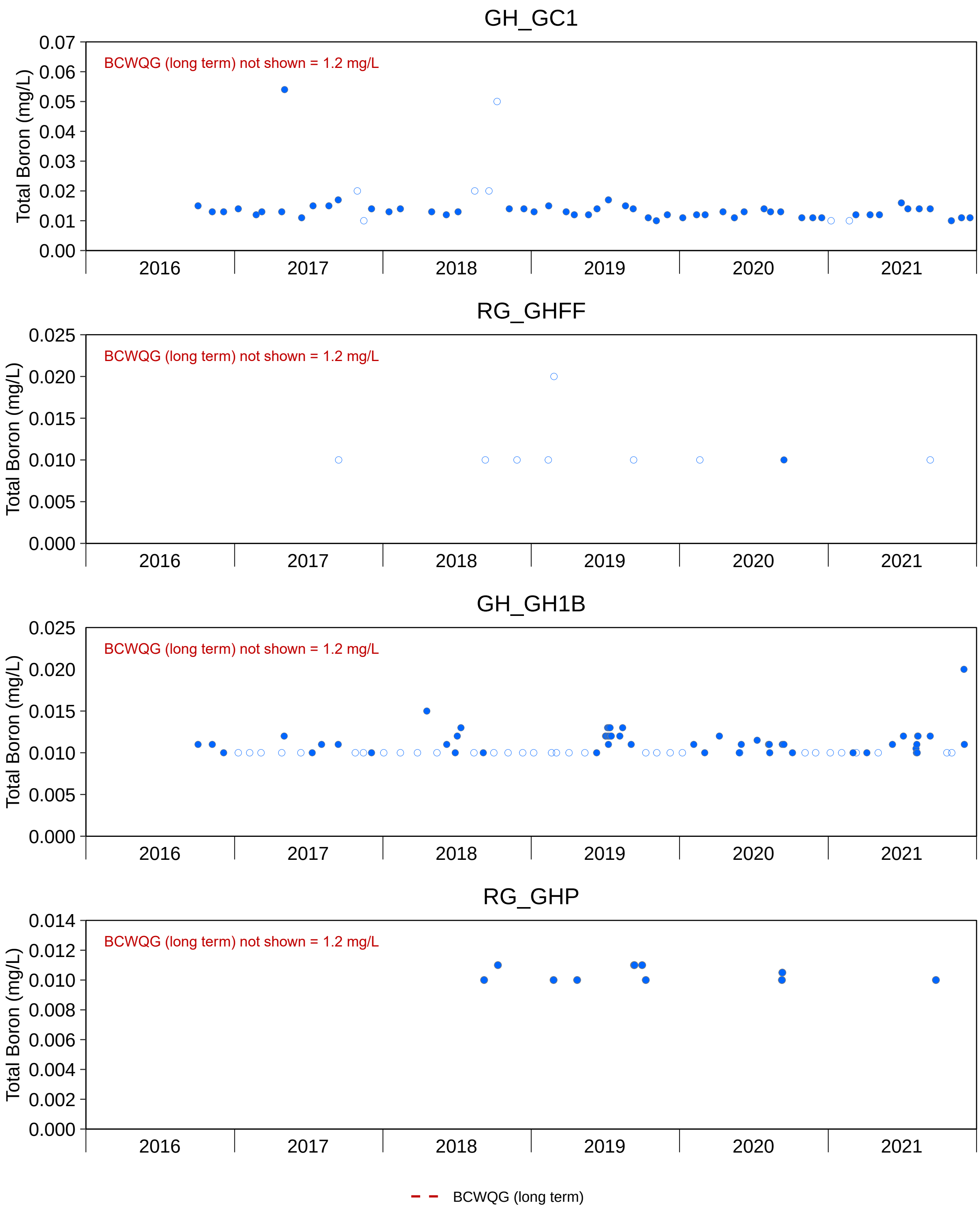


Figure C.7: Total Boron Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

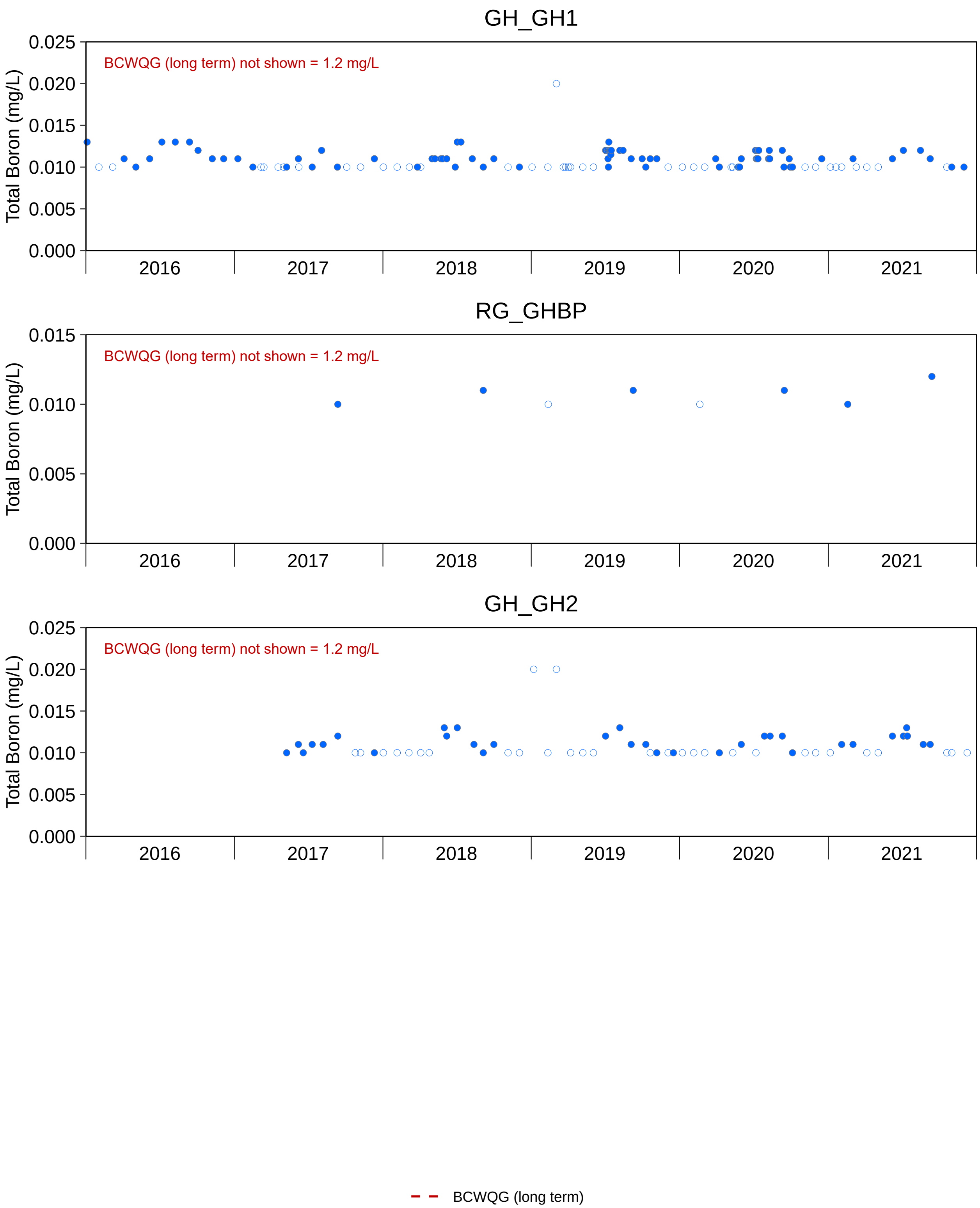


Figure C.7: Total Boron Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

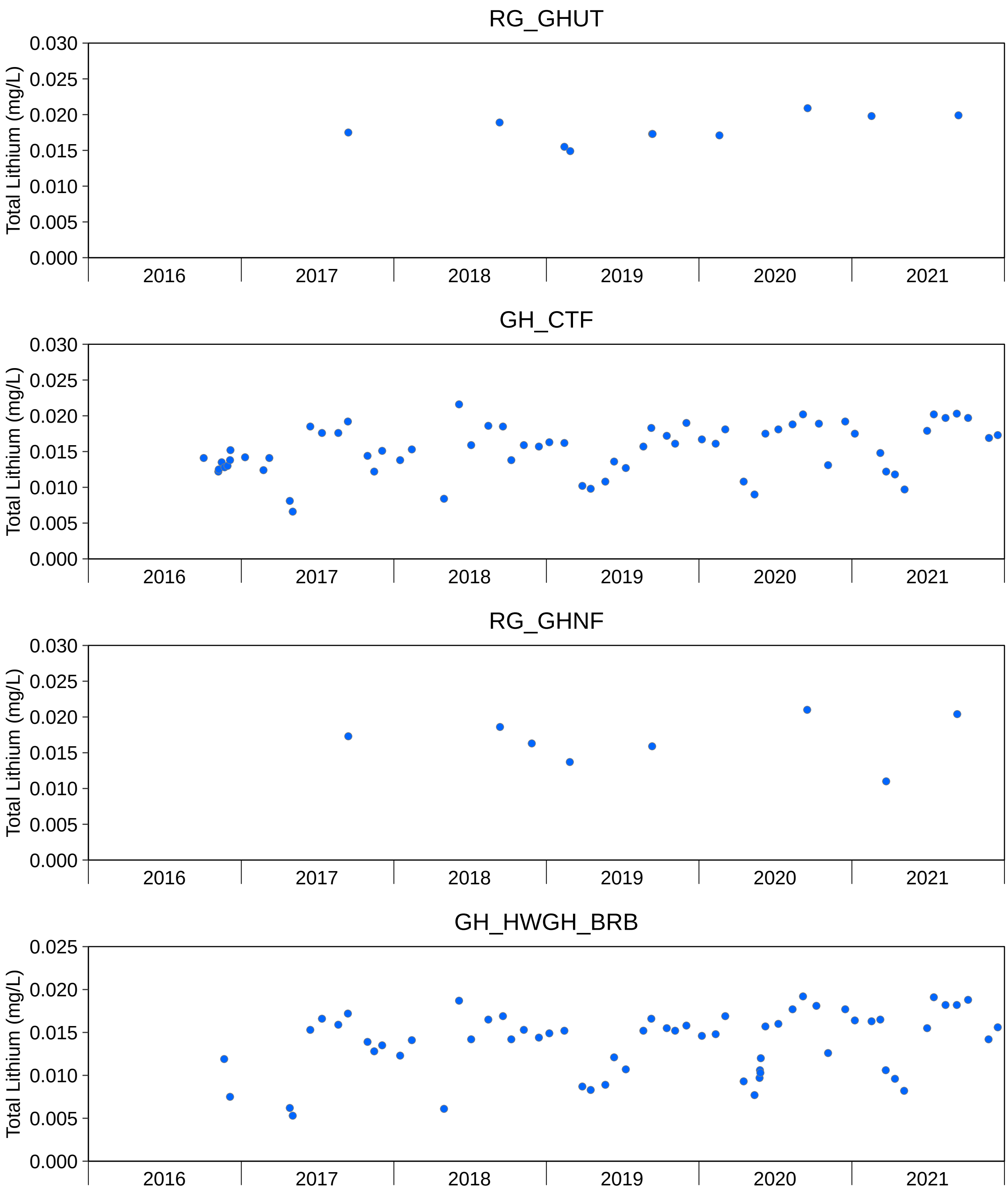


Figure C.8: Total Lithium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

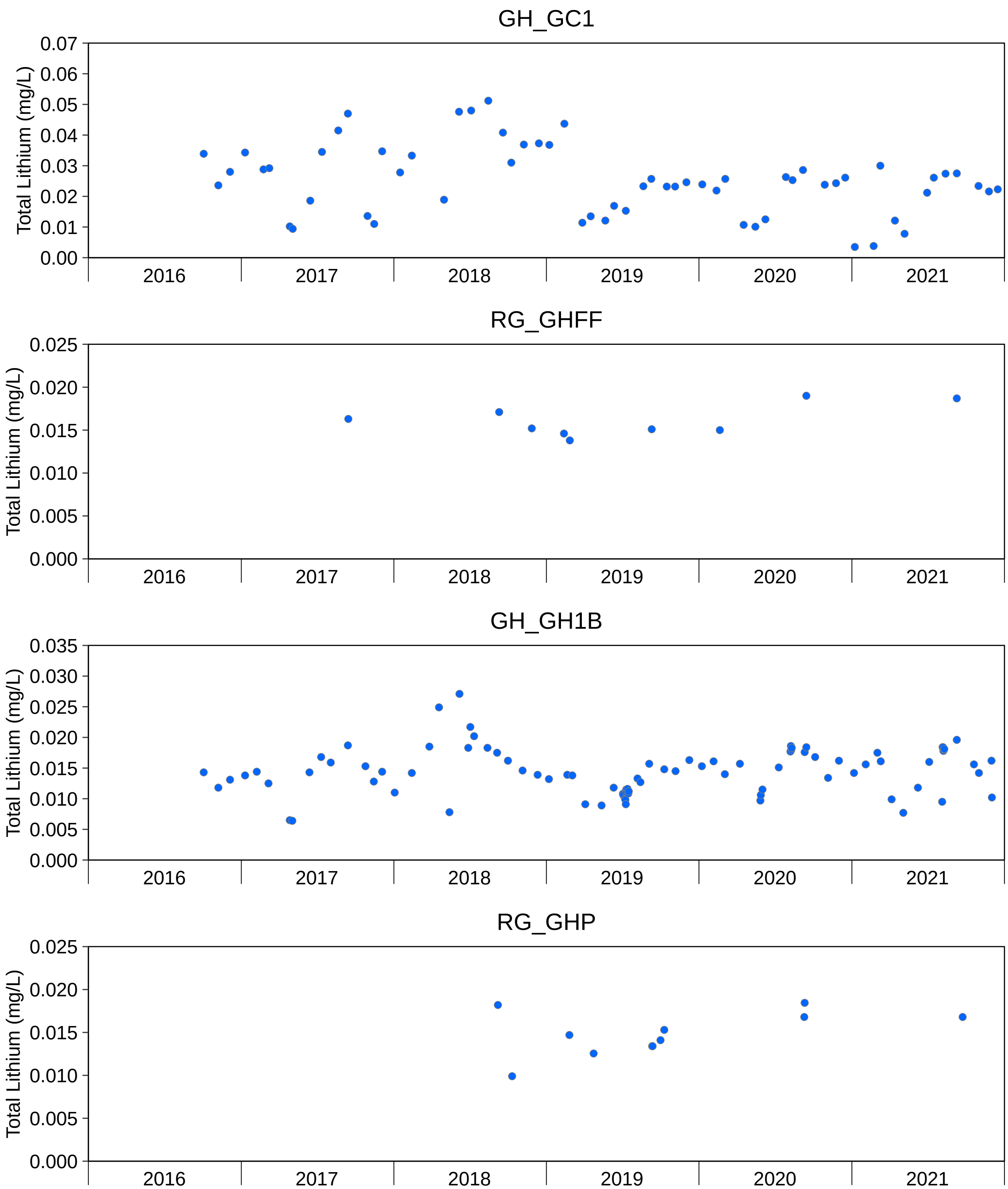


Figure C.8: Total Lithium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

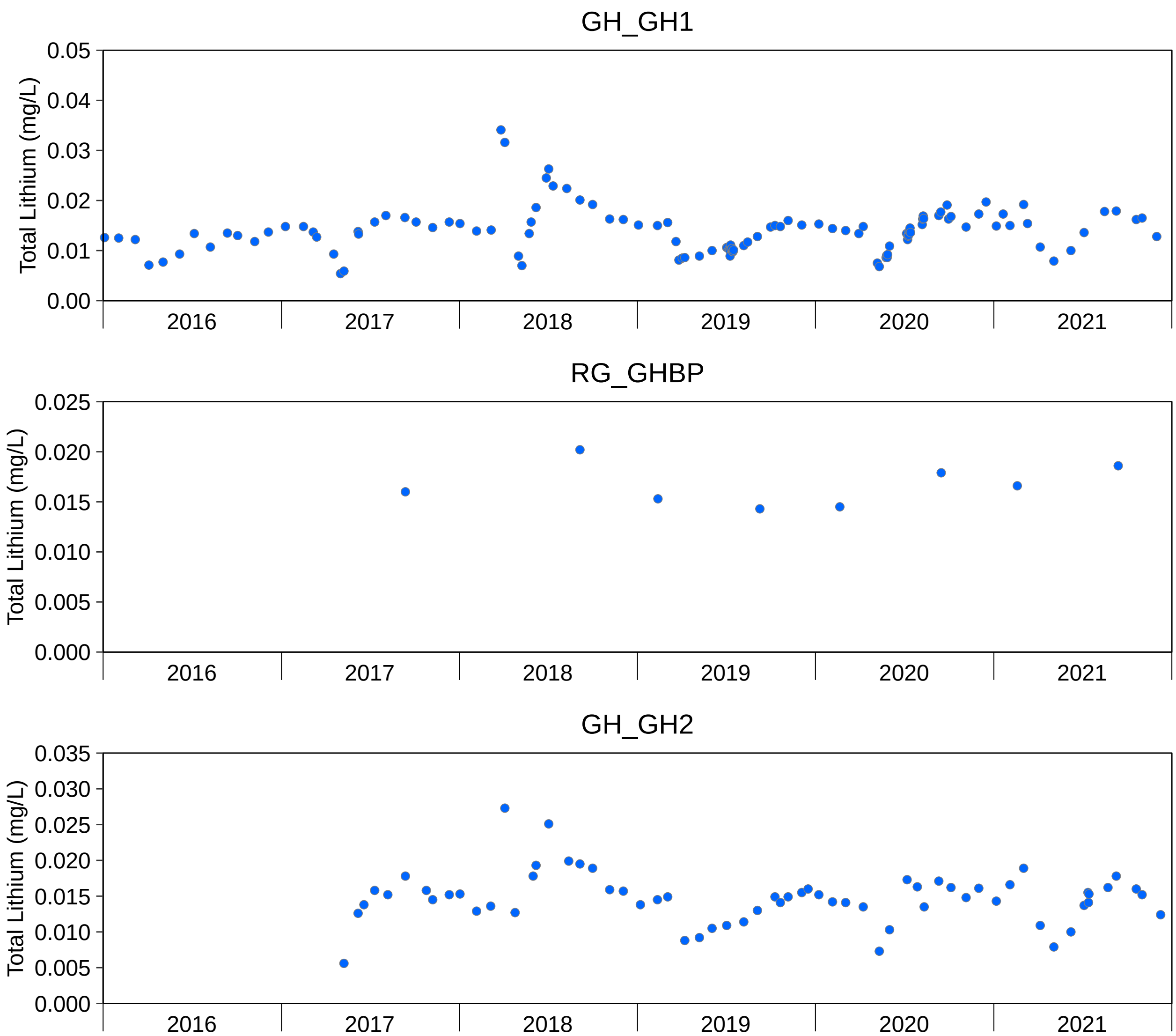


Figure C.8: Total Lithium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

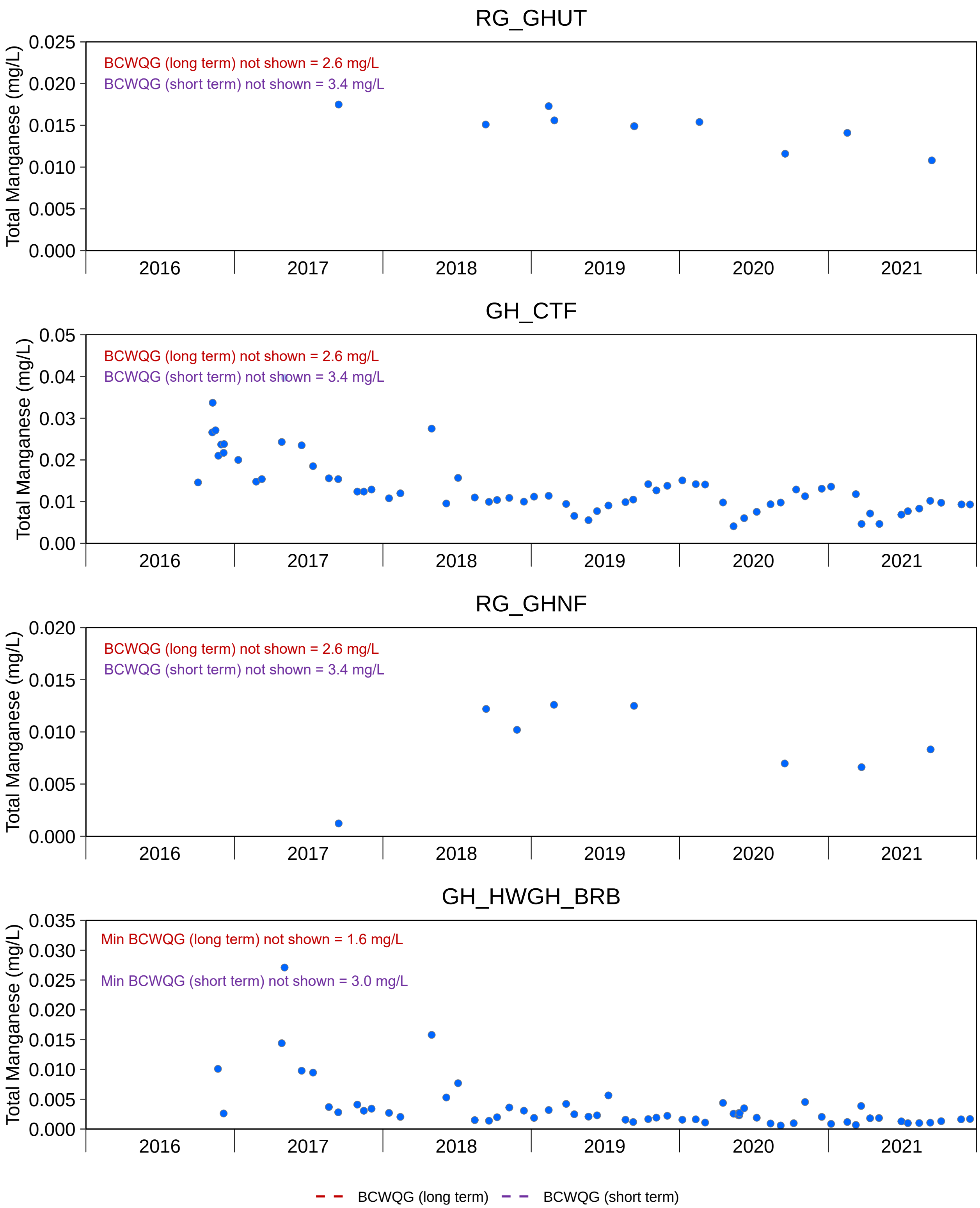


Figure C.9: Total Manganese Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

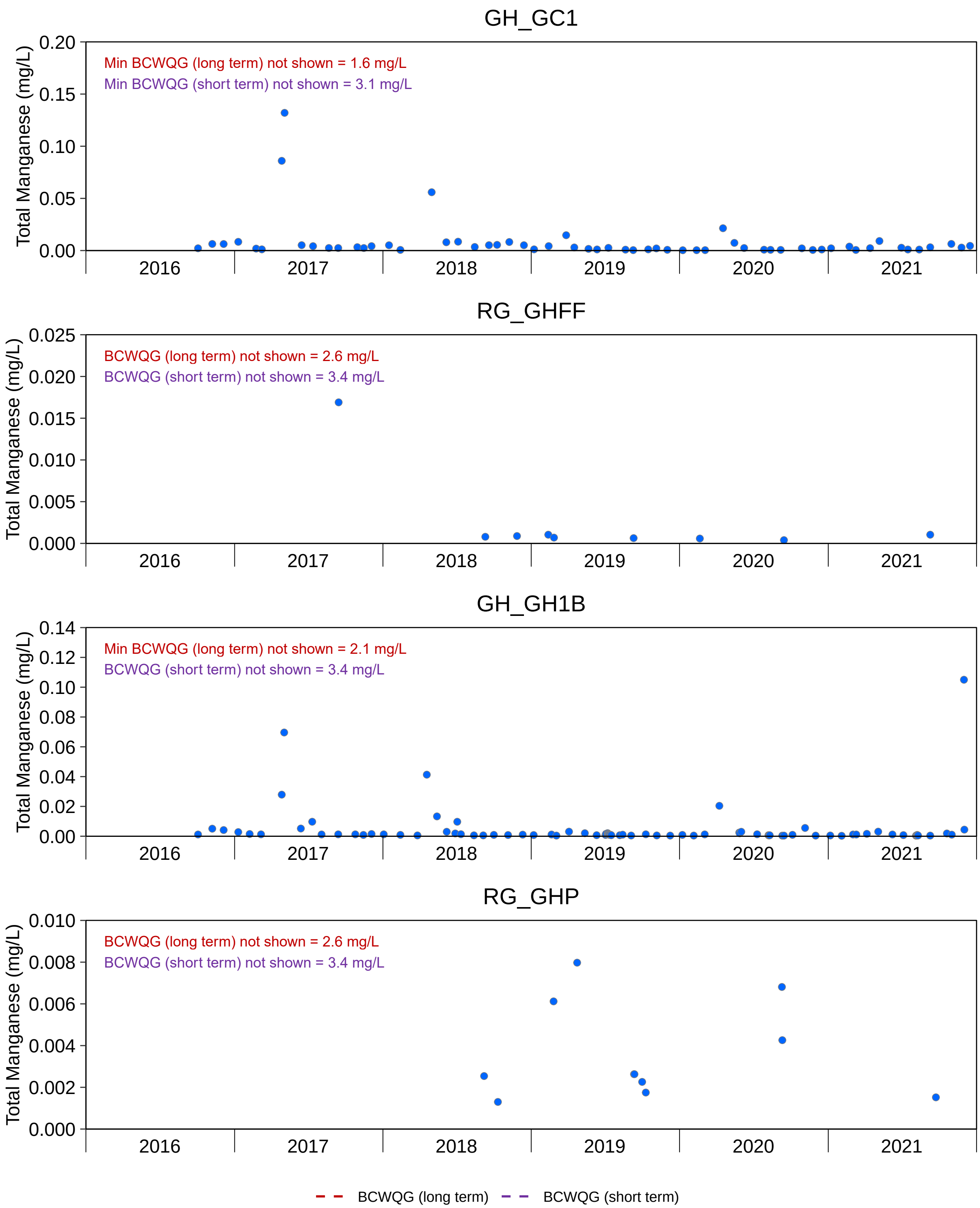


Figure C.9: Total Manganese Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

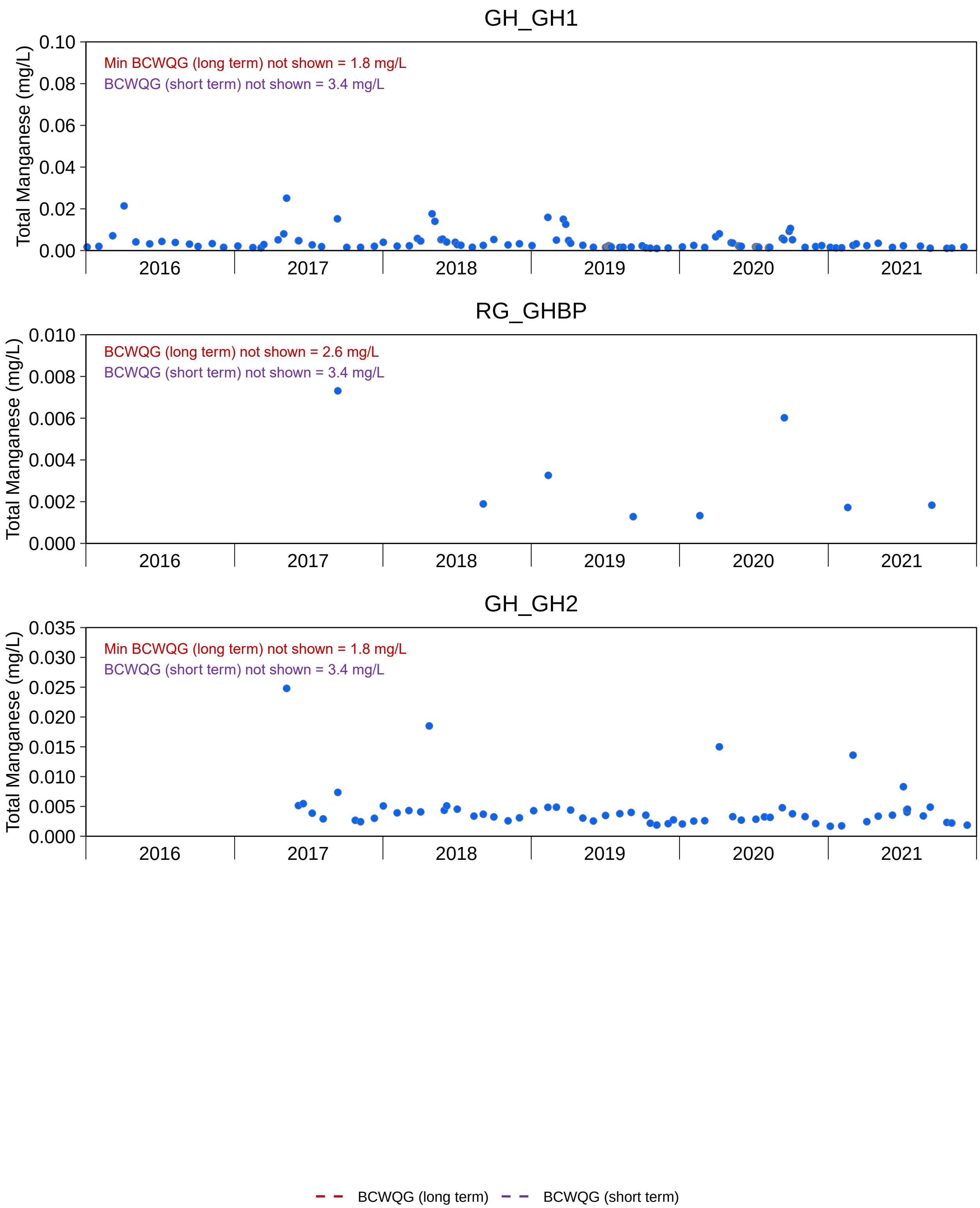


Figure C.9: Total Manganese Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

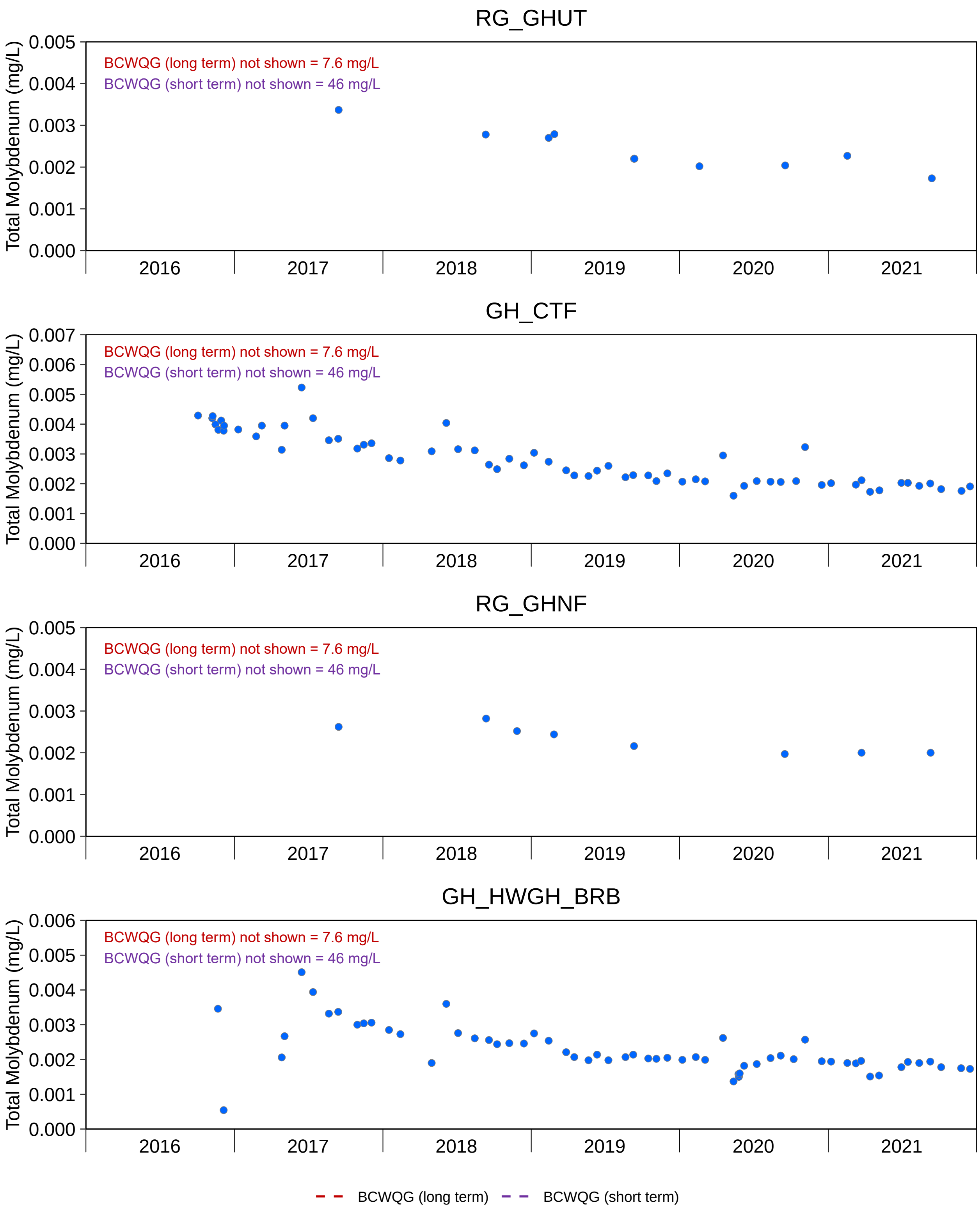


Figure C.10: Total Molybdenum Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

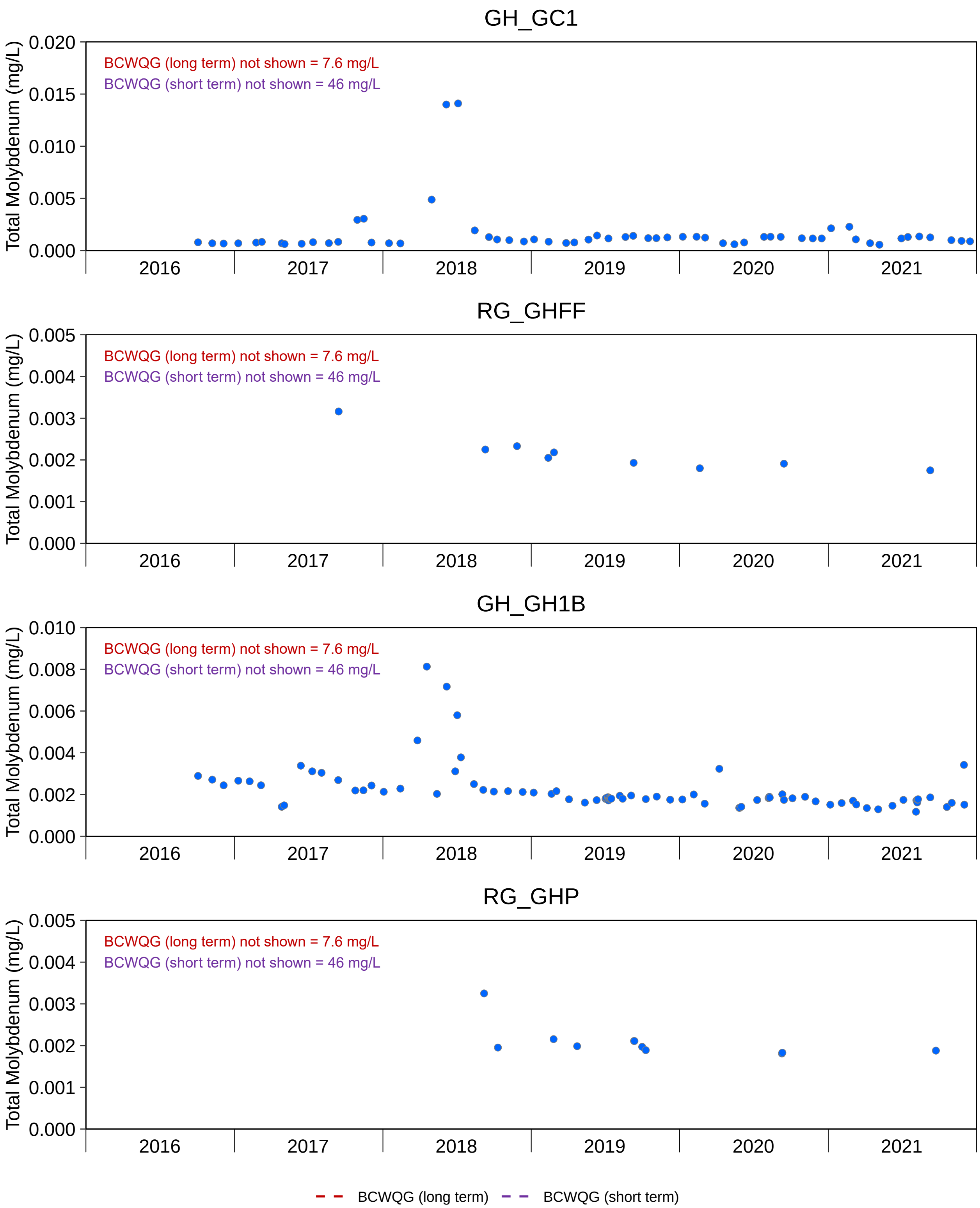


Figure C.10: Total Molybdenum Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

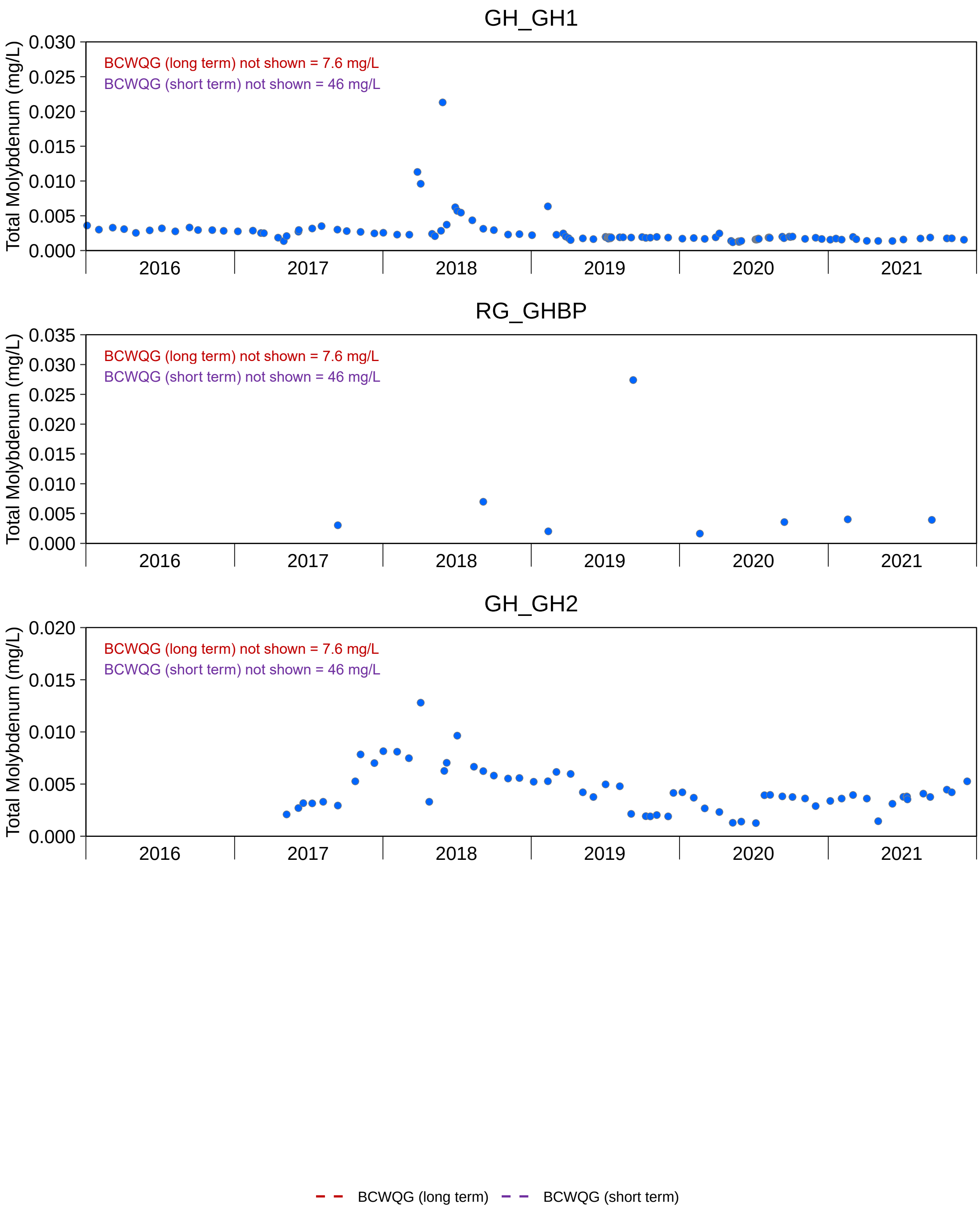


Figure C.10: Total Molybdenum Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

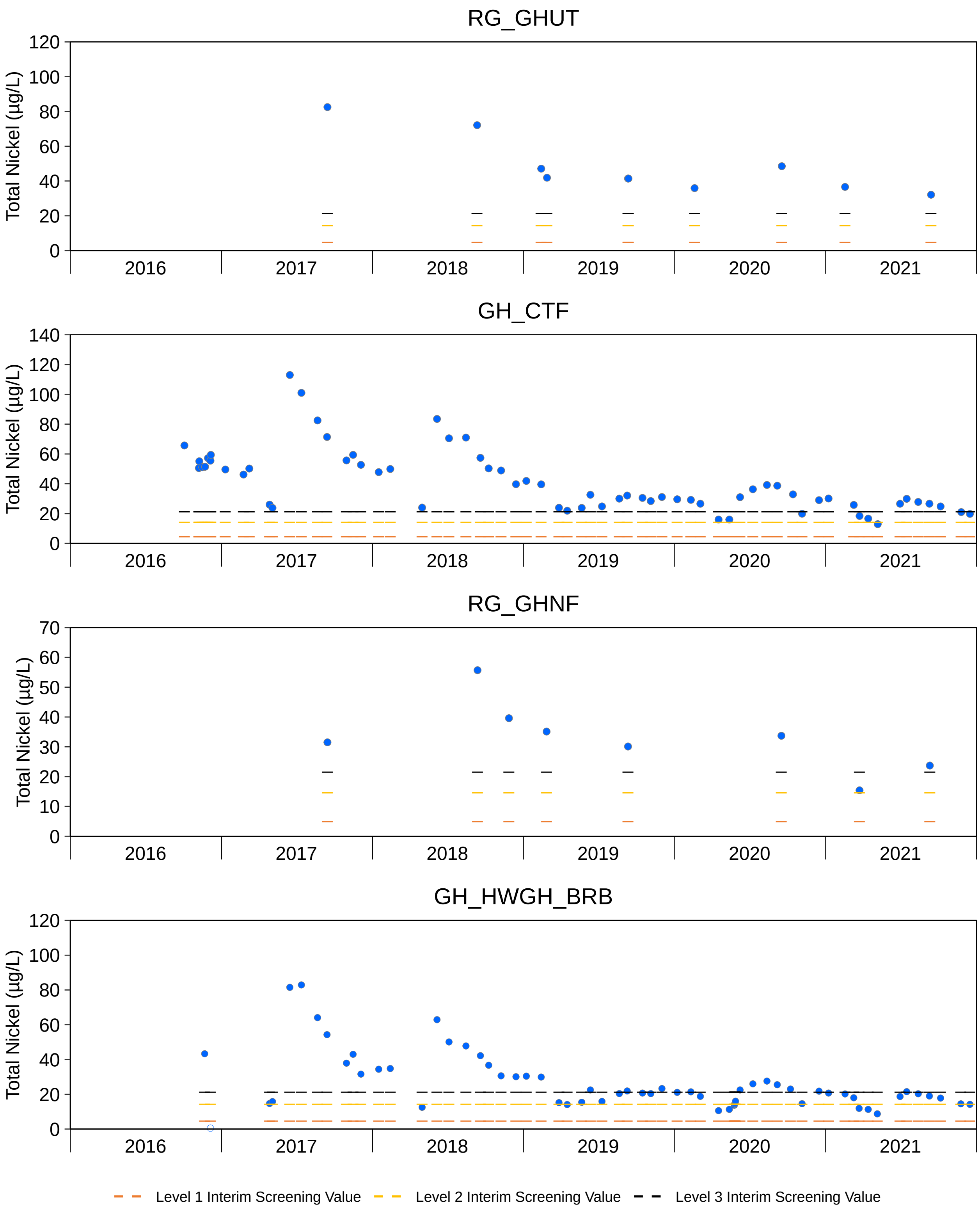


Figure C.11: Total Nickel Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

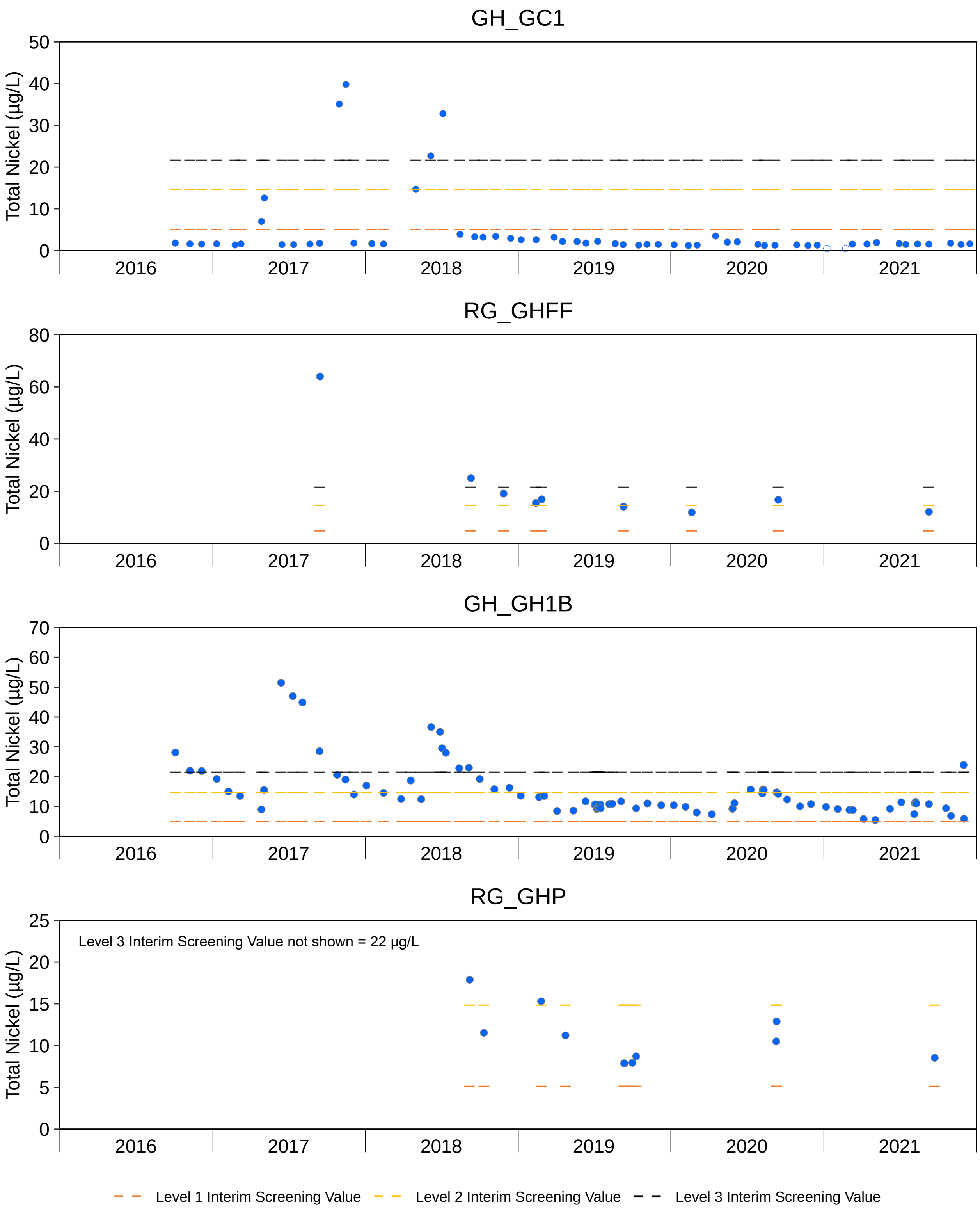


Figure C.11: Total Nickel Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

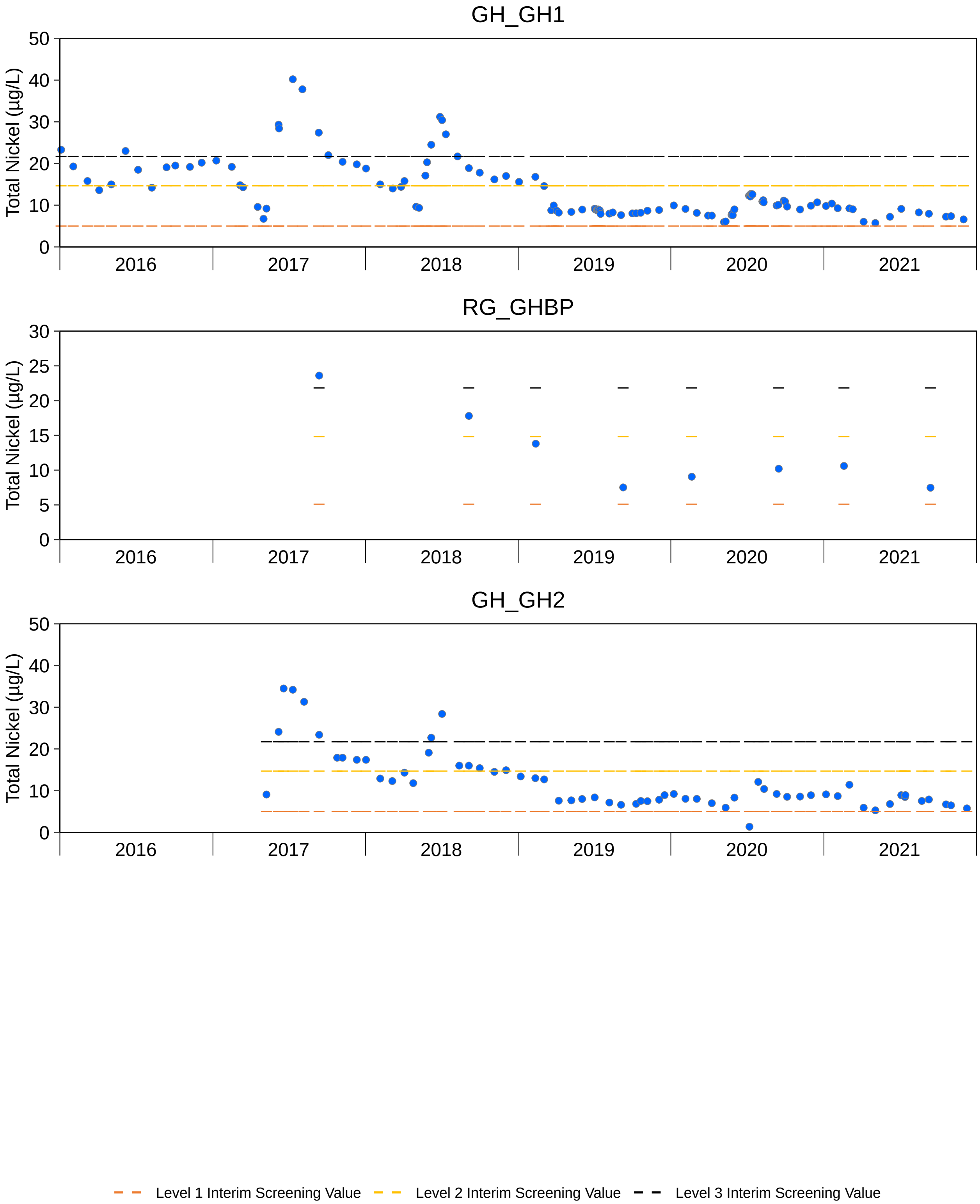


Figure C.11: Total Nickel Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

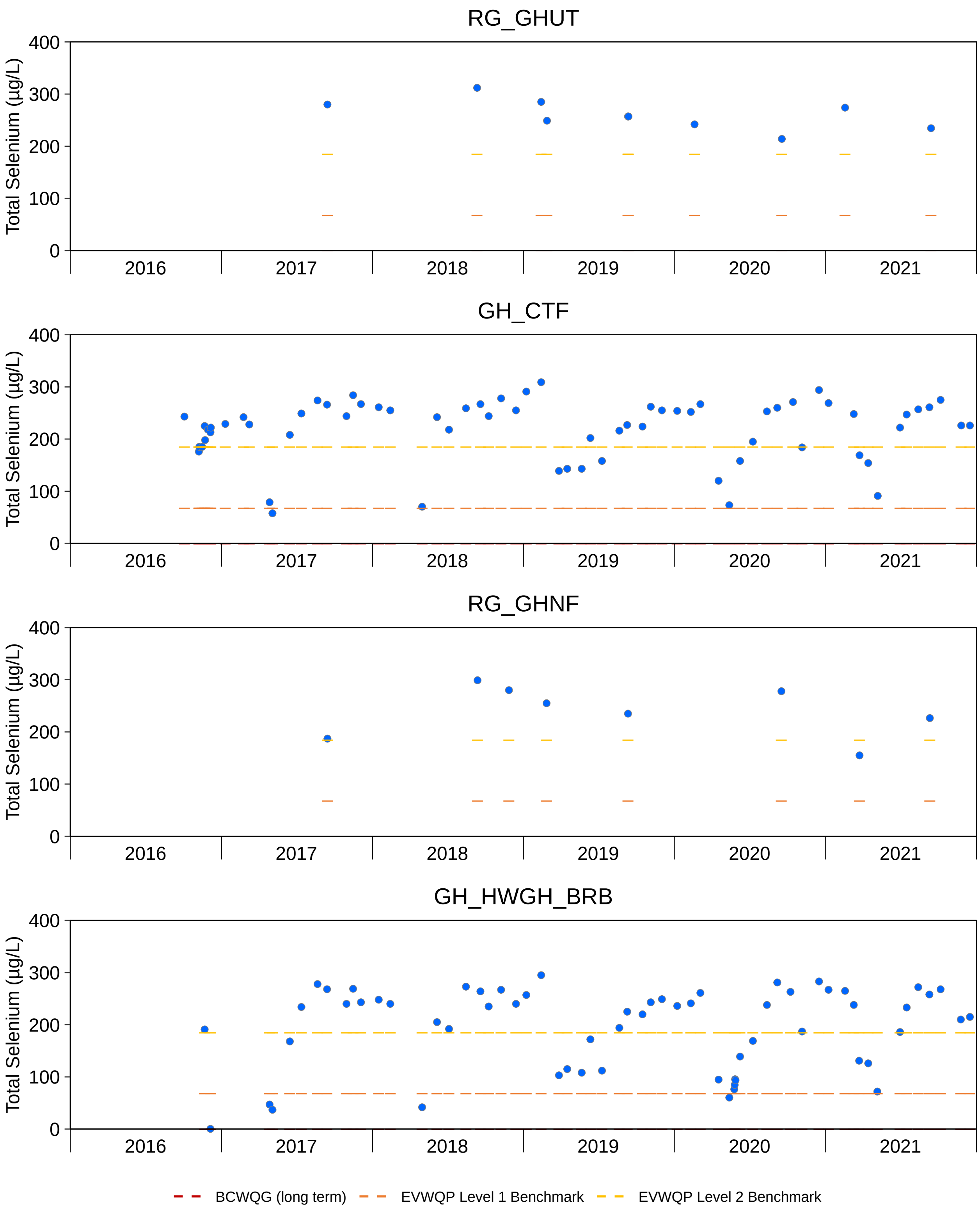


Figure C.12: Total Selenium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

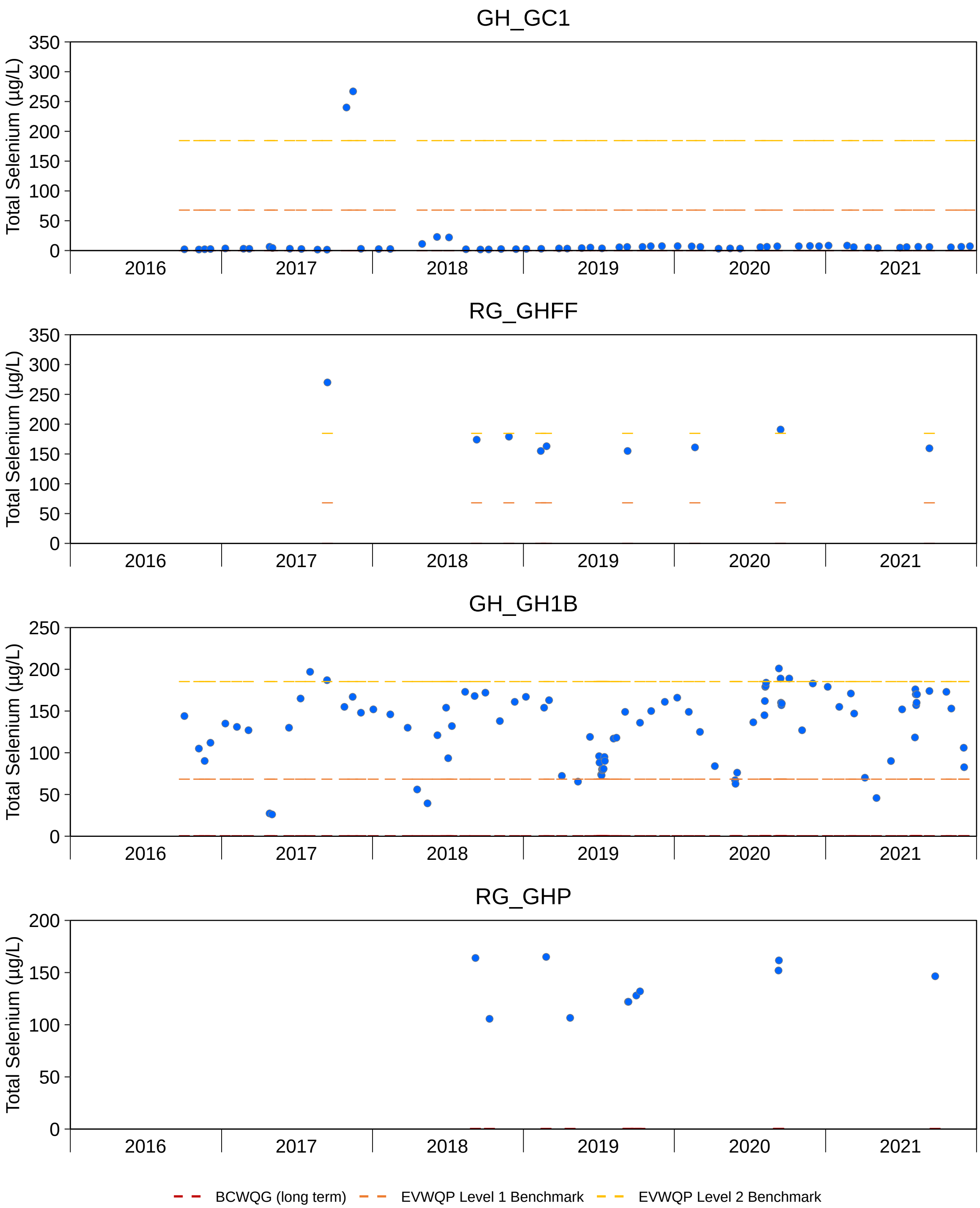


Figure C.12: Total Selenium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

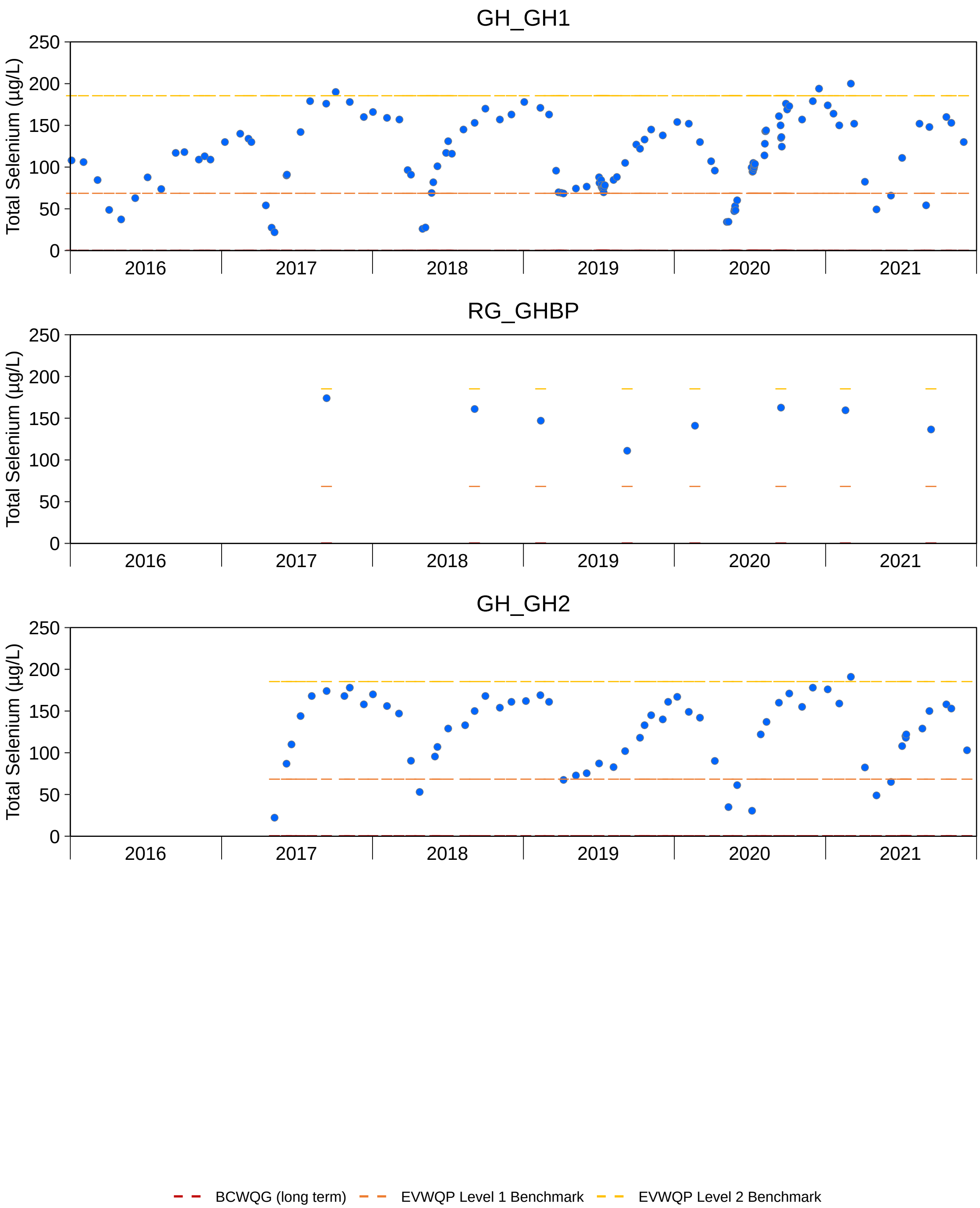


Figure C.12: Total Selenium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

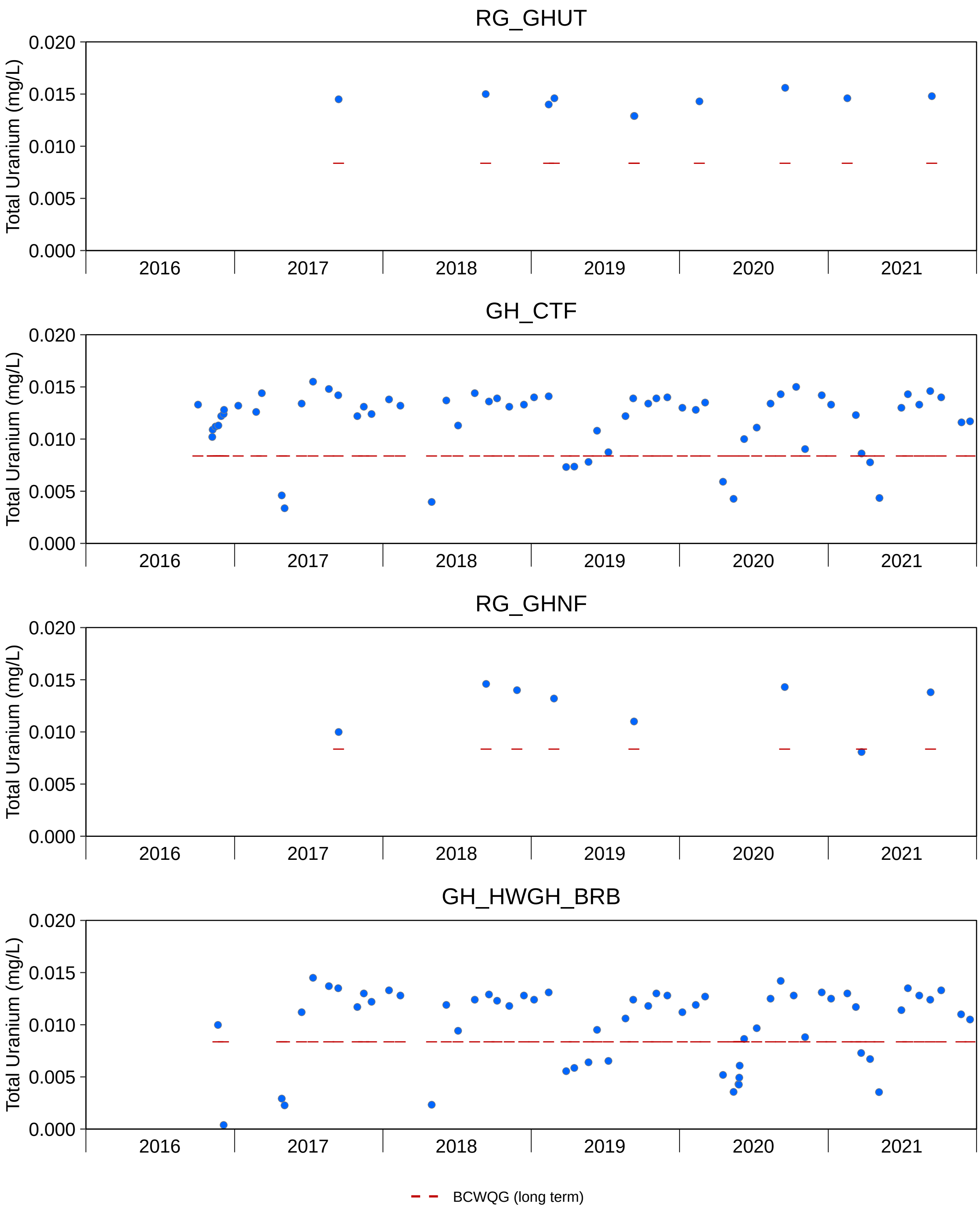


Figure C.13: Total Uranium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

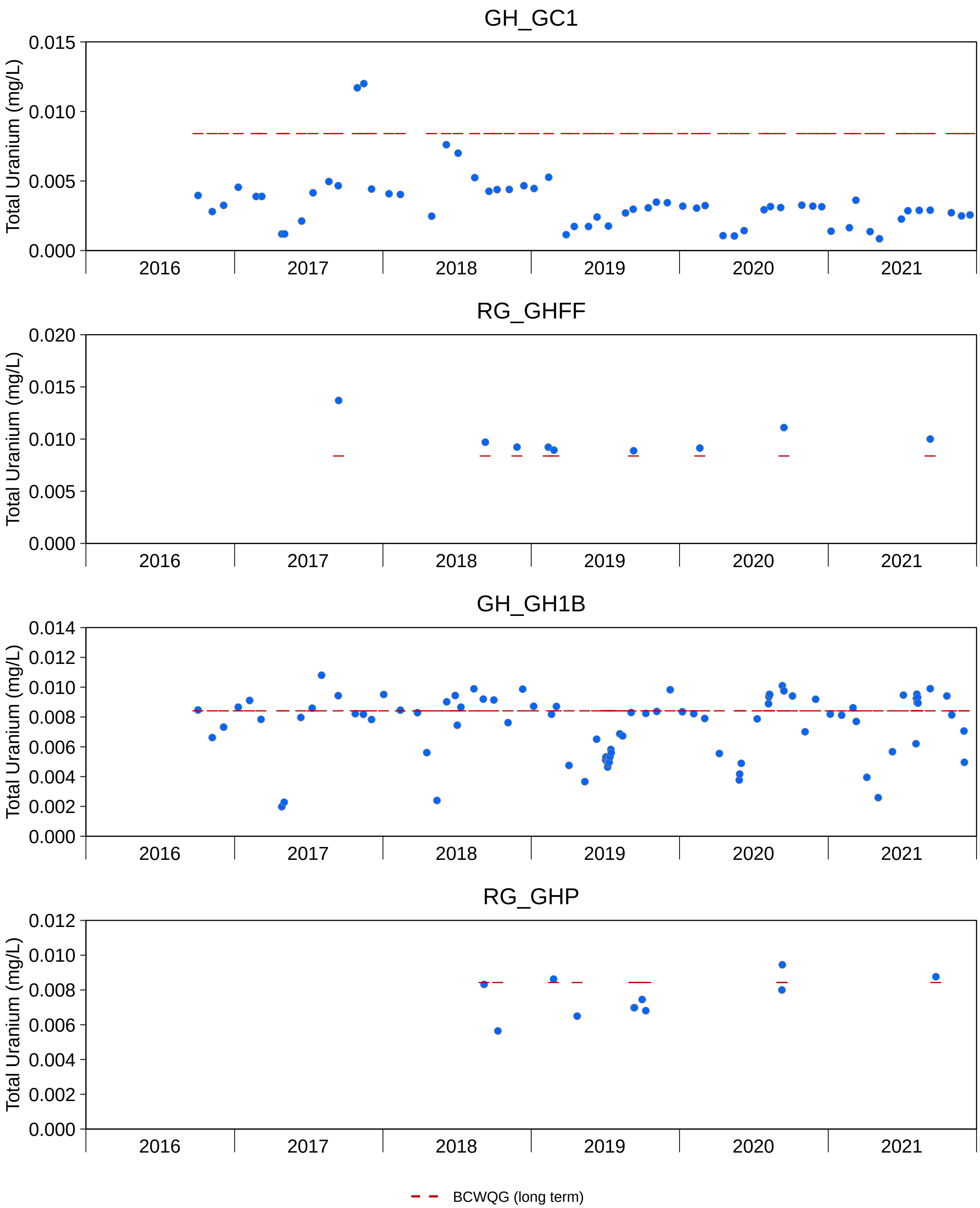


Figure C.13: Total Uranium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

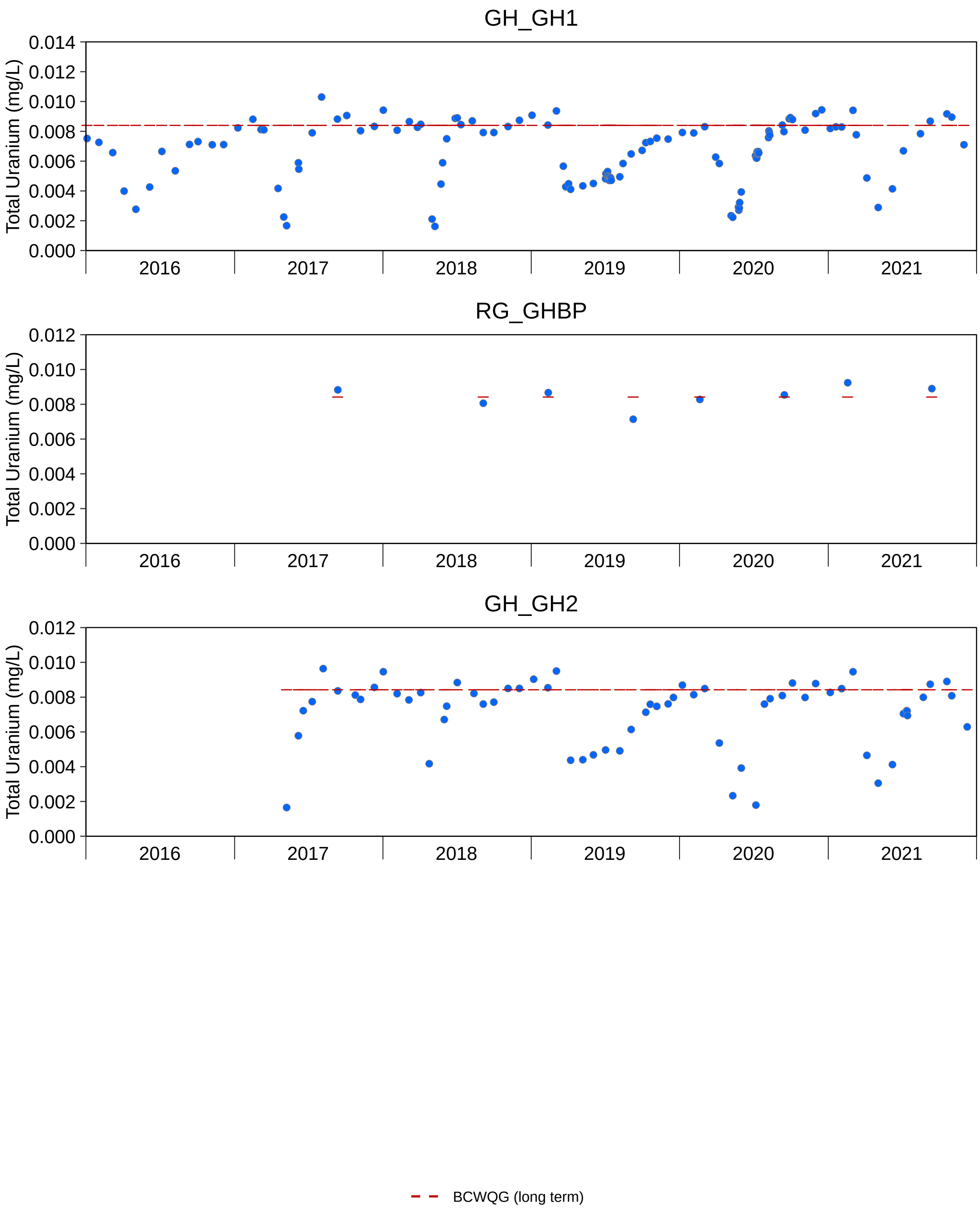


Figure C.13: Total Uranium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

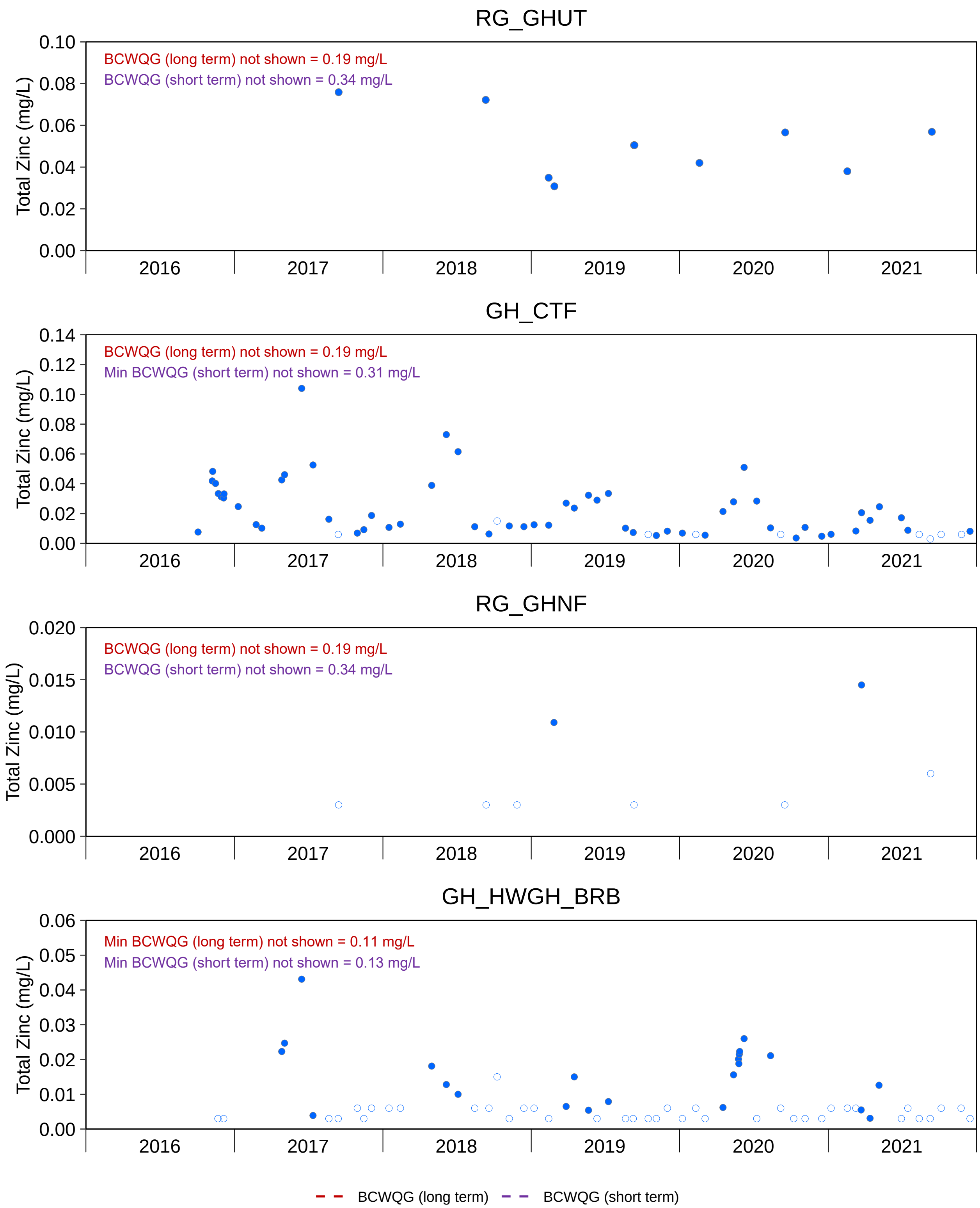


Figure C.14: Total Zinc Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

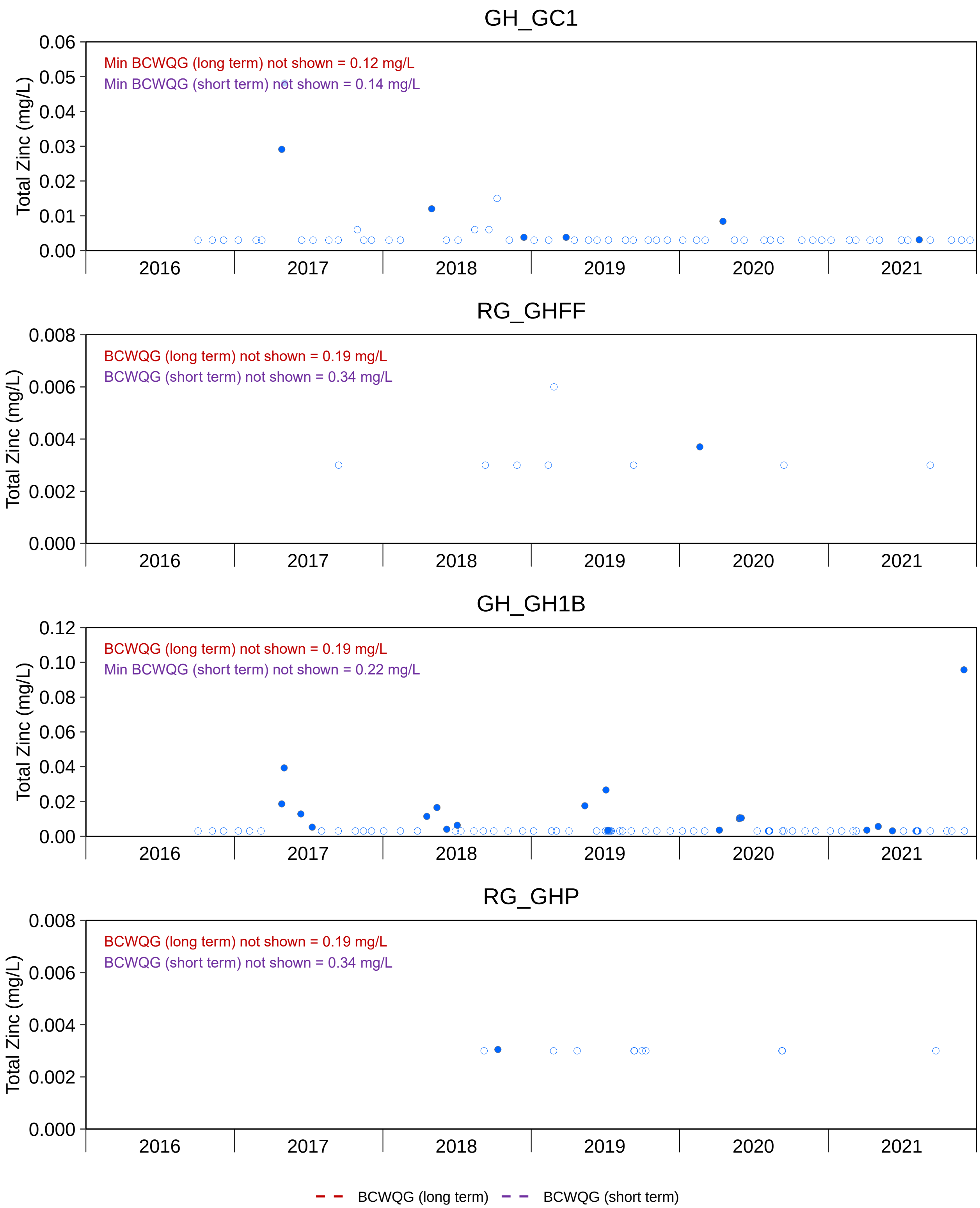


Figure C.14: Total Zinc Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

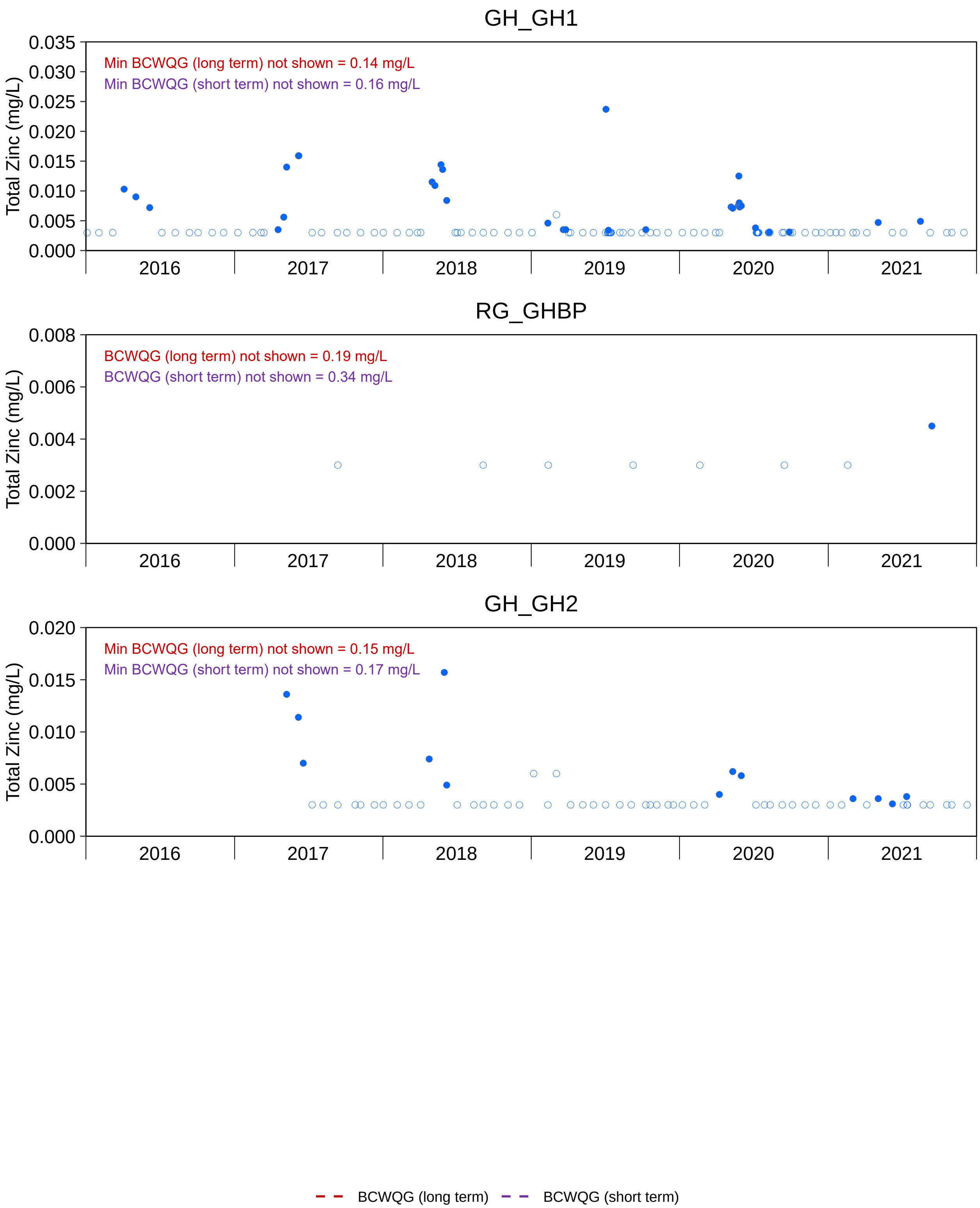


Figure C.14: Total Zinc Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

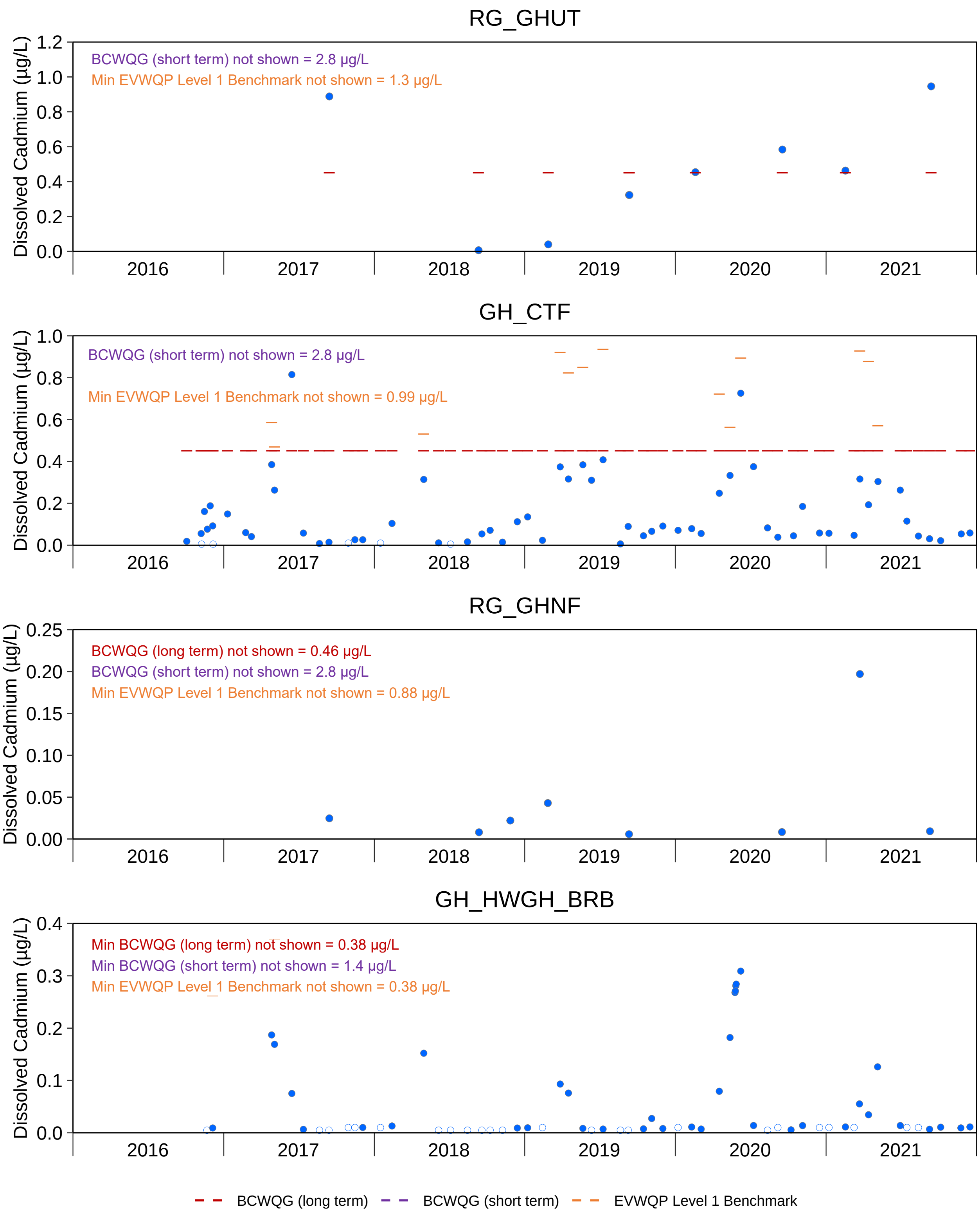


Figure C.15: Dissolved Cadmium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

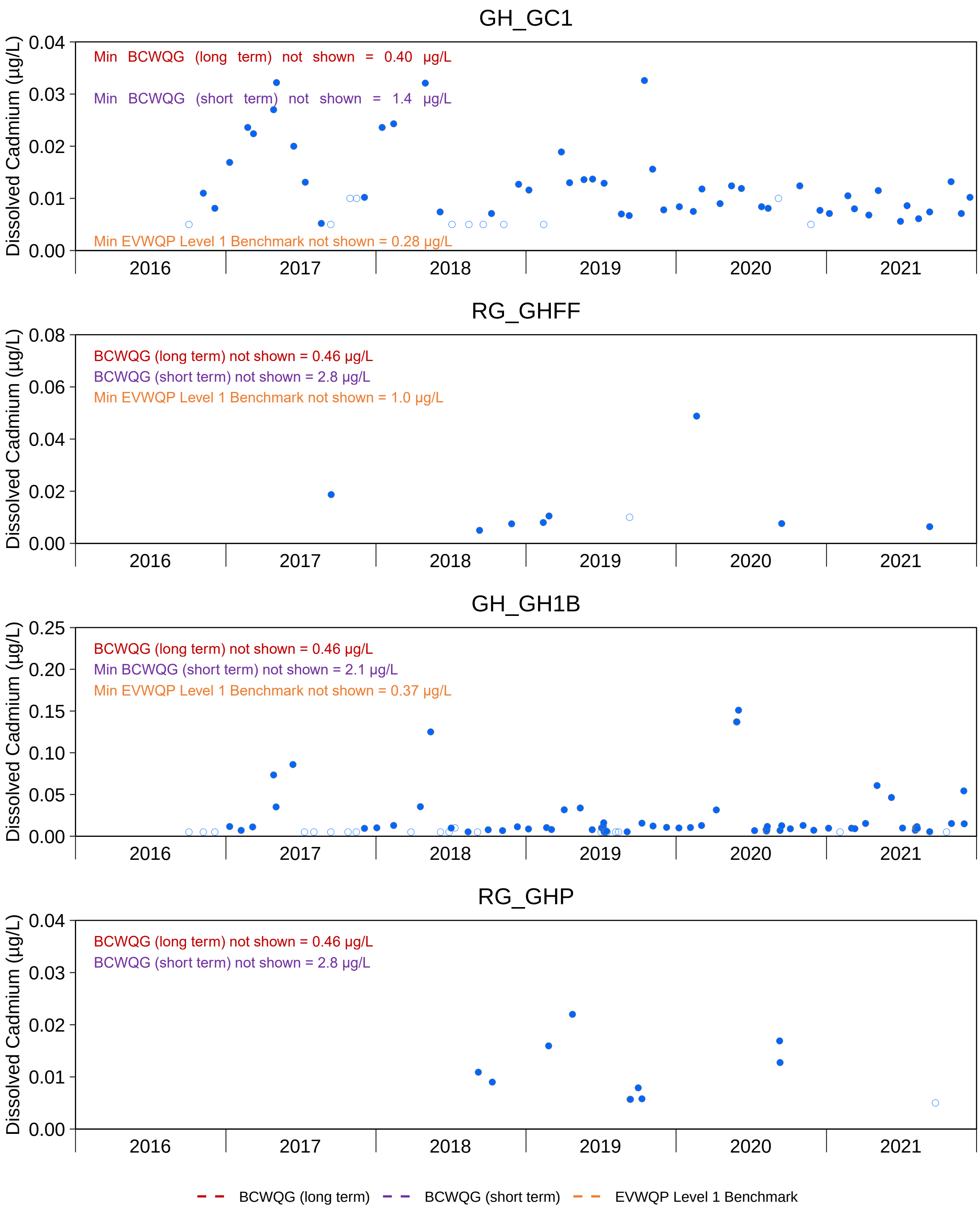


Figure C.15: Dissolved Cadmium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

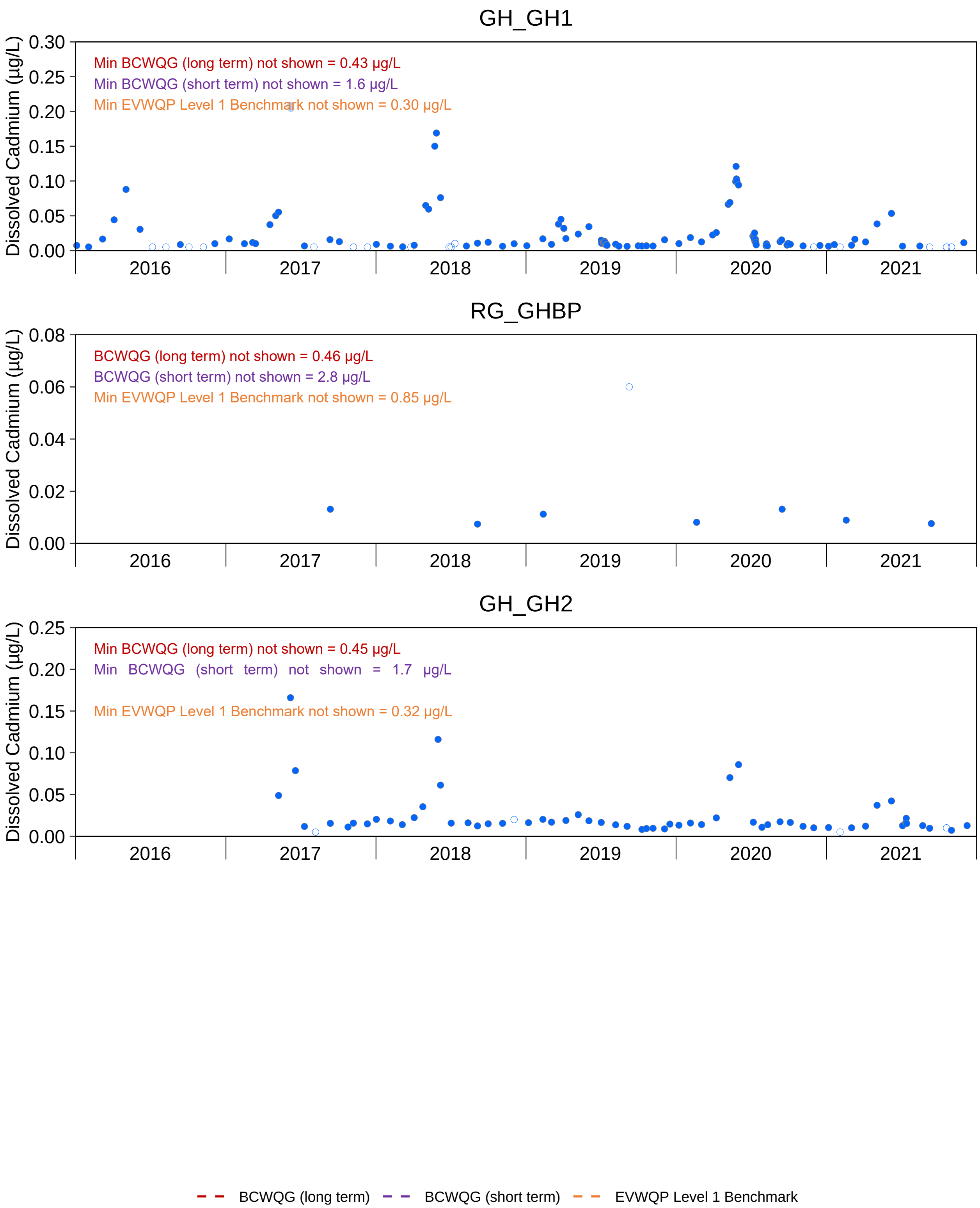


Figure C.15: Dissolved Cadmium Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness.

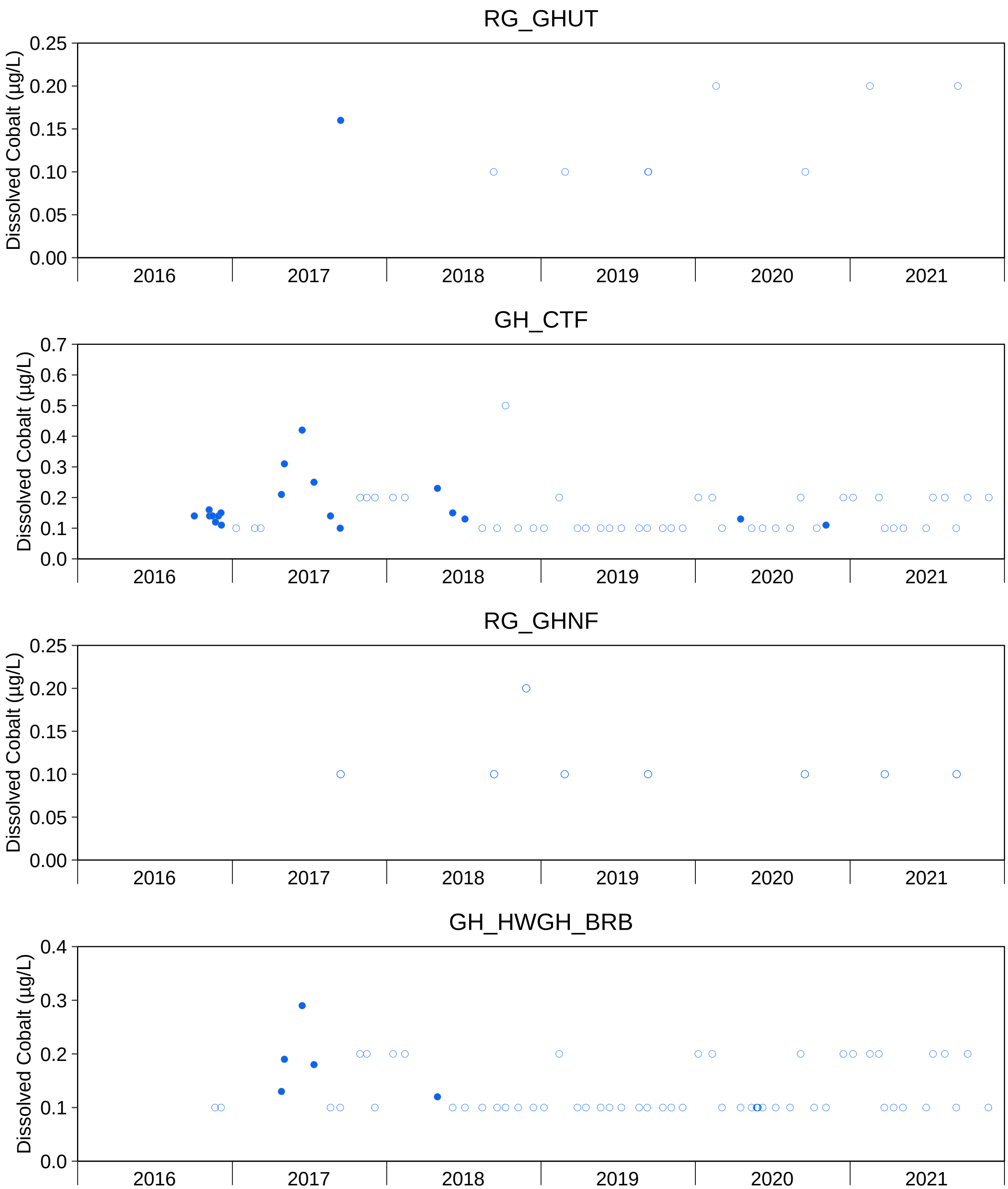


Figure C.16: Dissolved Cobalt Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

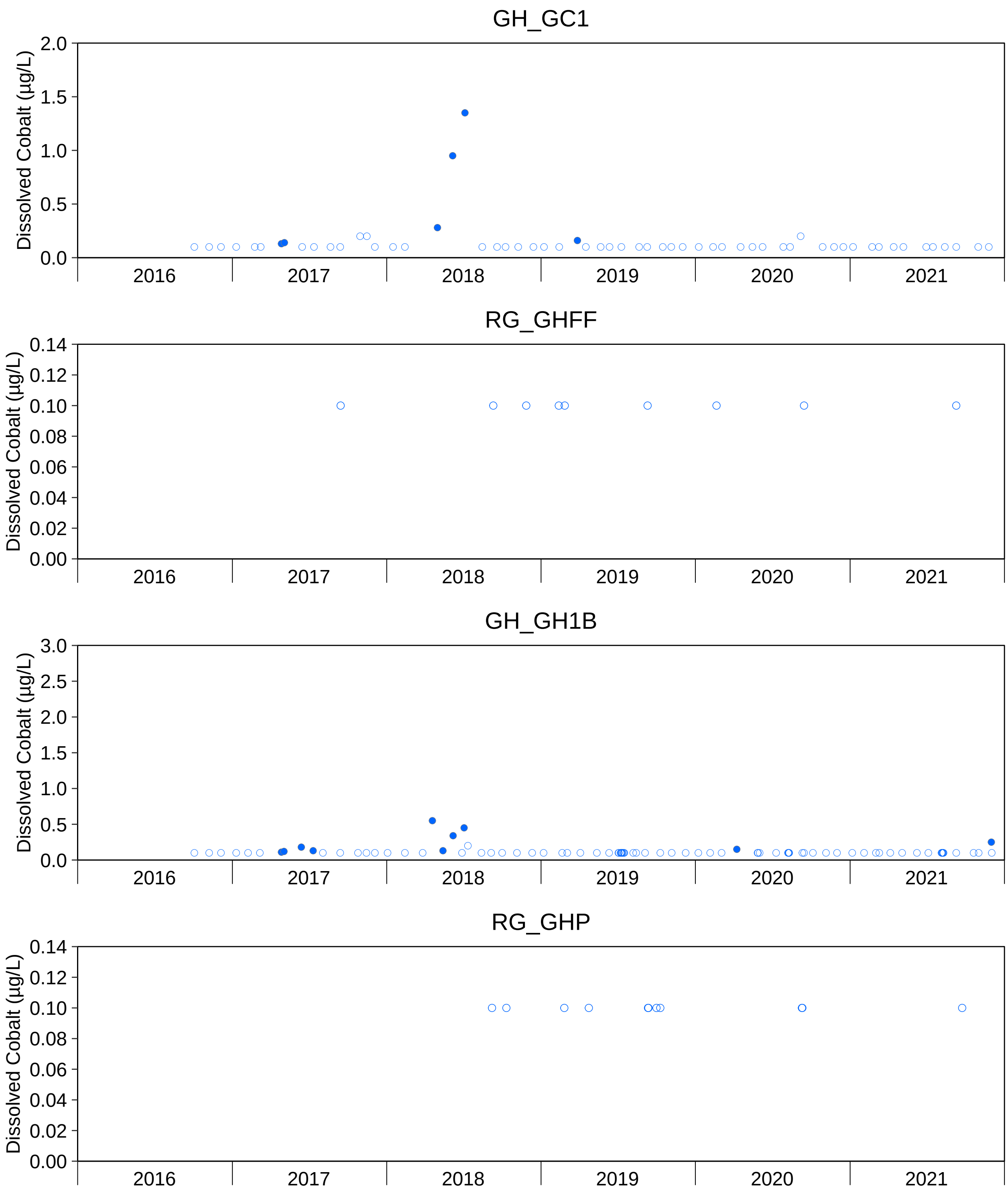


Figure C.16: Dissolved Cobalt Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

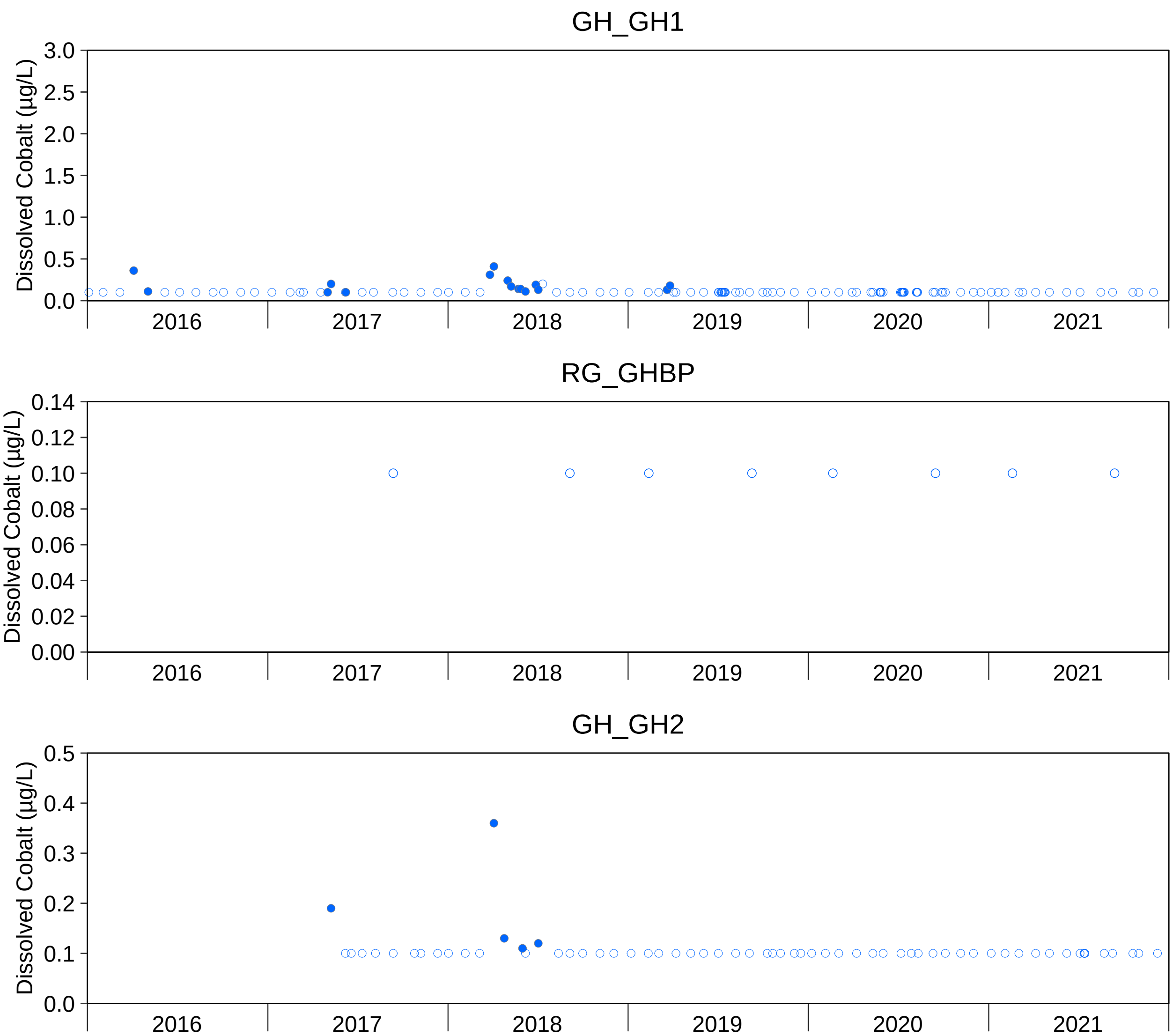


Figure C.16: Dissolved Cobalt Concentrations at Sampling Locations on Greenhills and Gardine Creeks, 2016 to 2021

Note: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL.

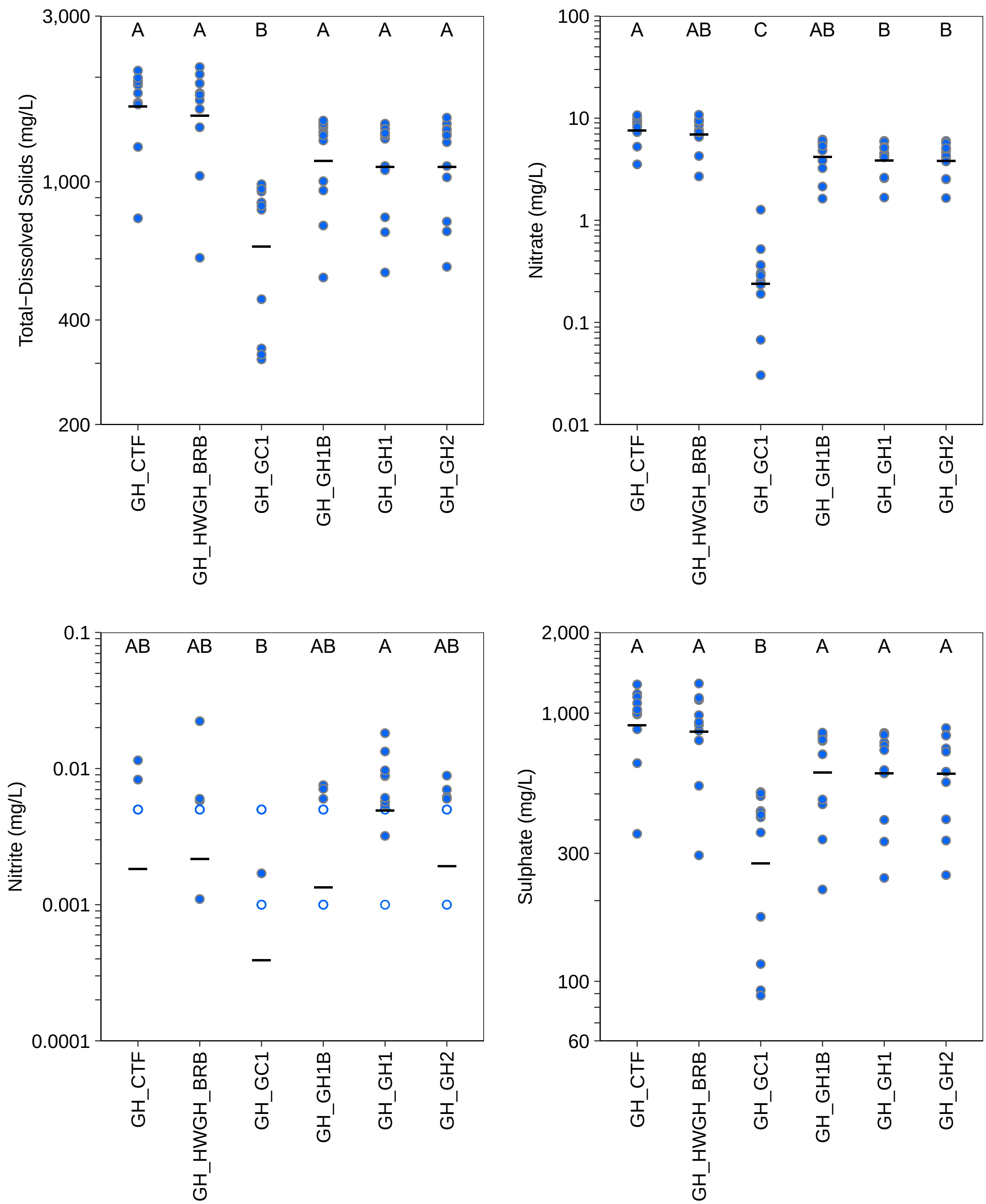


Figure C.17: Comparisons of Monthly Mean Concentrations for Water Quality Analytes in Samples from Routine Monitoring Stations on Greenhills and Gardine Creeks, 2021

Notes: Concentrations 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 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. Statistical analyses were not completed for dissolved cobalt because most data were at the LRL.

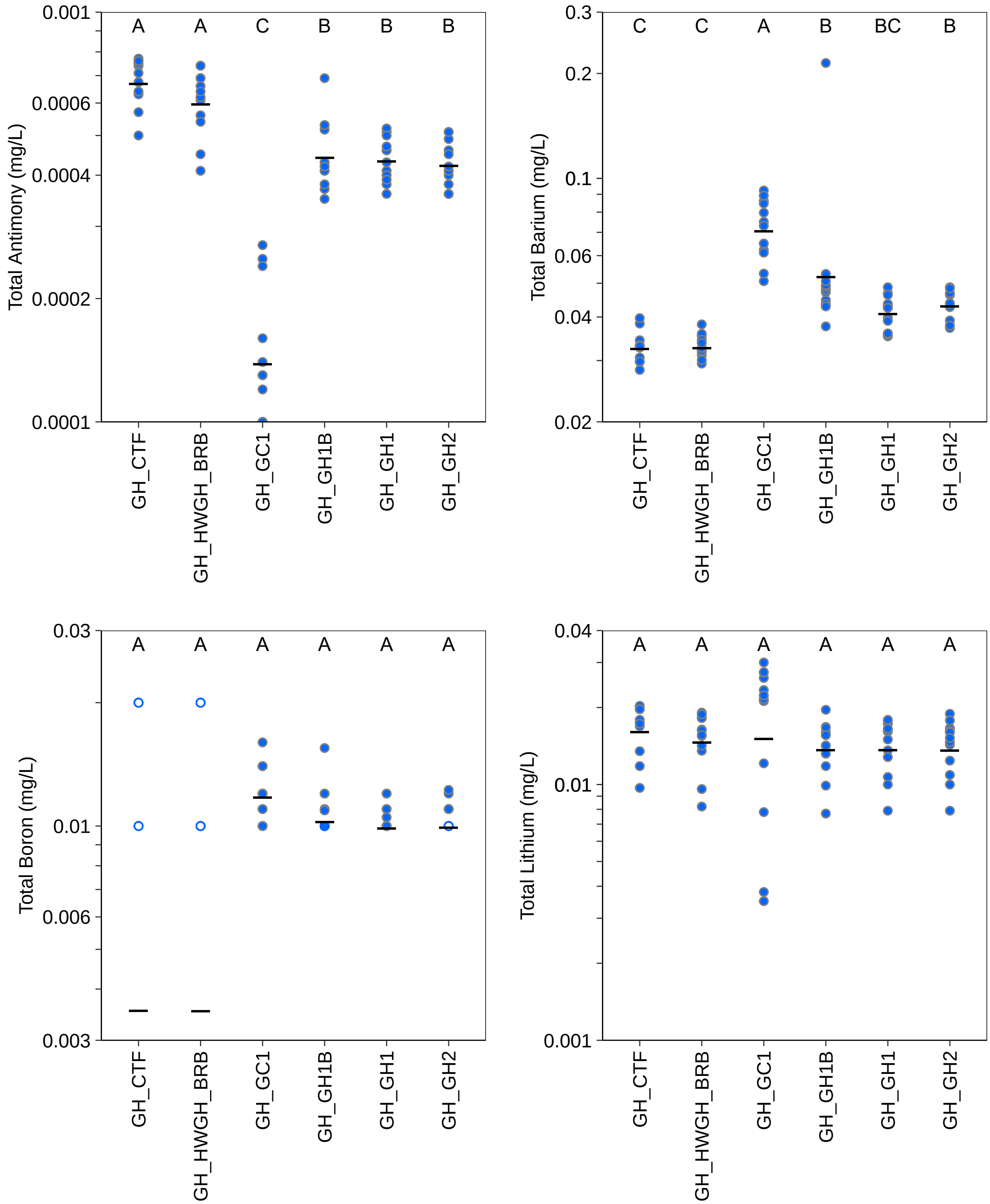


Figure C.17: Comparisons of Monthly Mean Concentrations for Water Quality Analytes in Samples from Routine Monitoring Stations on Greenhills and Gardine Creeks, 2021

Notes: Concentrations 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 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. Statistical analyses were not completed for dissolved cobalt because most data were at the LRL.

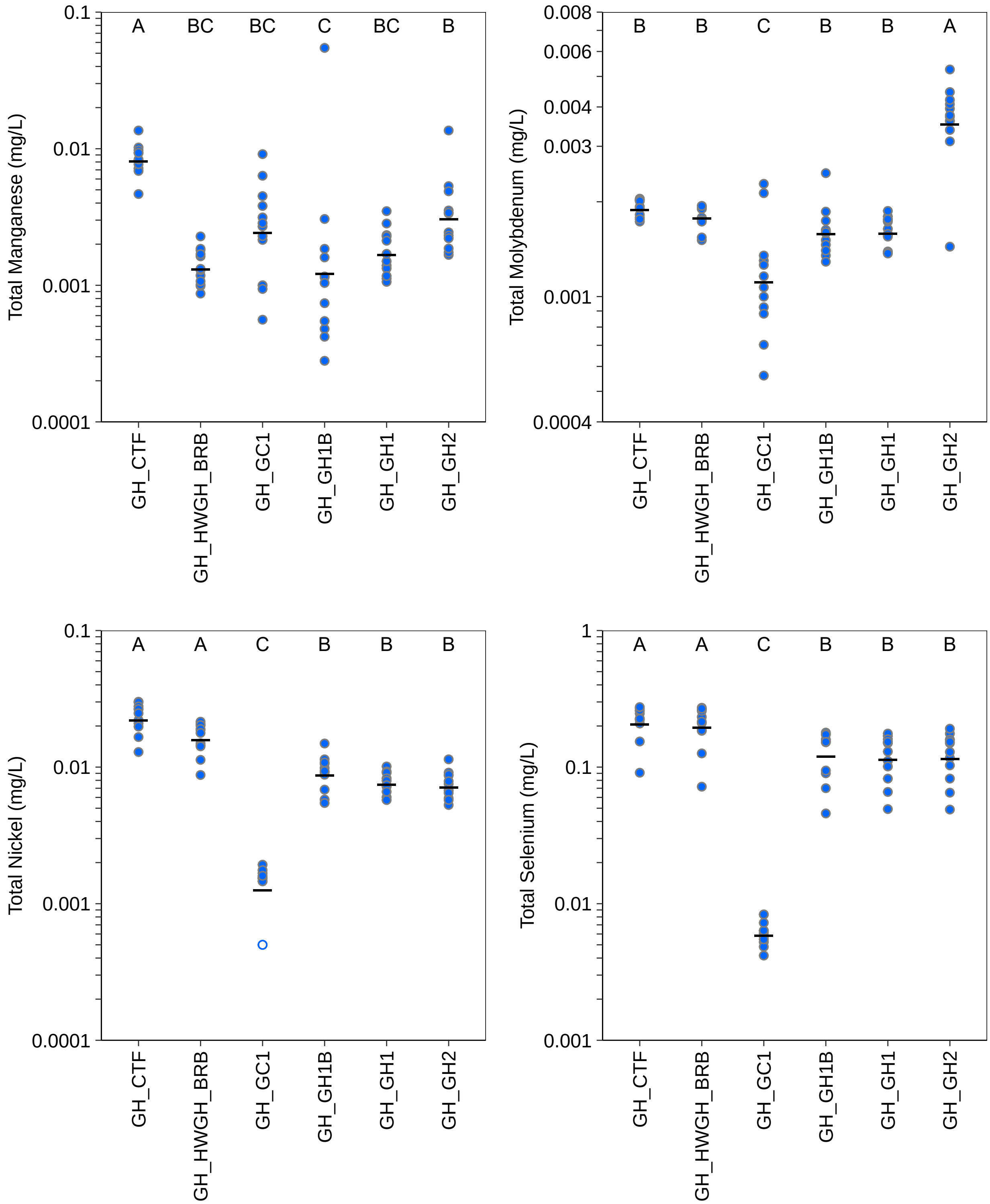


Figure C.17: Comparisons of Monthly Mean Concentrations for Water Quality Analytes in Samples from Routine Monitoring Stations on Greenhills and Gardine Creeks, 2021

Notes: Concentrations 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 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. Statistical analyses were not completed for dissolved cobalt because most data were at the LRL.

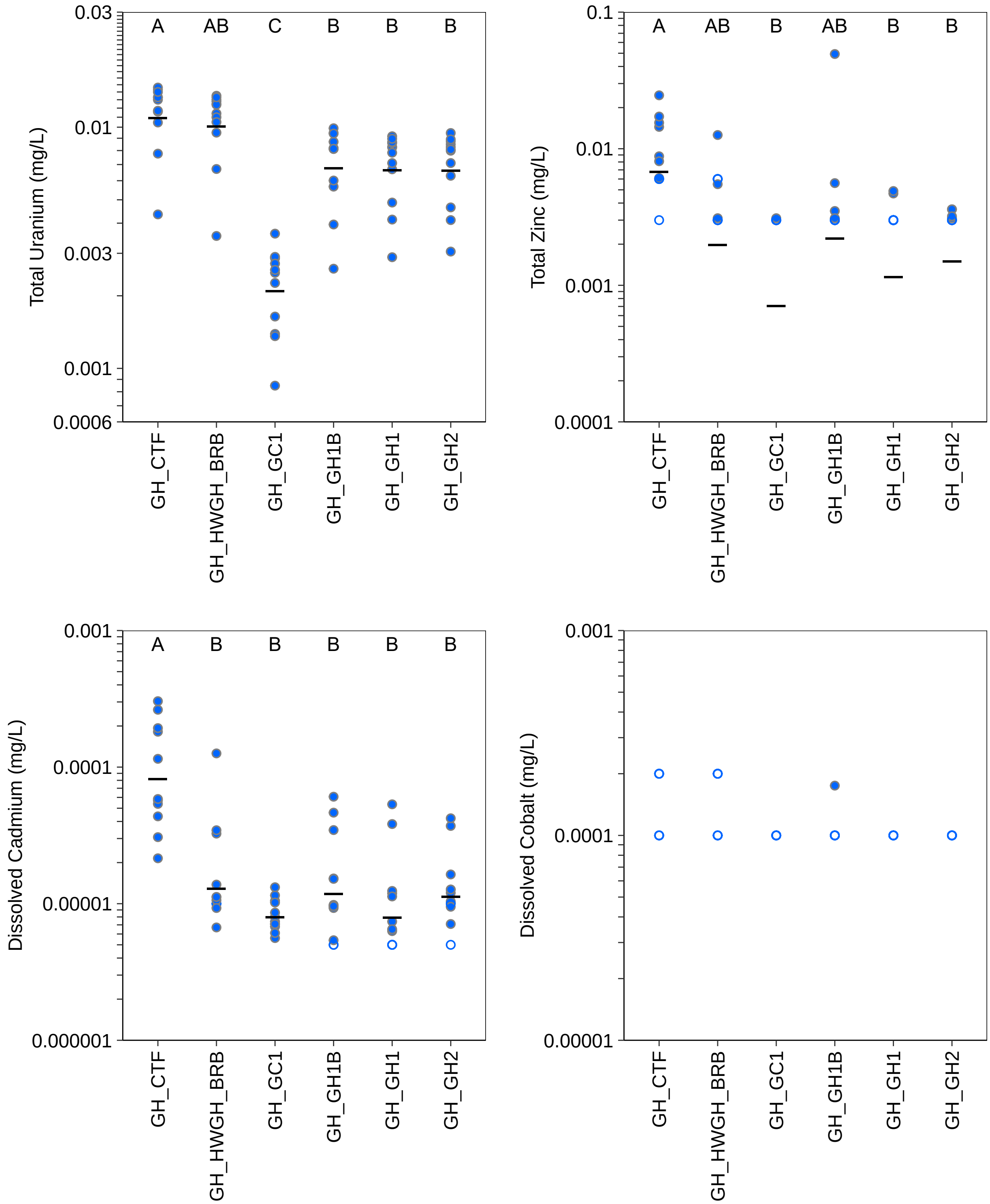


Figure C.17: Comparisons of Monthly Mean Concentrations for Water Quality Analytes in Samples from Routine Monitoring Stations on Greenhills and Gardine Creeks, 2021

Notes: Concentrations 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 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. Statistical analyses were not completed for dissolved cobalt because most data were at the LRL.

Table C.1: Summary of Water Chemistry Data for Key Parameters Measured at Routine Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2021

Area	Station	Summary Statistic	Total Dissolved Solids (mg/L)	Lab pH	Field pH	Dissolved Oxygen (mg/L)	Alkalinity (mg/L)	Nitrate-N (mg/L)	Nitrite-N (mg/L)
Upper Greenhills Creek Upstream from Gardine Creek	GH_CTF	n	12	12	11	11	12	12	12
		Annual Minimum	785	8.00	8.11	9.67	237	3.53	<0.005
		Annual Maximum	2,090	8.43	8.50	11.7	424	10.7	0.0116
		Annual Mean	1,723	8.21	8.24	10.6	359	8.19	0.00609
		Annual Median	1,905	8.20	8.22	10.6	376	8.91	<0.005
		% <LRL	0%	0%	0%	0%	0%	0%	83%
		% > Long-term BC WQG [a]	-	-	0%	0%	0%	100%	0%
		% > Short-term Max BC WQG [a]	-	-	0%	0%	-	0%	0%
		% > Level 1 Benchmark [b]	92%	-	-	-	-	0%	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	0%	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
	GH_HWGH_BRB	n	13	13	13	13	13	13	13
		Annual Minimum	604	8.12	7.94	9.68	226	2.69	0.00110
		Annual Maximum	2,140	8.45	8.61	11.9	374	10.8	0.0223
		Annual Mean	1,633	8.26	8.28	11.0	311	7.66	0.00353
		Annual Median	1,780	8.27	8.29	11.0	313	8.46	0.00110
		% <LRL	0%	0%	0%	0%	0%	0%	69%
		% > Long-term BC WQG [a]	-	-	0%	0%	0%	92%	0%
		% > Short-term Max BC WQG [a]	-	-	0%	0%	-	0%	0%
		% > Level 1 Benchmark [b]	92%	-	-	-	-	0%	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	0%	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
Lower Gardine Creek	GH_GC1	n	12	12	12	12	12	12	12
		Annual Minimum	308	7.82	8.21	9.33	157	0.0304	<0.001
		Annual Maximum	984	8.50	8.81	11.9	341	1.27	<0.005
		Annual Mean	723	8.32	8.44	10.7	260	0.354	0.00117
		Annual Median	860	8.33	8.44	11.0	279	0.295	<0.001
		% <LRL	0%	0%	0%	0%	0%	0.0%	92%
		% > Long-term BC WQG [a]	-	-	0%	0%	0%	0%	0%
		% > Short-term Max BC WQG [a]	-	-	0%	0%	-	0%	0%
		% > Level 1 Benchmark [b]	0%	-	-	-	-	0%	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	0%	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
Upper Greenhills Creek Downstream from Gardine Creek	GH_GH1B	n	19	19	17	17	19	19	19
		Annual Minimum	530	7.47	6.64	9.43	179	1.63	<0.001
		Annual Maximum	1,640	8.43	8.71	12.6	300	6.56	0.0101
		Annual Mean	1,273	8.31	8.34	10.8	269	4.97	0.00206
		Annual Median	1,390	8.36	8.42	10.8	279	5.75	<0.005
		% <LRL	0%	0%	0%	0%	0%	0.0%	84%
		% > Long-term BC WQG [a]	-	-	0%	0%	0%	84%	0%
		% > Short-term Max BC WQG [a]	-	-	0%	0%	-	0%	0%
		% > Level 1 Benchmark [b]	79%	-	-	-	-	0%	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	0%	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
Lower Greenhills Creek Upstream from the Antiscalant Addition Facility	GH_GH1	n	14	14	55	27	49	14	14
		Annual Minimum	548	8.13	6.66	7.88	189	1.67	<0.001
		Annual Maximum	1,470	8.43	8.68	12.4	297	6.19	0.0182
		Annual Mean	1,202	8.33	8.26	10.5	249	4.49	0.00762
		Annual Median	1,370	8.34	8.25	10.8	245	4.62	0.00615
		% <LRL	0%	0%	0%	0%	0%	0%	21%
		% > Long-term BC WQG [a]	-	-	0%	4%	0%	79%	0%
		% > Short-term Max BC WQG [a]	-	-	0%	0%	-	0%	0%
		% > Level 1 Benchmark [b]	79%	-	-	-	-	0%	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	0%	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
Lower Greenhills Creek Downstream from the Antiscalant Addition Facility	GH_GH2	n	15	15	15	14	15	15	15
		Annual Minimum	569	8.23	6.61	7.50	202	1.65	<0.001
		Annual Maximum	1,530	8.52	8.68	12.0	307	5.99	0.0152
		Annual Mean	1,159	8.39	8.26	9.79	252	4.23	0.00365
		Annual Median	1,170	8.39	8.37	10.1	238	4.14	<0.005
		% <LRL	0%	0%	0%	0%	0%	0.0%	67%
		% > Long-term BC WQG [a]	-	-	0%	21%	0%	80%	0%
		% > Short-term Max BC WQG [a]	-	-	0%	0%	-	0%	0%
		% > Level 1 Benchmark [b]	80%	-	-	-	-	0%	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	0%	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-

Concentrations in >5% of samples exceeded the BC WQG, benchmark, or screening value.
Concentrations in > 50% of samples exceeded the BC WQG, benchmark, or screening value.
Concentrations in > 95% of samples exceeded the BC WQG, benchmark, or screening value.

Notes: mg/L = milligrams per litre; < = less than; % = percent; LRL = laboratory reporting limit; > = greater than; BC WQG = British Columbia Water Quality Guideline; max = maximum- = no data/not applicable. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Working and Approved BC WQG for the Protection of Freshwater Aquatic Life (BCMOECCS 2021a,b).

[b] Total nickel has an interim screening value, rather than Level 1, 2, and 3 benchmarks. Similarly, screening values are used for total dissolved solids, rather than benchmarks.

Table C.1: Summary of Water Chemistry Data for Key Parameters Measured at Routine Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2021

Area	Station	Summary Statistic	Ammonia (mg/L)	Sulphate (mg/L)	Total Chloride (mg/L)	Total Fluoride (mg/L)	Total Antimony (mg/L)	Total Arsenic (mg/L)	Total Barium (mg/L)
Upper Greenhills Creek Upstream from Gardine Creek	GH_CTF	n	12	12	12	12	12	12	12
		Annual Minimum	<0.005	355	1.00	<0.1	0.000500	0.000200	0.0282
		Annual Maximum	0.192	1,280	2.36	0.107	0.000770	0.000300	0.0397
		Annual Mean	0.0289	957.2	1.78	0.101	0.000682	0.000252	0.0327
		Annual Median	0.00530	1,025	1.78	<0.1	0.000705	0.000250	0.0329
		% <LRL	42%	0%	0%	92%	0%	0%	0%
		% > Long-term BC WQG [a]	0%	92%	0%	-	0%	-	0%
		% > Short-term Max BC WQG [a]	0%	-	0%	0%	-	0%	-
		% > Level 1 Benchmark [b]	-	92%	-	-	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
	GH_HWGH_BRB	n	13	13	13	13	13	13	13
		Annual Minimum	<0.005	295	0.530	0.0710	0.000410	0.000180	0.0289
		Annual Maximum	0.0479	1,290	2.58	<0.1	0.000740	0.000260	0.0381
		Annual Mean	0.0116	914.4	1.67	0.0710	0.000612	0.000221	0.0330
		Annual Median	0.00650	983	1.60	0.0710	0.000640	0.000220	0.0326
		% <LRL	23%	0%	0%	92%	0%	15%	0%
		% > Long-term BC WQG [a]	0%	92%	0%	-	0%	-	0%
		% > Short-term Max BC WQG [a]	0%	-	0%	0%	-	0%	-
		% > Level 1 Benchmark [b]	-	92%	-	-	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
Lower Gardine Creek	GH_GC1	n	12	12	12	12	12	12	12
		Annual Minimum	<0.005	88.5	0.250	0.108	<0.0001	0.000140	0.0507
		Annual Maximum	0.0441	508	3.91	0.908	0.000270	0.000320	0.0923
		Annual Mean	0.0142	335	2.63	0.340	0.000153	0.000213	0.0727
		Annual Median	0.00800	414	2.88	0.260	0.000130	0.000210	0.0740
		% <LRL	33%	0%	0%	0%	25%	0%	0%
		% > Long-term BC WQG [a]	0%	33%	0%	-	0%	-	0%
		% > Short-term Max BC WQG [a]	0%	-	0%	0%	-	0%	-
		% > Level 1 Benchmark [b]	-	33%	-	-	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
Upper Greenhills Creek Downstream from Gardine Creek	GH_GH1B	n	19	19	19	19	19	19	19
		Annual Minimum	<0.005	220	0.910	0.0810	0.000350	0.000153	0.0326
		Annual Maximum	0.0456	906	4.57	0.270	0.000970	0.00350	0.384
		Annual Mean	0.0129	699	1.86	0.145	0.000482	0.000375	0.0647
		Annual Median	0.00860	796	1.55	0.133	0.000420	0.000200	0.0479
		% <LRL	21%	0%	0%	5%	0%	0%	0%
		% > Long-term BC WQG [a]	0%	84%	0%	-	0%	-	0%
		% > Short-term Max BC WQG [a]	0%	-	0%	0%	-	0%	-
		% > Level 1 Benchmark [b]	-	84%	-	-	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
Lower Greenhills Creek Upstream from the Antiscalant Addition Facility	GH_GH1	n	14	14	14	14	14	14	14
		Annual Minimum	0.00500	243	1.04	0.0760	0.000360	0.000150	0.0352
		Annual Maximum	0.118	874	5.86	0.238	0.000520	0.000320	0.0489
		Annual Mean	0.0222	673	2.40	0.151	0.000441	0.000220	0.0420
		Annual Median	0.0138	743	2.00	0.156	0.000440	0.000210	0.0425
		% <LRL	0%	0%	0%	21%	0%	0%	0%
		% > Long-term BC WQG [a]	0%	79%	0%	-	0%	-	0%
		% > Short-term Max BC WQG [a]	0%	-	0%	0%	-	0%	-
		% > Level 1 Benchmark [b]	-	79%	-	-	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
Lower Greenhills Creek Downstream from the Antiscalant Addition Facility	GH_GH2	n	15	15	15	15	15	15	15
		Annual Minimum	<0.005	249	1.27	0.0760	0.000360	0.000170	0.0372
		Annual Maximum	0.0457	880	4.16	0.250	0.000530	0.000300	0.0496
		Annual Mean	0.0157	640	2.34	0.142	0.000446	0.000221	0.0446
		Annual Median	0.0134	616	2.18	0.145	0.000450	0.000220	0.0463
		% <LRL	7%	0%	0%	13%	0%	0%	0%
		% > Long-term BC WQG [a]	0%	80%	0%	-	0%	-	0%
		% > Short-term Max BC WQG [a]	0%	-	0%	0%	-	0%	-
		% > Level 1 Benchmark [b]	-	80%	-	-	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-

Concentrations in >5% of samples exceeded the BC WQG, benchmark, or screening value.
Concentrations in > 50% of samples exceeded the BC WQG, benchmark, or screening value.
Concentrations in > 95% of samples exceeded the BC WQG, benchmark, or screening value.

Notes: mg/L = milligrams per litre; < = less than; % = percent; LRL = laboratory reporting limit; > = greater than; BC WQG = British Columbia Water Quality Guideline; max = maximum- = no data/not applicable. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Working and Approved BC WQG for the Protection of Freshwater Aquatic Life (BCMOECCS 2021a,b).

[b] Total nickel has an interim screening value, rather than Level 1, 2, and 3 benchmarks. Similarly, screening values are used for total dissolved solids, rather than benchmarks.

Table C.1: Summary of Water Chemistry Data for Key Parameters Measured at Routine Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2021

Area	Station	Summary Statistic	Total Beryllium (mg/L)	Total Boron (mg/L)	Total Chromium (mg/L)	Total Cobalt (ug/L)	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)
Upper Greenhills Creek Upstream from Gardine Creek	GH_CTF	n	12	12	12	12	12	12	12
		Annual Minimum	<0.00002	<0.01	0.000110	<0.1	<0.01	<0.00005	0.00970
		Annual Maximum	<0.00004	<0.02	0.000250	<0.2	0.0730	<0.0001	0.0203
		Annual Mean	<0.00002	<0.01	0.000140	0.112	0.0188	0.0000540	0.0165
		Annual Median	<0.00004	<0.02	0.000120	<0.1	0.0150	<0.00005	0.0174
		% <LRL	100%	100%	58%	92%	67%	92%	0%
		% > Long-term BC WQG [a]	0%	0%	0%	0%	-	0%	-
		% > Short-term Max BC WQG [a]	-	-	-	0%	0%	0%	-
		% > Level 1 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
	GH_HWGH_BRB	n	13	13	13	13	13	13	13
		Annual Minimum	<0.00002	<0.01	<0.0001	<0.1	<0.01	<0.00005	0.00820
		Annual Maximum	<0.00004	<0.02	<0.0002	<0.2	0.0510	<0.0001	0.0191
		Annual Mean	<0.00002	<0.01	0.000119	<0.1	0.0143	0.0000507	0.0152
		Annual Median	<0.00002	<0.01	0.000100	<0.1	<0.01	<0.00005	0.0163
		% <LRL	100%	100%	54%	100%	77%	92%	0%
		% > Long-term BC WQG [a]	0%	0%	0%	0%	-	0%	-
		% > Short-term Max BC WQG [a]	-	-	-	0%	0%	0%	-
		% > Level 1 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
Lower Gardine Creek	GH_GC1	n	12	12	12	12	12	12	12
		Annual Minimum	<0.00002	<0.01	<0.0001	<0.1	<0.01	<0.00005	0.00350
		Annual Maximum	<0.00002	0.0160	0.000390	0.210	0.361	0.000256	0.0300
		Annual Mean	<0.00002	0.0122	0.000176	0.109	0.0616	0.0000686	0.0189
		Annual Median	<0.00002	0.0120	0.000155	<0.1	0.0335	<0.00005	0.0220
		% <LRL	100%	17%	17%	92%	33%	83%	0%
		% > Long-term BC WQG [a]	0%	0%	0%	0%	-	0%	-
		% > Short-term Max BC WQG [a]	-	-	-	0%	0%	0%	-
		% > Level 1 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
Upper Greenhills Creek Downstream from Gardine Creek	GH_GH1B	n	19	19	19	19	19	19	19
		Annual Minimum	<0.00002	<0.01	<0.0001	<0.1	<0.01	<0.00005	0.00770
		Annual Maximum	0.000614	0.0200	0.00546	6.63	6.78	0.0111	0.0196
		Annual Mean	0.0000513	0.0111	0.000414	0.444	0.380	0.000637	0.0150
		Annual Median	<0.00002	0.0100	0.000130	<0.1	<0.01	<0.00005	0.0160
		% <LRL	95%	32%	11%	89%	53%	79%	0%
		% > Long-term BC WQG [a]	5%	0%	5%	5%	-	0%	-
		% > Short-term Max BC WQG [a]	-	-	-	0%	5%	0%	-
		% > Level 1 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
Lower Greenhills Creek Upstream from the Antiscalant Addition Facility	GH_GH1	n	14	14	14	14	14	14	14
		Annual Minimum	<0.00002	<0.01	<0.0001	<0.1	<0.01	<0.00005	0.00790
		Annual Maximum	<0.00002	0.0120	0.000250	0.100	0.113	0.000148	0.0192
		Annual Mean	<0.00002	0.0105	0.000130	0.100	0.0209	0.0000594	0.0147
		Annual Median	<0.00002	0.0100	0.000120	<0.1	<0.01	<0.00005	0.0152
		% <LRL	100%	50%	21%	93%	57%	79%	0%
		% > Long-term BC WQG [a]	0%	0%	0%	0%	-	0%	-
		% > Short-term Max BC WQG [a]	-	-	-	0%	0%	0%	-
		% > Level 1 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-
Lower Greenhills Creek Downstream from the Antiscalant Addition Facility	GH_GH2	n	15	15	15	15	15	15	15
		Annual Minimum	<0.00002	<0.01	<0.0001	<0.1	<0.01	<0.00005	0.00790
		Annual Maximum	<0.00002	0.0130	0.000290	0.170	0.153	0.000185	0.0189
		Annual Mean	<0.00002	0.0110	0.000154	0.106	0.0453	0.0000691	0.0143
		Annual Median	<0.00002	0.0110	0.000130	<0.1	0.0260	<0.00005	0.0152
		% <LRL	100%	40%	7%	87%	27%	67%	0%
		% > Long-term BC WQG [a]	0%	0%	0%	0%	-	0%	-
		% > Short-term Max BC WQG [a]	-	-	-	0%	0%	0%	-
		% > Level 1 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-	-

Concentrations in >5% of samples exceeded the BC WQG, benchmark, or screening value.
Concentrations in > 50% of samples exceeded the BC WQG, benchmark, or screening value.
Concentrations in > 95% of samples exceeded the BC WQG, benchmark, or screening value.

Notes: mg/L = milligrams per litre; < = less than; % = percent; LRL = laboratory reporting limit; > = greater than; BC WQG = British Columbia Water Quality Guideline; max = maximum- = no data/not applicable. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Working and Approved BC WQG for the Protection of Freshwater Aquatic Life (BCMOECCS 2021a,b).

[b] Total nickel has an interim screening value, rather than Level 1, 2, and 3 benchmarks. Similarly, screening values are used for total dissolved solids, rather than benchmarks.

Table C.1: Summary of Water Chemistry Data for Key Parameters Measured at Routine Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2021

Area	Station	Summary Statistic	Total Manganese (mg/L)	Total Mercury (mg/L)	Total Molybdenum (mg/L)	Total Nickel (ug/L)	Total Selenium (ug/L)	Total Silver (mg/L)	Total Thallium (mg/L)	Total Uranium (mg/L)
Upper Greenhills Creek Upstream from Gardine Creek	GH_CTF	n	12	12	12	12	12	12	12	12
		Annual Minimum	0.00466	<0.0000005	0.00173	12.9	91.0	<0.00001	0.0000130	0.00435
		Annual Maximum	0.0136	<0.000005	0.00212	30.1	275	<0.00002	<0.00002	0.0146
		Annual Mean	0.00862	0.000000687	0.00193	23.4	220	<0.00001	0.0000150	0.0116
		Annual Median	0.00883	<0.0000005	0.00195	25.3	236	<0.00002	0.0000150	0.0126
		% <LRL	0%	67%	0%	0%	0%	100%	58%	0%
		% > Long-term BC WQG [a]	0%	17%	0%	-	100%	0%	0%	83%
		% > Short-term Max BC WQG [a]	0%	-	0%	-	-	0%	-	-
		% > Level 1 Benchmark [b]	-	-	-	100%	100%	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	92%	75%	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	58%	-	-	-	-
	GH_HWGH_BRB	n	13	13	13	13	13	13	13	13
		Annual Minimum	0.000690	<0.0000005	0.00151	8.76	71.9	<0.00001	<0.00001	0.00354
		Annual Maximum	0.00387	<0.000005	0.00196	21.5	272	<0.00002	<0.00002	0.0135
		Annual Mean	0.00148	0.000000608	0.00181	16.7	211	<0.00001	<0.00001	0.0107
		Annual Median	0.00129	<0.0000005	0.00189	18.0	233	<0.00001	<0.00001	0.0117
		% <LRL	0%	77%	0%	0%	0%	100%	100%	0%
		% > Long-term BC WQG [a]	0%	15%	0%	-	100%	0%	0%	77%
		% > Short-term Max BC WQG [a]	0%	-	0%	-	-	0%	-	-
		% > Level 1 Benchmark [b]	-	-	-	100%	100%	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	62%	69%	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	0%	-	-	-	-
Lower Gardine Creek	GH_GC1	n	12	12	12	12	12	12	12	12
		Annual Minimum	0.000560	<0.0000005	0.000561	<0.5	4.17	<0.00001	<0.00001	0.000848
		Annual Maximum	0.00913	0.00000398	0.00228	1.93	8.35	0.0000150	0.0000100	0.00362
		Annual Mean	0.00328	0.000000912	0.00122	1.42	6.17	0.0000104	0.0000100	0.00229
		Annual Median	0.00277	0.000000515	0.00112	1.54	5.96	<0.00001	<0.00001	0.00253
		% <LRL	0%	50%	0%	17%	0%	92%	92%	0%
		% > Long-term BC WQG [a]	0%	8%	0%	-	100%	0%	0%	0%
		% > Short-term Max BC WQG [a]	0%	-	0%	-	-	0%	-	-
		% > Level 1 Benchmark [b]	-	-	-	0%	0%	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	0%	0%	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	0%	-	-	-	-
Upper Greenhills Creek Downstream from Gardine Creek	GH_GH1B	n	19	19	19	19	19	19	19	19
		Annual Minimum	0.000280	<0.0000005	0.00117	5.46	45.8	<0.00001	<0.00001	0.00259
		Annual Maximum	0.105	<0.0001	0.00342	23.9	179	0.000337	0.000292	0.00990
		Annual Mean	0.00661	0.000000702	0.00167	9.94	139	0.0000272	0.0000248	0.00768
		Annual Median	0.000850	0.000000620	0.00160	9.36	155	<0.00001	<0.00001	0.00819
		% <LRL	0%	37%	0%	0%	0%	95%	95%	0%
		% > Long-term BC WQG [a]	0%	11%	0%	-	100%	0%	0%	47%
		% > Short-term Max BC WQG [a]	0%	-	0%	-	-	0%	-	-
		% > Level 1 Benchmark [b]	-	-	-	100%	95%	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	5%	0%	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	5%	-	-	-	-
Lower Greenhills Creek Upstream from the Antiscalant Addition Facility	GH_GH1	n	14	14	14	14	15	14	14	14
		Annual Minimum	0.00106	<0.0000005	0.00137	5.74	49.3	<0.00001	<0.00001	0.00289
		Annual Maximum	0.00349	0.00000193	0.00196	10.4	200	<0.00001	<0.00001	0.00941
		Annual Mean	0.00190	0.000000688	0.00163	8.10	130	<0.00001	<0.00001	0.00731
		Annual Median	0.00161	0.000000510	0.00160	8.12	150	<0.00001	<0.00001	0.00802
		% <LRL	0%	50%	0%	0%	0%	100%	100%	0%
		% > Long-term BC WQG [a]	0%	7%	0%	-	100%	0%	0%	29%
		% > Short-term Max BC WQG [a]	0%	-	0%	-	-	0%	-	-
		% > Level 1 Benchmark [b]	-	-	-	100%	80%	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	0%	7%	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	0%	-	-	-	-
Lower Greenhills Creek Downstream from the Antiscalant Addition Facility	GH_GH2	n	15	15	15	15	15	15	15	15
		Annual Minimum	0.00167	<0.0000005	0.00144	5.28	48.9	<0.00001	<0.00001	0.00305
		Annual Maximum	0.0136	0.00000193	0.00526	11.4	191	<0.00001	0.0000120	0.00946
		Annual Mean	0.00415	0.000000845	0.00372	7.78	126	<0.00001	0.0000101	0.00710
		Annual Median	0.00340	0.000000690	0.00377	7.88	122	<0.00001	<0.00001	0.00722
		% <LRL	0%	27%	0%	0%	0%	100%	93%	0%
		% > Long-term BC WQG [a]	0%	20%	0%	-	100%	0%	0%	20%
		% > Short-term Max BC WQG [a]	0%	-	0%	-	-	0%	-	-
		% > Level 1 Benchmark [b]	-	-	-	93%	87%	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	0%	7%	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	0%	-	-	-	-

Concentrations in >5% of samples exceeded the BC WQG, benchmark, or screening value.
Concentrations in > 50% of samples exceeded the BC WQG, benchmark, or screening value.
Concentrations in > 95% of samples exceeded the BC WQG, benchmark, or screening value.

Notes: mg/L = milligrams per litre; < = less than; % = percent; LRL = laboratory reporting limit; > = greater than; BC WQG = British Columbia Water Quality Guideline; max = maximum- = no data/not applicable. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Working and Approved BC WQG for the Protection of Freshwater Aquatic Life (BCMOECCS 2021a,b).

[b] Total nickel has an interim screening value, rather than Level 1, 2, and 3 benchmarks. Similarly, screening values are used for total dissolved solids, rather than benchmarks.

Table C.1: Summary of Water Chemistry Data for Key Parameters Measured at Routine Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2021

Area	Station	Summary Statistic	Total Zinc (mg/L)	Dissolved Aluminum (mg/L)	Dissolved Cadmium (ug/L)	Dissolved Cobalt (ug/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)
Upper Greenhills Creek Upstream from Gardine Creek	GH_CTF	n	12	12	12	11	12	12
		Annual Minimum	<0.003	<0.001	0.0215	<0.1	0.000280	<0.01
		Annual Maximum	0.0246	0.00430	0.316	<0.2	0.000500	<0.02
		Annual Mean	0.0101	0.00198	0.125	<0.1	0.000337	<0.01
		Annual Median	0.00820	0.00140	0.0577	<0.2	0.000310	<0.02
		% <LRL	33%	42%	0%	100%	50%	100%
		% > Long-term BC WQG [a]	0%	0%	0%	-	0%	-
		% > Short-term Max BC WQG [a]	0%	0%	0%	-	0%	0%
		% > Level 1 Benchmark [b]	-	-	0%	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-
	GH_HWGH_BRB	n	13	13	13	12	13	13
		Annual Minimum	<0.003	<0.001	0.00670	<0.1	0.000220	<0.01
		Annual Maximum	0.0126	0.00350	0.126	<0.2	0.00135	<0.02
		Annual Mean	0.00414	0.00176	0.0239	<0.1	0.000375	<0.01
		Annual Median	<0.003	0.00160	0.0106	<0.2	0.000280	<0.01
		% <LRL	77%	23%	31%	100%	38%	100%
		% > Long-term BC WQG [a]	0%	0%	0%	-	8%	-
		% > Short-term Max BC WQG [a]	0%	0%	0%	-	0%	0%
		% > Level 1 Benchmark [b]	-	-	0%	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-
Lower Gardine Creek	GH_GC1	n	12	12	12	11	12	12
		Annual Minimum	<0.003	<0.001	0.00560	<0.1	<0.0002	<0.01
		Annual Maximum	0.00310	0.00740	0.0132	<0.1	0.000550	0.0210
		Annual Mean	0.00301	0.00231	0.00851	<0.1	0.000262	0.0109
		Annual Median	<0.003	0.00140	0.00770	<0.1	0.000220	<0.01
		% <LRL	92%	25%	0%	100%	42%	92%
		% > Long-term BC WQG [a]	0%	0%	0%	-	0%	-
		% > Short-term Max BC WQG [a]	0%	0%	0%	-	0%	0%
		% > Level 1 Benchmark [b]	-	-	0%	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-
Upper Greenhills Creek Downstream from Gardine Creek	GH_GH1B	n	19	19	19	19	19	19
		Annual Minimum	<0.003	<0.001	<0.005	<0.1	<0.0002	<0.01
		Annual Maximum	0.0957	0.0384	0.0607	0.250	0.000780	0.0110
		Annual Mean	0.00805	0.00388	0.0167	0.108	0.000318	0.0101
		Annual Median	<0.003	0.00140	0.00980	<0.1	0.000250	<0.01
		% <LRL	79%	37%	11%	95%	21%	95%
		% > Long-term BC WQG [a]	0%	0%	0%	-	0%	-
		% > Short-term Max BC WQG [a]	0%	0%	0%	-	0%	0%
		% > Level 1 Benchmark [b]	-	-	0%	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-
Lower Greenhills Creek Upstream from the Antiscalant Addition Facility	GH_GH1	n	14	14	14	14	14	14
		Annual Minimum	<0.003	<0.001	<0.005	<0.1	<0.0002	<0.01
		Annual Maximum	0.00490	0.00340	0.0534	<0.1	0.000550	<0.01
		Annual Mean	0.00326	0.00138	0.0133	<0.1	0.000291	<0.01
		Annual Median	<0.003	0.00120	0.00705	<0.1	0.000255	<0.01
		% <LRL	86%	57%	29%	100%	29%	100%
		% > Long-term BC WQG [a]	0%	0%	0%	-	0%	-
		% > Short-term Max BC WQG [a]	0%	0%	0%	-	0%	0%
		% > Level 1 Benchmark [b]	-	-	0%	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-
Lower Greenhills Creek Downstream from the Antiscalant Addition Facility	GH_GH2	n	15	15	15	15	15	15
		Annual Minimum	<0.003	<0.001	<0.005	<0.1	<0.0002	<0.01
		Annual Maximum	0.00380	0.0135	0.0422	<0.1	0.000630	0.0280
		Annual Mean	0.00314	0.00227	0.0154	<0.1	0.000323	0.0112
		Annual Median	<0.003	0.00130	0.0126	<0.1	0.000310	<0.01
		% <LRL	73%	47%	13%	100%	20%	93%
		% > Long-term BC WQG [a]	0%	0%	0%	-	7%	-
		% > Short-term Max BC WQG [a]	0%	0%	0%	-	0%	0%
		% > Level 1 Benchmark [b]	-	-	0%	-	-	-
		% > Level 2 Benchmark [b]	-	-	-	-	-	-
		% > Level 3 Benchmark [b]	-	-	-	-	-	-

Concentrations in >5% of samples exceeded the BC WQG, benchmark, or screening value.
Concentrations in > 50% of samples exceeded the BC WQG, benchmark, or screening value.
Concentrations in > 95% of samples exceeded the BC WQG, benchmark, or screening value.

Notes: mg/L = milligrams per litre; < = less than; % = percent; LRL = laboratory reporting limit; > = greater than; BC WQG = British Columbia Water Quality Guideline; max = maximum- = no data/not applicable. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Working and Approved BC WQG for the Protection of Freshwater Aquatic Life (BCMOECCS 2021a,b).

[b] Total nickel has an interim screening value, rather than Level 1, 2, and 3 benchmarks. Similarly, screening values are used for total dissolved solids, rather than benchmarks.

Table C.2: Water Quality at Biological Monitoring Areas on Greenhills Creek, Greenhills Creek Sedimentation Pond, and Gardine Creek, 2021

	Analyte	Units	BC WQGs Long-term Average	BC WQGs Short-term Maximum	EVWQP Level 1 Benchmarks/ Relevant Screening Values	Upper Greenhills Creek RG_GHUT 17-Feb-21	Upper Greenhills Creek RG_GHUT 13-Sep-21	Upper Greenhills Creek RG_GHNF 10-Sep-21	Upper Greenhills Creek RG_GHFF 09-Sep-21
Physical Characteristics	Hardness (as $CaCO_3$)	mg/L	-	-	-	1,800	1,600	1,550	1,175
	pH, Field	pH	6.5 to 9.0	6.5 to 9.0	-	8.03	7.39	8.36	8.24
	pH, Lab	pH	6.5 to 9.0	6.5 to 9.0	-	8.12	8.04	8.23	8.34
	Total Suspended Solids, Lab	mg/L	-	-	-	15.6	1.70	1.40	1.85
	Total Dissolved Solids	mg/L	1,000 to 3,000	-	1,000	2,310	2,040	1,910	1,625
	Dissolved Oxygen, Field	mg/L	≥8	≥5	-	11.41	10.05	10.08	10.51
	Dissolved Oxygen, Field	%	-	-	-	83.1	105.5	98.5	104.8
	Temperature, Field	°C	-	-	-	2.1	5.1	5.4	6.7
Anions and Nutrients	Ammonia (as N) [a]	mg/L	0.10 to 2.0	0.68 to 26	-	<0.005	<0.005	<0.005	0.00675
	Bromide (Br)	mg/L	-	-	-	<0.25	<0.25	<0.25	<0.25
	Chloride (Cl)	mg/L	150	600	-	1.70	1.63	1.46	2.10
	Fluoride (F) [b]	mg/L	-	1.73 to 1.88	-	<0.1	<0.1	<0.1	0.140
	Nitrate (as N) [b,c]	mg/L	3	32.8	6.8 to 15	10.5	10.0	8.96	7.00
	Nitrite (as N) [d]	mg/L	0.020 to 0.20	0.060 to 0.60	0.015 to 0.050	<0.005	<0.005	0.00500	0.0104
	Phosphorus (P), Total	mg/L	-	-	-	0.00700	0.00940	0.00220	0.00460
	Sulphate (SO_4) [b]	mg/L	429	-	429	1,320	1,120	1,120	944
Organic Carbon	Total Organic Carbon	mg/L	-	-	-	1.27	1.54	2.44	1.86
	Dissolved Organic Carbon	mg/L	-	-	-	1.20	1.52	2.46	1.29
Total Metals	Aluminum (Al)	mg/L	-	-	-	0.00610	0.00750	<0.006	0.00970
	Antimony (Sb)	mg/L	0.009	-	-	0.000870	0.000830	0.000710	0.000520
	Arsenic (As)	mg/L	-	0.005	-	0.000380	0.000210	0.000240	0.000220
	Barium (Ba)	mg/L	1	-	-	0.0270	0.0306	0.0324	0.0456
	Beryllium (Be)	mg/L	0.00013	-	0.0053	<0.00004	<0.00004	<0.00004	<0.00002
	Bismuth (Bi)	mg/L	-	-	-	<0.0001	<0.0001	<0.0001	<0.00005
	Boron (B)	mg/L	1.2	-	-	<0.02	<0.02	<0.02	0.0100
	Cadmium (Cd)	mg/L	-	-	-	0.000549	0.000906	0.0000116	0.0000168
	Calcium (Ca)	mg/L	-	-	-	399	328	273	189
	Chromium (Cr)	mg/L	0.001	-	0.005	<0.0002	<0.0002	<0.0002	0.000125
	Cobalt (Co) [b]	µg/L	4	110	3.8 to 8.3	<0.2	<0.2	<0.2	<0.1
	Copper (Cu)	mg/L	-	-	-	<0.001	<0.001	<0.001	<0.0005
	Iron (Fe)	mg/L	-	1	-	<0.02	<0.02	<0.02	0.0120
	Lead (Pb) [b]	mg/L	0.012 to 0.020	0.23 to 0.42	-	<0.0001	<0.0001	<0.0001	<0.00005
	Lithium (Li)	mg/L	-	-	-	0.0198	0.0199	0.0204	0.0193
	Magnesium (Mg)	mg/L	-	-	-	251	196	216	171
	Manganese (Mn) [b]	mg/L	1.6 to 2.6	3.0 to 3.4	-	0.0141	0.0108	0.00832	0.00108
	Mercury (Hg)	mg/L	0.0000013	-	-	<0.0000005	0.000000720	<0.0000005	<0.0000005
	Molybdenum (Mo)	mg/L	7.6	46	-	0.00227	0.00173	0.00200	0.00181
	Nickel (Ni)	µg/L	-	-	5.3	36.6	32.1	23.7	12.6
	Potassium (K)	mg/L	-	-	-	3.08	2.95	2.96	2.73
	Selenium (Se) [e]	µg/L	2.0	-	70	274	234	226	169
	Silicon (Si)-Total	mg/L	-	-	-	3.38	3.07	3.31	3.80
	Silver (Ag) [b]	mg/L	0.0015	0.0030	-	<0.00002	<0.00002	<0.00002	<0.00001
	Sodium (Na)	mg/L	-	-	-	2.04	1.84	1.90	2.50
	Strontium (Sr)	mg/L	-	-	-	0.211	0.179	0.176	0.199
	Thallium (Tl)	mg/L	0.0008	-	-	0.0000230	0.0000250	<0.00002	<0.00001
	Tin (Sn)	mg/L	-	-	-	<0.0002	<0.0002	<0.0002	<0.0001
	Titanium (Ti)	mg/L	-	-	-	<0.01	<0.0006	<0.0006	<0.0003
	Uranium (U)	mg/L	0.0085	-	-	0.0146	0.0148	0.0138	0.0102
	Vanadium (V)	mg/L	-	-	0.12	<0.001	<0.001	<0.001	<0.0005
	Zinc (Zn) [b]	mg/L	0.11 to 0.19	0.13 to 0.34	-	0.0380	0.0569	<0.006	<0.003
Dissolved Metals	Aluminum (Al) [f]	mg/L	0.05	0.1	-	<0.003	0.00220	<0.001	<0.001
	Antimony (Sb)	mg/L	-	-	-	0.000760	0.000800	0.000700	0.000510
	Arsenic (As)	mg/L	-	-	-	0.000240	0.000230	0.000180	0.000160
	Barium (Ba)	mg/L	-	-	-	0.0249	0.0313	0.0351	0.0470
	Beryllium (Be)	mg/L	-	-	-	<0.00004	<0.00004	<0.00002	<0.00002
	Bismuth (Bi)	mg/L	-	-	-	<0.0001	<0.0001	<0.00005	<0.00005
	Boron (B)	mg/L	-	-	-	<0.02	<0.02	<0.01	<0.01
	Cadmium (Cd) [b,g]	µg/L	0.38 to 0.46	1.4 to 2.8	0.26 to 1.6	0.463	0.946	0.00920	0.00607
	Calcium (Ca)	mg/L	-	-	-	329	316	275	196
	Chromium (Cr)	mg/L	-	-	-	<0.0002	<0.0002	<0.0001	<0.0001
	Cobalt (Co)	µg/L	-	-	-	<0.2	<0.2	<0.1	<0.1
	Copper (Cu) [h]	mg/L	0.00060 to 0.0047	0.0038 to 0.028	-	<0.0004	0.000600	0.000450	0.000215
	Iron (Fe)	mg/L	-	0.35	1.1	<0.02	<0.02	<0.01	<0.01
	Lead (Pb)	mg/L	-	-	-	<0.0001	<0.0001	<0.00005	<0.00005
	Lithium (Li)	mg/L	-	-	-	0.0179	0.0201	0.0197	0.0186
	Magnesium (Mg)	mg/L	-	-	-	237	196	210	167
	Manganese (Mn)	mg/L	-	-	-	0.0126	0.00982	0.00849	0.000470
	Mercury (Hg)	mg/L	-	-	-	<0.000005	<0.000005	<0.000005	<0.000005
	Molybdenum (Mo)	mg/L	-	-	-	0.00190	0.00177	0.00192	0.00174
	Nickel (Ni)	mg/L	-	-	-	0.0337	0.0332	0.0230	0.0117
	Potassium (K)	mg/L	-	-	-	2.98	3.08	3.41	2.82
	Selenium (Se)	mg/L	-	-	-	0.274	0.234	0.248	0.176
	Silicon (Si)	mg/L	-	-	-	3.20	3.43	3.32	3.66
	Silver (Ag)	mg/L	-	-	-	<0.00002	<0.00002	<0.00001	<0.00001
	Sodium (Na)	mg/L	-	-	-	1.97	1.90	2.18	2.49
	Strontium (Sr)	mg/L	-	-	-	0.183	0.171	0.182	0.196
	Thallium (Tl)	mg/L	-	-	-	<0.00002	0.0000230	0.0000130	<0.00001
	Tin (Sn)	mg/L	-	-	-	<0.0002	<0.0002	<0.0001	<0.0001
	Titanium (Ti)	mg/L	-	-	-	<0.01	<0.0006	<0.0003	<0.0003
	Uranium (U)	mg/L	-	-	-	0.0123	0.0144	0.0126	0.00936
	Vanadium (V)	mg/L	-	-	-	<0.001	<0.001	<0.0005	<0.0005
	Zinc (Zn)	mg/L	-	-	-	0.0366	0.0605	0.00210	<0.001

Exceeds the Long-term Average BC WQG for the protection of freshwater aquatic life (BCMOECCS 2021a,b).

Exceeds the Short-term Maximum BC WQG for the protection of freshwater aquatic life (BCMOECCS 2021a,b).

Exceeds the site-specific EVWQP Level 1 Benchmark (Teck 2014) or relevant site-specific screening value.

Notes: BC WQGs = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; - = no data/not applicable; < = less than; ≥ = greater than or equal to; % = percent; °C = degrees Celsius; µg/L = micrograms per litre; MU = Management Unit.

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

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

[c] The upper (i.e., highest) EVWQP Level 1 Benchmark for nitrate was calculated based on the maximum applicable hardness (Teck 2014).

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

[e] The EVWQP Level 1 Benchmark for selenium (i.e., 0.070 mg/L for MU 1; Golder 2014) was derived for lotic habitats and does not apply to Greenhills Creek Sedimentation Pond.

[f] Dissolved aluminum guidelines were calculated based on the pH of individual water samples.

[g] The upper (highest) EVWQP Level 1 Benchmark for dissolved cadmium was calculated based on the maximum applicable hardness (Teck 2014).

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

Table C.2: Water Quality at Biological Monitoring Areas on Greenhills Creek, Greenhills Creek Sedimentation Pond, and Gardine Creek, 2021

Analyte		Units	BC WQGs		EVWQP Level 1 Benchmarks/ Relevant Screening Values	Greenhills Creek Sedimentation Pond	Lower Greenhills Creek	
			Long-term Average	Short-term Maximum		RG_GHP	RG_GHBP	
						23-Sep-21	18-Feb-21	13-Sep-21
Physical Characteristics	Hardness (as $CaCO_3$)	mg/L	-	-	-	1,050	1,180	989
	pH, Field	pH	6.5 to 9.0	6.5 to 9.0	-	8.33	8.19	8.07
	pH, Lab	pH	6.5 to 9.0	6.5 to 9.0	-	8.39	8.22	8.44
	Total Suspended Solids, Lab	mg/L	-	-	-	1.50	<1	2.40
	Total Dissolved Solids	mg/L	1,000 to 3,000	-	1,000	1,380	1,540	1,310
	Dissolved Oxygen, Field	mg/L	≥8	≥5	-	10.10	-	9.93
		%	-	-	-	107.9	84.7	114.9
	Temperature, Field	°C	-	-	-	10.3	0.1	13.7
Anions and Nutrients	Ammonia (as N) [a]	mg/L	0.10 to 2.0	0.68 to 26	-	0.0140	0.0227	0.0108
	Bromide (Br)	mg/L	-	-	-	<0.25	<0.25	<0.25
	Chloride (Cl)	mg/L	150	600	-	1.84	1.88	1.50
	Fluoride (F) [b]	mg/L	-	1.73 to 1.88	-	0.152	0.160	0.112
	Nitrate (as N) [b,c]	mg/L	3	32.8	6.8 to 15	6.52	5.87	4.74
	Nitrite (as N) [d]	mg/L	0.020 to 0.20	0.060 to 0.60	0.015 to 0.050	0.00640	0.00640	0.00640
	Phosphorus (P), Total	mg/L	-	-	-	0.00500	0.00340	0.00650
	Sulphate (SO_4) [b]	mg/L	429	-	429	804	910	787
Organic Carbon	Total Organic Carbon	mg/L	-	-	-	2.44	1.43	2.24
	Dissolved Organic Carbon	mg/L	-	-	-	2.29	1.51	2.35
Total Metals	Aluminum (Al)	mg/L	-	-	-	0.00630	<0.003	0.0110
	Antimony (Sb)	mg/L	0.009	-	-	0.000510	0.000470	0.000530
	Arsenic (As)	mg/L	-	0.005	-	0.000230	0.000280	0.000200
	Barium (Ba)	mg/L	1	-	-	0.0394	0.0525	0.0363
	Beryllium (Be)	mg/L	0.00013	-	0.0053	<0.00002	<0.00002	<0.00002
	Bismuth (Bi)	mg/L	-	-	-	<0.00005	<0.00005	<0.00005
	Boron (B)	mg/L	1.2	-	-	0.0100	0.0100	0.0120
	Cadmium (Cd)	mg/L	-	-	-	0.00000670	0.00000980	0.0000128
	Calcium (Ca)	mg/L	-	-	-	174	224	176
	Chromium (Cr)	mg/L	0.001	-	0.005	0.000390	0.000100	<0.0001
	Cobalt (Co) [b]	µg/L	4	110	3.8 to 8.3	<0.1	<0.1	<0.1
	Copper (Cu)	mg/L	-	-	-	<0.0005	<0.0005	0.000510
	Iron (Fe)	mg/L	-	1	-	<0.01	<0.01	0.0100
	Lead (Pb) [b]	mg/L	0.012 to 0.020	0.23 to 0.42	-	<0.00005	<0.00005	<0.00005
	Lithium (Li)	mg/L	-	-	-	0.0168	0.0166	0.0186
	Magnesium (Mg)	mg/L	-	-	-	159	175	139
	Manganese (Mn) [b]	mg/L	1.6 to 2.6	3.0 to 3.4	-	0.00152	0.00172	0.00183
	Mercury (Hg)	mg/L	0.0000013	-	-	<0.0000005	<0.0000005	0.000000510
	Molybdenum (Mo)	mg/L	7.6	46	-	0.00188	0.00403	0.00394
	Nickel (Ni)	µg/L	-	-	5.3	8.54	10.6	7.47
	Potassium (K)	mg/L	-	-	-	2.81	2.45	2.42
	Selenium (Se) [e]	µg/L	2.0	-	70	146 [e]	160	136
	Silicon (Si)-Total	mg/L	-	-	-	4.42	4.14	3.78
	Silver (Ag) [b]	mg/L	0.0015	0.0030	-	<0.00001	<0.00001	<0.00001
	Sodium (Na)	mg/L	-	-	-	2.86	3.02	2.54
	Strontium (Sr)	mg/L	-	-	-	0.194	0.230	0.188
	Thallium (Tl)	mg/L	0.0008	-	-	<0.00001	<0.00001	<0.00001
	Tin (Sn)	mg/L	-	-	-	<0.0001	<0.0001	<0.0001
	Titanium (Ti)	mg/L	-	-	-	<0.0003	<0.01	<0.0003
	Uranium (U)	mg/L	0.0085	-	-	0.00876	0.00924	0.00890
	Vanadium (V)	mg/L	-	-	0.12	<0.0005	<0.0005	<0.0005
	Zinc (Zn) [b]	mg/L	0.11 to 0.19	0.13 to 0.34	-	<0.003	<0.003	0.00450
Dissolved Metals	Aluminum (Al) [f]	mg/L	0.05	0.1	-	0.00120	<0.003	<0.001
	Antimony (Sb)	mg/L	-	-	-	0.000460	0.000430	0.000500
	Arsenic (As)	mg/L	-	-	-	0.000190	0.000190	0.000190
	Barium (Ba)	mg/L	-	-	-	0.0351	0.0471	0.0390
	Beryllium (Be)	mg/L	-	-	-	<0.00002	<0.00002	<0.00002
	Bismuth (Bi)	mg/L	-	-	-	<0.00005	<0.00005	<0.00005
	Boron (B)	mg/L	-	-	-	0.0100	0.0100	0.0100
	Cadmium (Cd) [b,g]	µg/L	0.38 to 0.46	1.4 to 2.8	0.26 to 1.6	<0.005	0.00890	0.00760
	Calcium (Ca)	mg/L	-	-	-	173	202	170
	Chromium (Cr)	mg/L	-	-	-	<0.0001	0.000100	<0.0001
	Cobalt (Co)	µg/L	-	-	-	<0.1	<0.1	<0.1
	Copper (Cu) [h]	mg/L	0.00060 to 0.0047	0.0038 to 0.028	-	0.000250	<0.0002	0.000450
	Iron (Fe)	mg/L	-	0.35	1.1	<0.01	<0.01	<0.01
	Lead (Pb)	mg/L	-	-	-	<0.00005	<0.00005	<0.00005
	Lithium (Li)	mg/L	-	-	-	0.0162	0.0172	0.0179
	Magnesium (Mg)	mg/L	-	-	-	150	164	137
	Manganese (Mn)	mg/L	-	-	-	0.000470	0.000810	0.000650
	Mercury (Hg)	mg/L	-	-	-	<0.000005	<0.000005	<0.000005
	Molybdenum (Mo)	mg/L	-	-	-	0.00168	0.00386	0.00380
	Nickel (Ni)	mg/L	-	-	-	0.00698	0.00991	0.00724
	Potassium (K)	mg/L	-	-	-	2.41	2.53	2.60
	Selenium (Se)	mg/L	-	-	-	0.143	0.158	0.134
	Silicon (Si)	mg/L	-	-	-	4.12	3.99	3.85
	Silver (Ag)	mg/L	-	-	-	<0.00001	<0.00001	<0.00001
	Sodium (Na)	mg/L	-	-	-	2.48	3.08	2.66
	Strontium (Sr)	mg/L	-	-	-	0.184	0.223	0.178
	Thallium (Tl)	mg/L	-	-	-	<0.00001	<0.00001	<0.00001
	Tin (Sn)	mg/L	-	-	-	<0.0001	<0.0001	<0.0001
	Titanium (Ti)	mg/L	-	-	-	<0.0003	<0.01	<0.0003
	Uranium (U)	mg/L	-	-	-	0.00811	0.00785	0.00831
	Vanadium (V)	mg/L	-	-	-	<0.0005	<0.0005	<0.0005
	Zinc (Zn)	mg/L	-	-	-	<0.001	<0.001	0.00530

Exceeds the Long-term Average BC WQG for the protection of freshwater aquatic life (BCMOECCS 2021a,b).

Exceeds the Short-term Maximum BC WQG for the protection of freshwater aquatic life (BCMOECCS 2021a,b).

Exceeds the site-specific EVWQP Level 1 Benchmark (Teck 2014) or relevant site-specific screening value.

Notes: BC WQGs = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; - = no data/not applicable; < = less than; ≥ = greater than or equal to; % = percent; °C = degrees Celsius; µg/L = micrograms per litre; MU = Management Unit.

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

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

[c] The upper (i.e., highest) EVWQP Level 1 Benchmark for nitrate was calculated based on the maximum applicable hardness (Teck 2014).

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

[e] The EVWQP Level 1 Benchmark for selenium (i.e., 0.070 mg/L for MU 1; Golder 2014) was derived for lotic habitats and does not apply to Greenhills Creek Sedimentation Pond.

[f] Dissolved aluminum guidelines were calculated based on the pH of individual water samples.

[g] The upper (highest) EVWQP Level 1 Benchmark for dissolved cadmium was calculated based on the maximum applicable hardness (Teck 2014).

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

Table C.2: **Water Quality at Biological Monitoring Areas on Greenhills Creek, Greenhills Creek Sedimentation Pond, and Gardine Creek, 2021**

	Analyte	Units	BC WQGs		EVWQP Level 1 Benchmarks/ Relevant Screening Values	Gardine Creek	
			Long-term Average	Short-term Maximum		RG_GAUT 16-Sep-21	RG_GANF 15-Sep-21
Physical Characteristics	Hardness (as $CaCO_3$)	mg/L	-	-	-	262	800
	pH, Field	pH	6.5 to 9.0	6.5 to 9.0	-	7.93	8.07
	pH, Lab	pH	6.5 to 9.0	6.5 to 9.0	-	8.43	8.54
	Total Suspended Solids, Lab	mg/L	-	-	-	2.60	1.40
	Total Dissolved Solids	mg/L	1,000 to 3,000	-	1,000	323	892
	Dissolved Oxygen, Field	mg/L	≥8	≥5	-	9.84	10.43
		%	-	-	-	93.1	104.6
	Temperature, Field	°C	-	-	-	4.1	6.7
Anions and Nutrients	Ammonia (as N) [a]	mg/L	0.10 to 2.0	0.68 to 26	-	0.00570	<0.005
	Bromide (Br)	mg/L	-	-	-	<0.05	<0.25
	Chloride (Cl)	mg/L	150	600	-	3.11	3.22
	Fluoride (F) [b]	mg/L	-	1.73 to 1.88	-	0.149	0.353
	Nitrate (as N) [b,c]	mg/L	3	32.8	6.8 to 15	<0.005	0.322
	Nitrite (as N) [d]	mg/L	0.020 to 0.20	0.060 to 0.60	0.015 to 0.050	<0.001	<0.005
	Phosphorus (P), Total	mg/L	-	-	-	0.0150	0.00270
	Sulphate (SO_4) [b]	mg/L	429	-	429	61.7	473
Organic Carbon	Total Organic Carbon	mg/L	-	-	-	3.33	2.58
	Dissolved Organic Carbon	mg/L	-	-	-	3.14	2.56
Total Metals	Aluminum (Al)	mg/L	-	-	-	0.0214	0.00430
	Antimony (Sb)	mg/L	0.009	-	-	0.000220	0.000110
	Arsenic (As)	mg/L	-	0.005	-	0.000260	0.000160
	Barium (Ba)	mg/L	1	-	-	0.104	0.0670
	Beryllium (Be)	mg/L	0.00013	-	0.0053	<0.00002	<0.00002
	Bismuth (Bi)	mg/L	-	-	-	<0.00005	<0.00005
	Boron (B)	mg/L	1.2	-	-	0.0100	0.0120
	Cadmium (Cd)	mg/L	-	-	-	0.0000167	<0.000005
	Calcium (Ca)	mg/L	-	-	-	62.3	124
	Chromium (Cr)	mg/L	0.001	-	0.005	<0.0001	<0.0001
	Cobalt (Co) [b]	µg/L	4	110	3.8 to 8.3	<0.1	<0.1
	Copper (Cu)	mg/L	-	-	-	<0.0005	<0.0005
	Iron (Fe)	mg/L	-	1	-	0.0220	<0.01
	Lead (Pb) [b]	mg/L	0.012 to 0.020	0.23 to 0.42	-	<0.00005	<0.00005
	Lithium (Li)	mg/L	-	-	-	0.00670	0.0255
	Magnesium (Mg)	mg/L	-	-	-	22.8	94.6
	Manganese (Mn) [b]	mg/L	1.6 to 2.6	3.0 to 3.4	-	0.00369	0.000800
	Mercury (Hg)	mg/L	0.0000013	-	-	0.000000730	<0.0000005
	Molybdenum (Mo)	mg/L	7.6	46	-	0.000882	0.00126
	Nickel (Ni)	µg/L	-	-	5.3	1.87	1.38
	Potassium (K)	mg/L	-	-	-	1.26	2.81
	Selenium (Se) [e]	µg/L	2.0	-	70	0.690	5.97
	Silicon (Si)-Total	mg/L	-	-	-	3.29	3.94
	Silver (Ag) [b]	mg/L	0.0015	0.0030	-	<0.00001	<0.00001
	Sodium (Na)	mg/L	-	-	-	3.50	4.40
	Strontium (Sr)	mg/L	-	-	-	0.248	0.256
	Thallium (Tl)	mg/L	0.0008	-	-	<0.00001	<0.00001
	Tin (Sn)	mg/L	-	-	-	<0.0001	<0.0001
	Titanium (Ti)	mg/L	-	-	-	<0.0009	<0.0003
	Uranium (U)	mg/L	0.0085	-	-	0.000488	0.00272
	Vanadium (V)	mg/L	-	-	0.12	<0.0005	<0.0005
	Zinc (Zn) [b]	mg/L	0.11 to 0.19	0.13 to 0.34	-	0.00320	<0.003
Dissolved Metals	Aluminum (Al) [f]	mg/L	0.05	0.1	-	0.00190	<0.001
	Antimony (Sb)	mg/L	-	-	-	0.000160	0.000100
	Arsenic (As)	mg/L	-	-	-	0.000230	0.000160
	Barium (Ba)	mg/L	-	-	-	0.116	0.0794
	Beryllium (Be)	mg/L	-	-	-	<0.00002	<0.00002
	Bismuth (Bi)	mg/L	-	-	-	<0.00005	<0.00005
	Boron (B)	mg/L	-	-	-	0.0110	0.0130
	Cadmium (Cd) [b,g]	µg/L	0.38 to 0.46	1.4 to 2.8	0.26 to 1.6	0.0117	<0.005
	Calcium (Ca)	mg/L	-	-	-	66.7	144
	Chromium (Cr)	mg/L	-	-	-	<0.0001	0.000110
	Cobalt (Co)	µg/L	-	-	-	<0.1	<0.1
	Copper (Cu) [h]	mg/L	0.00060 to 0.0047	0.0038 to 0.028	-	0.000300	0.000360
	Iron (Fe)	mg/L	-	0.35	1.1	<0.01	<0.01
	Lead (Pb)	mg/L	-	-	-	<0.00005	<0.00005
	Lithium (Li)	mg/L	-	-	-	0.00700	0.0275
	Magnesium (Mg)	mg/L	-	-	-	23.1	107
	Manganese (Mn)	mg/L	-	-	-	0.00279	0.000850
	Mercury (Hg)	mg/L	-	-	-	<0.000005	<0.000005
	Molybdenum (Mo)	mg/L	-	-	-	0.000893	0.00132
	Nickel (Ni)	mg/L	-	-	-	0.00186	0.00136
	Potassium (K)	mg/L	-	-	-	1.33	3.17
	Selenium (Se)	mg/L	-	-	-	0.000767	0.00644
	Silicon (Si)	mg/L	-	-	-	3.52	3.83
	Silver (Ag)	mg/L	-	-	-	<0.00001	<0.00001
	Sodium (Na)	mg/L	-	-	-	3.52	5.03
	Strontium (Sr)	mg/L	-	-	-	0.219	0.278
	Thallium (Tl)	mg/L	-	-	-	<0.00001	<0.00001
	Tin (Sn)	mg/L	-	-	-	<0.0001	<0.0001
	Titanium (Ti)	mg/L	-	-	-	<0.0003	<0.0003
	Uranium (U)	mg/L	-	-	-	0.000502	0.00289
	Vanadium (V)	mg/L	-	-	-	<0.0005	<0.0005
	Zinc (Zn)	mg/L	-	-	-	0.00140	0.00290

Exceeds the Long-term Average BC WQG for the protection of freshwater aquatic life (BCMOECCS 2021a,b).

Exceeds the Short-term Maximum BC WQG for the protection of freshwater aquatic life (BCMOECCS 2021a,b).

Exceeds the site-specific EVWQP Level 1 Benchmark (Teck 2014) or relevant site-specific screening value.

Notes: BC WQGs = British Columbia Water Quality Guidelines; EVWQP = Elk Valley Water Quality Plan; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; - = no data/not applicable; < = less than; ≥ = greater than or equal to; % = percent; °C = degrees Celsius; µg/L = micrograms per litre; MU = Management Unit.

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

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

[c] The upper (i.e., highest) EVWQP Level 1 Benchmark for nitrate was calculated based on the maximum applicable hardness (Teck 2014).

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

[e] The EVWQP Level 1 Benchmark for selenium (i.e., 0.070 mg/L for MU 1; Golder 2014) was derived for lotic habitats and does not apply to Greenhills Creek Sedimentation Pond.

[f] Dissolved aluminum guidelines were calculated based on the pH of individual water samples.

[g] The upper (highest) EVWQP Level 1 Benchmark for dissolved cadmium was calculated based on the maximum applicable hardness (Teck 2014).

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

Table C.3: Depth Profiles for Greenhills Pond, 2018 to 2021

Date	UTM Coordinates (NAD83, 11U)		Depth (m)	Temperature (°C)	pH	Dissolved Oxygen		Conductivity (µS/cm)	Specific Conductance (µS/cm)
	Easting	Northing				mg/L	%		
07-Sep-18	653480	5545945	Surface	12.4	8.01	9.80	109	1,215	1,594
			1.0	12.5	8.02	9.70	110	1,215	1,594
			2.0	12.5	8.03	9.90	112	1,214	1,595
			3.0	12.5	8.04	9.90	110	1,213	1,596
			4.0	12.2	8.03	10.10	113	1,206	1,595
			5.0	12.1	8.03	10.40	116	1,207	1,604
			5.5	12.0	7.96	9.80	110	1,208	1,608
11-Oct-18	653484	5545945	Surface	4.9	8.85	15.67	123	1,042	1,691
			0.5	4.7	8.87	15.70	123	1,035	1,693
			1.0	4.6	8.88	15.73	123	1,035	1,693
			2.0	4.4	8.89	15.75	122	1,028	1,694
			3.0	4.4	8.89	15.74	122	1,027	1,694
			4.0	4.4	8.89	15.74	122	1,027	1,694
			5.0	4.4	8.89	15.81	123	1,027	1,694
24-Apr-19	653471	5545949	Surface	6.8	8.32	10.64	87	653	1,005
			0.5	6.7	8.36	10.93	89	652	1,006
			1.0	6.7	8.37	10.94	90	676	1,041
			1.5	6.4	8.21	10.78	89	790	1,228
			2.0	4.8	7.90	8.38	66	1,032	1,691
			2.5	4.4	7.87	7.73	60	1,025	1,704
			3.0	4.0	7.84	7.24	56	1,022	1,709
			3.5	4.0	7.72	4.20	32	1,030	1,718
			4.0	4.1	7.60	3.40	26	1,032	1,720
			4.5	4.1	7.58	3.28	26	1,032	1,718
			5.0	4.1	7.59	3.18	24	1,032	1,719
			5.5	4.1	7.59	3.11	24	1,033	1,719
			6.0	4.1	7.59	3.07	24	1,033	1,719
12-Sep-19	653471	5545949	Surface	14.1	8.17	10.90	107	1,080	1,365
			1.0	14.0	8.17	10.80	106	1,078	1,366
			2.0	13.8	8.18	10.90	106	1,075	1,368
			3.0	13.8	8.16	10.80	105	1,082	1,378
			4.0	13.3	8.15	11.00	106	1,080	1,393
			5.0	12.8	8.13	11.10	105	1,075	1,400
			5.5	12.7	8.09	10.80	103	1,070	1,399
10-Oct-19	653466	5545942	Surface	3.1	8.03	11.23	100	885	1,504
			1.0	3.4	8.08	11.24	100	885	1,505
			2.0	3.4	8.10	11.24	100	884	1,505
			3.0	3.3	8.11	11.25	100	882	1,506
			4.0	3.5	8.11	11.20	100	886	1,504
			5.0	3.5	8.11	11.17	100	887	1,504
			5.7	3.5	8.11	11.17	100	888	1,504
10-Sep-20	653478	5545938	Surface	12.8	8.39	8.95	83	1,541	2,010
			1.0	12.8	8.48	8.65	82	1,542	2,009
			2.0	12.8	8.48	8.68	81	1,541	2,009
			3.0	12.7	8.48	8.40	82	1,539	2,010
			4.0	12.4	8.47	9.04	85	1,553	2,039
			5.0	12.1	8.45	9.30	87	1,545	2,051

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.

Table C.3: Depth Profiles for Greenhills Pond, 2018 to 2021

Date	UTM Coordinates (NAD83, 11U)		Depth (m)	Temperature (°C)	pH	Dissolved Oxygen		Conductivity (µS/cm)	Specific Conductance (µS/cm)
	Easting	Northing				mg/L	%		
23-Sep-21	653654	5546040	Surface	10.4	8.34	10.42	111	1,208	1,680
			0.5	10.4	8.34	10.35	110	1,206	1,680
			1.0	10.3	8.33	10.29	110	1,204	1,680
			1.5	10.3	8.34	10.22	109	1,204	1,680
			2.0	10.2	8.33	10.44	111	1,201	1,680
21-Sep-21	653481	5545994	0.5	10.1	8.33	9.56	101	1,200	1,680
			1.0	10.0	8.33	9.73	102	1,197	1,680
			1.5	10.0	8.34	9.65	102	1,196	1,680
			2.0	9.9	8.33	9.81	103	1,196	1,680
			2.5	9.9	8.33	9.55	100	1,195	1,680
			3.0	9.9	8.33	9.76	103	1,194	1,680
			3.5	9.8	8.24	9.71	102	1,190	1,680
			4.0	9.5	8.26	9.53	99	1,188	1,690
			4.5	9.5	8.27	9.42	98	1,186	1,690
21-Sep-21	653681	5545999	0.5	10.0	8.28	9.85	103	1,196	1,680
			1.0	10.0	8.30	9.86	104	1,196	1,680
			1.5	10.0	8.31	9.48	100	1,195	1,680
			2.0	10.0	8.30	9.41	99	1,195	1,680
			2.5	10.0	8.29	9.02	95	1,195	1,670
			3.0	10.0	8.29	9.25	97	1,194	1,680
			3.5	10.0	8.29	8.95	95	1,195	1,670
23-Sep-21	653537	5545648	Surface	10.3	8.33	10.1	108	1,208	1,680
			0.5	10.3	8.33	9.95	106	1,207	1,680
			1.0	10.3	8.33	10.1	108	1,207	1,680
			1.5	10.3	8.33	9.95	106	1,207	1,680
			2.0	10.3	8.33	10.03	107	1,207	1,680
			2.5	10.3	8.33	10	107	1,208	1,680
			3.0	10.3	8.33	9.95	106	1,208	1,680
			3.5	10.3	8.32	9.92	106	1,207	1,680
			4.0	10.1	8.28	9.87	105	1,201	1,680
			4.5	10.0	8.26	9.89	105	1,202	1,690
			5.0	10.0	8.25	9.84	104	1,202	1,690
			5.5	9.9	8.22	9.21	97	1,200	1,690
22-Sep-21	653681	5545953	Surface	10.1	8.32	9.75	104	1,202	1,680
			0.5	10.1	8.33	9.7	104	1,202	1,680
			1.0	10.1	8.32	9.72	103	1,202	1,680
			1.5	10.1	8.32	9.75	104	1,201	1,680
			2.0	10.1	8.32	9.75	104	1,202	1,680
			2.5	10.1	8.31	9.79	104	1,202	1,680
			3.0	10.1	8.30	9.75	104	1,201	1,680
			3.5	10.1	8.30	9.77	104	1,201	1,680
			4.0	10.1	8.27	9.64	103	1,201	1,680
			4.5	10.0	8.22	8.51	90	1,198	1,680

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.

Table C.4: Concentrations of Selenium Species Measured in Water Samples Collected from Biological Monitoring Areas on Greenhills and Gardine Creeks, 2021

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]
Upper Greenhills Creek	RG_GHUT	17-Feb-21	238	0.373	<0.010	0.013	<0.010	<0.010	<0.010	<0.010	<0.010	0.023
		13-Sep-21	230	0.363	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	RG_GHNF	10-Sep-21	189	1.10	<0.010	0.017	<0.010	<0.010	<0.010	<0.010	<0.010	<0.027 [b]
	RG_GHFF	09-Sep-21	167	1.08	<0.010	0.029	<0.010	<0.010	<0.010	<0.010	<0.010	<0.039
	GH_GH1A [c]	26-Aug-21	140	1.12	<0.010	0.031	<0.010	<0.010	<0.010	<0.010	<0.010	<0.041
		17-Sep-21	159	0.851	<0.010	0.014	<0.010	<0.010	<0.010	<0.010	<0.010	<0.024
		06-Oct-21	149	0.839	<0.010	0.021	<0.010	<0.010	<0.010	<0.010	<0.010	<0.031 [b]
		09-Nov-21	137	0.544	<0.010	<0.022	<0.010	<0.010	<0.010	<0.010	<0.010	<0.032 [b]
		06-Dec-21	100	0.633	<0.010	0.013	<0.010	<0.010	<0.010	<0.010	<0.010	<0.023
Greenhills Creek Sedimentation Pond	RG_GHP	23-Sep-21	124	3.52	0.213	0.098	<0.010	<0.010	<0.010	<0.010	<0.010	0.311
Lower Greenhills Creek	GH_GH1SP_DS1 [c]	26-Aug-21	120	3.80	0.042	0.082	<0.010	<0.010	<0.010	<0.010	<0.010	0.124
		14-Sep-21	133	3.44	0.163	0.121	<0.010	<0.010	<0.010	<0.010	<0.010	0.284
		06-Oct-21	129	3.69	0.119	0.103	<0.010	<0.010	<0.010	<0.010	<0.010	0.222
		11-Nov-21	136	2.30	0.065	0.069	<0.010	<0.010	<0.010	<0.010	<0.010	0.134
		06-Dec-21	95.2	0.937	<0.010	0.027	<0.010	<0.010	<0.010	<0.010	<0.010	<0.037
	RG_GHBP	18-Feb-21	120	1.46	0.066	0.032	<0.010	<0.010	<0.010	<0.010	<0.010	0.098
		13-Sep-21	132	4.23	0.250	0.099	<0.010	<0.010	<0.010	<0.010	<0.010	0.349
Gardine Creek	RG_GAUT	16-Sep-21	0.437	0.108	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	RG_GANF	15-Sep-21	5.39	0.112	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010

Exceeds the site-specific EVWQP Level 1 Benchmark (70 µg/L; Teck 2014).

Exceeds the Long-term Average BC WQG for the protection of freshwater aquatic life (2 µg/L; BCMOECCS 2021b).

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; EVWQP = Elk Valley Water Quality Plan; 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] Samples were collected as part of the 2021 Elk Valley Selenium Speciation Monitoring Program (ADEPT 2022).

Table C.5: Temporal Changes in Concentrations of Water Quality Parameters with Early Warning Triggers (EWT) at Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2016 to 2021

Parameter [a]	Station	Annual Variation [b]		Q1. Is there a positive or negative change in concentrations since the base year (b) of monitoring? MOD [c] and Significance (bolded) from Base Year (b) [d]						Q2. Is the 2021 annual mean greater or less than all annual historical means (2016 to 2020)? [d]						
		DF	P-Value	2016	2017	2018	2019	2020	2021	2016	2017	2018	2019	2020	2021	2021 vs. 2016 to 2020
Nitrate-N	GH_CTF	4	<0.001	-	b	-0.4	-10	**-20**	**-23**	-	A	A	AB	B	B	-
	GH_HWGH_BRB	4	0.158	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GC1	4	0.464	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GH1B	4	<0.001	-	b	15	-4.8	-6.3	**-25**	-	A	A	AB	AB	B	-
	GH_GH1	5	<0.001	b	25	**38**	-10	-2.4	-18	BC	AB	A	C	C	C	-
	GH_GH5	2	<0.001	-	-	b	**-32**	**-34**	-	-	-	A	B	B	-	-
	GH_GH2	4	<0.001	-	b	-8.3	**-33**	**-33**	**-41**	-	A	A	B	B	B	-
Nitrite-N	GH_CTF	4	<0.001	-	b	**276**	0.1	-43	59	-	B	A	B	B	AB	-
	GH_HWGH_BRB	4	<0.001	-	b	130	-24	-26	49	-	AB	A	B	B	AB	-
	GH_GC1	4	0.003	-	b	194	-76	-94	-4.4	-	AB	A	B	AB	AB	-
	GH_GH1B	4	0.004	-	b	81	-39	-39	-11	-	AB	A	AB	B	AB	-
	GH_GH1	5	0.013	b	63	69	2.2	-23	-36	AB	A	A	AB	AB	B	-
	GH_GH5	2	0.001	-	-	b	**-43**	**-60**	-	-	-	A	B	B	-	-
	GH_GH2	4	<0.001	-	b	-16	-51	**-60**	**-76**	-	A	AB	ABC	BC	C	-
Sulphate	GH_CTF	4	0.711	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_HWGH_BRB	4	0.640	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GC1	4	<0.001	-	b	3.9	-31	-33	**-49**	-	A	A	AB	AB	B	-
	GH_GH1B	4	0.710	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GH1	5	<0.001	b	18	**35**	7.7	20	19	B	AB	A	B	AB	AB	-
	GH_GH5	2	0.107	-	-	ns	ns	ns	-	-	-	-	-	-	-	-
	GH_GH2	4	0.473	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
Total Dissolved Solids	GH_CTF	4	0.854	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_HWGH_BRB	4	0.829	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GC1	4	<0.001	-	b	4.2	-26	-24	**-40**	-	A	A	AB	AB	B	-
	GH_GH1B	4	0.357	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GH1	5	<0.001	b	15	**26**	6.3	**16**	9.5	C	ABC	A	BC	AB	ABC	-
	GH_GH5	2	0.166	-	-	ns	ns	ns	-	-	-	-	-	-	-	-
	GH_GH2	4	0.181	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
Total Antimony	GH_CTF	4	<0.001	-	b	**-19**	**-35**	**-44**	**-50**	-	A	B	C	D	E	↓
	GH_HWGH_BRB	4	<0.001	-	b	**-18**	**-31**	**-37**	**-45**	-	A	B	C	C	D	-
	GH_GC1	4	<0.001	-	b	55	-37	**-61**	**-52**	-	AB	A	BC	C	C	-
	GH_GH1B	4	<0.001	-	b	6.8	**-32**	**-31**	**-41**	-	A	A	B	B	B	-
	GH_GH1	5	<0.001	b	-11	5.9	**-41**	**-44**	**-49**	A	A	A	B	B	B	-
	GH_GH5	2	<0.001	-	-	b	**-45**	**-50**	-	-	-	A	B	B	-	-
	GH_GH2	4	<0.001	-	b	3.4	**-36**	**-39**	**-44**	-	A	A	B	B	B	-
Total Barium	GH_CTF	4	<0.001	-	b	**-12**	**-17**	**-20**	**-22**	-	A	B	BC	BC	C	-
	GH_HWGH_BRB	4	<0.001	-	b	**-12**	**-21**	**-23**	**-24**	-	A	B	BC	C	C	-
	GH_GC1	4	0.267	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GH1B	4	0.054	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GH1	5	<0.001	b	-0.5	-7.2	**-27**	**-24**	**-27**	A	A	A	B	B	B	-
	GH_GH5	2	<0.001	-	-	b	**-21**	**-22**	-	-	-	A	B	B	-	-
	GH_GH2	4	<0.001	-	b	**-11**	**-28**	**-25**	**-29**	-	A	B	C	C	C	-

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).

Significantly less than all historical years.
Significantly greater than all historical years.

Notes: DF = degrees of freedom; MOD = Magnitude of Difference; vs. = versus; < = less than; - = no data available/not applicable; ns = not significant; b = base year; > = greater than; % = percent; ANOVA = Analysis of Variance.

[a] Total boron is excluded from the table because there were too few detectable concentrations to support statistical comparisons

[b] The presence of annual variation was determined by a significant *Year* term (α = 0.05) using an ANOVA with factors *Year* and *Month*.

[c] The MOD was calculated as the concentrations in each year minus the concentrations in the first or base year divided by the concentration in the first or base year × 10C

[d] Significance between each year was determined using all pairwise comparisons with Tukey corrections

Table C.5: Temporal Changes in Concentrations of Water Quality Parameters with Early Warning Triggers (EWT) at Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2016 to 2021

Parameter [a]	Station	Annual Variation [b]		Q1. Is there a positive or negative change in concentrations since the base year (b) of monitoring? MOD [c] and Significance (bolded) from Base Year (b) [d]						Q2. Is the 2021 annual mean greater or less than all annual historical means (2016 to 2020)? [d]						
		DF	P-Value	2016	2017	2018	2019	2020	2021	2016	2017	2018	2019	2020	2021	2021 vs. 2016 to 2020
Total Lithium	GH_CTF	4	<0.001	-	b	7.6	5.6	**18**	**21**	-	C	ABC	BC	AB	A	-
	GH_HWGH_BRB	4	<0.001	-	b	6.9	4.9	**23**	**23**	-	B	AB	B	A	A	-
	GH_GC1	4	<0.001	-	b	53	-8.6	-10	-32	-	AB	A	B	B	B	-
	GH_GH1B	4	0.007	-	b	**24**	-1.0	15	7.8	-	B	A	B	AB	AB	-
	GH_GH1	5	<0.001	b	19	**69**	8.7	**27**	**24**	C	BC	A	BC	B	B	-
	GH_GH2	4	<0.001	-	b	**22**	-8.2	1.4	2.0	-	B	A	B	B	B	-
Total Manganese	GH_CTF	4	<0.001	-	b	**-32**	**-44**	**-43**	**-52**	-	A	B	B	B	B	-
	GH_HWGH_BRB	4	<0.001	-	b	**-42**	**-63**	**-71**	**-78**	-	A	B	BC	CD	D	-
	GH_GC1	4	<0.001	-	b	17	**-70**	**-79**	-55	-	A	A	B	B	AB	-
	GH_GH1B	4	0.005	-	b	-44	**-73**	-57	-61	-	A	AB	B	AB	AB	-
	GH_GH1	5	0.014	b	-10	-0.7	-28	-20	**-51**	A	AB	A	AB	AB	B	-
	GH_GH2	4	0.060	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
Total Molybdenum	GH_CTF	4	<0.001	-	b	**-20**	**-35**	**-42**	**-48**	-	A	B	C	CD	D	-
	GH_HWGH_BRB	4	<0.001	-	b	**-20**	**-33**	**-37**	**-44**	-	A	B	C	CD	D	-
	GH_GC1	4	0.039	-	b	**106**	18	17	22	-	B	A	AB	AB	AB	-
	GH_GH1B	4	<0.001	-	b	24	-22	**-25**	**-33**	-	AB	A	BC	C	C	-
	GH_GH1	5	<0.001	b	-13	32	**-31**	**-42**	**-47**	AB	BC	A	CD	D	D	-
	GH_GH2	4	<0.001	-	b	**55**	-10	**-33**	-16	-	B	A	BC	C	BC	-
Total Nickel	GH_CTF	4	<0.001	-	b	-12	**-47**	**-50**	**-59**	-	A	A	B	BC	C	-
	GH_HWGH_BRB	4	<0.001	-	b	-20	**-51**	**-52**	**-61**	-	A	A	B	B	B	-
	GH_GC1	4	<0.001	-	b	49	-46	**-57**	**-66**	-	AB	A	BC	C	C	-
	GH_GH1B	4	<0.001	-	b	-12	**-49**	**-49**	**-58**	-	A	A	B	B	B	-
	GH_GH1	5	<0.001	b	12	1.1	**-47**	**-48**	**-57**	A	A	A	B	B	B	-
	GH_GH2	4	<0.001	-	b	**-29**	**-60**	**-62**	**-66**	-	A	B	C	C	C	-
Total Selenium	GH_CTF	4	0.721	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_HWGH_BRB	4	0.505	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GC1	4	0.663	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GH1B	4	0.661	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GH1	5	<0.001	b	**40**	**53**	**28**	**41**	**40**	B	A	A	A	A	A	-
	GH_GH2	4	0.416	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
Total Uranium	GH_CTF	4	0.945	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_HWGH_BRB	4	0.802	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GC1	4	<0.001	-	b	10	**-33**	**-37**	**-45**	-	A	A	B	B	B	-
	GH_GH1B	4	0.425	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GH1	5	<0.001	b	18	**34**	5.0	15	16	B	AB	A	B	AB	AB	-
	GH_GH2	4	0.252	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-

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).

Significantly less than all historical years.
Significantly greater than all historical years.

Notes: DF = degrees of freedom; MOD = Magnitude of Difference; vs. = versus; < = less than; - = no data available/not applicable; ns = not significant; b = base year; > = greater than; % = percent; ANOVA = Analysis of Variance.

[a] Total boron is excluded from the table because there were too few detectable concentrations to support statistical comparisons.

[b] The presence of annual variation was determined by a significant *Year* term (α = 0.05) using an ANOVA with factors *Year* and *Month*.

[c] The MOD was calculated as the concentrations in each year minus the concentrations in the first or base year divided by the concentration in the first or base year × 100.

[d] Significance between each year was determined using all pairwise comparisons with Tukey corrections.

Table C.5: Temporal Changes in Concentrations of Water Quality Parameters with Early Warning Triggers (EWT) at Water Quality Monitoring Stations on Greenhills and Gardine Creeks, 2016 to 2021

Parameter [a]	Station	Annual Variation [b]		Q1. Is there a positive or negative change in concentrations since the base year (b) of monitoring? MOD [c] and Significance (bolded) from Base Year (b) [d]						Q2. Is the 2021 annual mean greater or less than all annual historical means (2016 to 2020)? [d]						
		DF	P-Value	2016	2017	2018	2019	2020	2021	2016	2017	2018	2019	2020	2021	2021 vs. 2016 to 2020
Total Zinc	GH_CTF	4	<0.001	-	b	-10	-30	**-49**	**-64**	-	A	A	AB	BC	C	-
	GH_HWGH_BRB	4	0.167	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GC1	4	0.154	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GH1B	4	0.381	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GH1	5	0.661	ns	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GH2	4	0.002	-	b	-22	-96	-40	-47	-	A	A	A	A	A	-
Dissolved Cadmium	GH_CTF	4	0.012	-	b	-35	96	121	51	-	AB	B	A	A	AB	-
	GH_HWGH_BRB	4	0.252	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GC1	4	0.051	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GH1B	4	0.164	-	ns	ns	ns	ns	ns	-	-	-	-	-	-	-
	GH_GH1	5	0.014	b	41	6.7	32	66	-14	AB	AB	AB	AB	A	B	-
	GH_GH2	4	0.002	-	b	21	-14	11	-30	-	AB	A	AB	A	B	-
Dissolved Cobalt	GH_CTF	4	<0.001	-	b	**-46**	-92	**-63**	-92	-	A	B	AB	B	AB	-
	GH_HWGH_BRB	4	<0.001	-	b	**-56**	-84	-84	-84	-	A	B	AB	AB	AB	-
	GH_GC1	4	<0.001	-	b	**929**	-28	-97	-97	-	B	A	B	AB	AB	-
	GH_GH1B	4	0.002	-	b	82	-97	-46	-35	-	AB	A	AB	B	AB	-
	GH_GH1	5	<0.001	b	-19	89	-34	-95	-95	AB	B	A	B	AB	AB	-
	GH_GH2	4	<0.001	-	b	28	-79	-79	-79	-	A	A	A	A	A	-

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).

Significantly less than all historical years.
Significantly greater than all historical years.

Notes: DF = degrees of freedom; MOD = Magnitude of Difference; vs. = versus; < = less than; - = no data available/not applicable; ns = not significant; b = base year; > = greater than; % = percent; ANOVA = Analysis of Variance.

[a] Total boron is excluded from the table because there were too few detectable concentrations to support statistical comparisons.

[b] The presence of annual variation was determined by a significant *Year* term (α = 0.05) using an ANOVA with factors *Year* and *Month*.

[c] The MOD was calculated as the concentrations in each year minus the concentrations in the first or base year divided by the concentration in the first or base year × 100.

[d] Significance between each year was determined using all pairwise comparisons with Tukey corrections.

Table C.6: Comparison of Relative Monthly Mean Concentrations of Analytes Before (May to September 2017) and After (May to September 2018 to 2021) Calcite Treatment for Stations Upstream (GH_GH1) and Downstream (GH_GH2) of Water Treatment [a]

Analyte		Units	Sample Size [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	2018	2019	2020	2021		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	0.455	-	-	-	-	-	-	-	-
	Conductivity, Lab	µS/cm	5	4	4	5	5	0.938	-	-	-	-	-	-	-	-
	Hardness (as $CaCO_3$)	mg/L	5	4	4	5	5	0.919	-	-	-	-	-	-	-	-
	pH, Field	pH	5	4	4	5	5	0.691	-	-	-	-	-	-	-	-
	pH, Lab	pH	5	4	4	5	5	0.471	-	-	-	-	-	-	-	-
	ORP, Field	mV	5	3	4	5	5	0.192	-	-	-	-	-	-	-	-
	ORP, Lab	mV	5	4	4	5	5	0.522	-	-	-	-	-	-	-	-
	Total Suspended Solids, Lab	mg/L	5	4	4	5	5	0.800	-	-	-	-	-	-	-	-
	Total Dissolved Solids	mg/L	5	4	4	5	5	0.917	-	-	-	-	-	-	-	-
	Turbidity, Field	NTU	4	4	4	5	5	0.955	-	-	-	-	-	-	-	-
	Turbidity, Lab	NTU	5	4	4	5	5	0.243	-	-	-	-	-	-	-	-
	Dissolved Oxygen-Field	mg/L	5	4	4	5	5	0.367	-	-	-	-	-	-	-	-
	Dissolved Oxygen-Field	%	5	4	4	5	5	0.430	-	-	-	-	-	-	-	-
	Temperature-Field	°C	5	4	4	5	5	0.838	-	-	-	-	-	-	-	-
Acidity and Alkalinity	Acidity (as $CaCO_3$)	mg/L	0	0	0	0	0	nd	-	-	-	-	-	-	-	-
	Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L	5	4	4	5	5	0.201	-	-	-	-	-	-	-	-
	Alkalinity, Carbonate (as $CaCO_3$)	mg/L	5	4	4	5	5	0.745	-	-	-	-	-	-	-	-
	Alkalinity, Hydroxide (as $CaCO_3$)	mg/L	0	0	0	0	0	nd	-	-	-	-	-	-	-	-
	Alkalinity, Total (as $CaCO_3$)	mg/L	5	4	4	5	5	0.067	-	-	-	-	-	-	-	-
Anions and Nutrients	Ammonia as N	mg/L	5	4	4	5	5	0.059	-	-	-	-	-	-	-	-
	Bromide (Br)	mg/L	0	0	0	0	0	nd	-	-	-	-	-	-	-	-
	Chloride (Cl)	mg/L	2	4	2	4	5	nd	-	-	-	-	-	-	-	-
	Fluoride (F)	mg/L	4	4	4	4	5	0.813	-	-	-	-	-	-	-	-
	Nitrate (as N)	mg/L	5	4	4	5	5	0.892	-	-	-	-	-	-	-	-
	Nitrite (as N)	mg/L	5	4	3	5	3	0.782	-	-	-	-	-	-	-	-
	Total Kjeldahl Nitrogen	mg/L	5	4	4	5	5	0.433	-	-	-	-	-	-	-	-
	Orthophosphate-Dissolved (as P)	mg/L	3	3	0	2	3	0.583	-	-	-	-	-	-	-	-
	Phosphorus (P)-Total	mg/L	5	4	4	5	5	0.038	0.845	-	0.969	-	0.909	-	0.104	-
	Sulphate (SO_4)	mg/L	5	4	4	5	5	0.819	-	-	-	-	-	-	-	-
Organic Carbon	Dissolved Organic Carbon	mg/L	5	4	4	5	5	0.092	-	-	-	-	-	-	-	-
	Total Organic Carbon	mg/L	5	4	4	5	5	0.608	-	-	-	-	-	-	-	-
Total Metals	Aluminum (Al)	mg/L	5	4	4	5	5	0.161	-	-	-	-	-	-	-	-
	Antimony (Sb)	mg/L	5	4	4	5	5	0.669	-	-	-	-	-	-	-	-
	Arsenic (As)	mg/L	5	4	4	5	5	0.306	-	-	-	-	-	-	-	-
	Barium (Ba)	mg/L	5	4	4	5	5	0.495	-	-	-	-	-	-	-	-
	Beryllium (Be)	mg/L	1	0	0	0	0	nd	-	-	-	-	-	-	-	-
	Bismuth (Bi)	mg/L	0	0	0	0	0	nd	-	-	-	-	-	-	-	-
	Boron (B)	mg/L	5	4	2	5	4	0.920	-	-	-	-	-	-	-	-
	Cadmium (Cd)	mg/L	5	4	4	5	5	0.085	-	-	-	-	-	-	-	-
	Calcium (Ca)	mg/L	5	4	4	5	5	0.374	-	-	-	-	-	-	-	-

P-value <0.05.
Positive MOD (increase in concentration of analyte at GH_GH2 relative to GH_GH1).
Negative MOD (decrease in concentration of analyte at GH_GH2 relative to GH_GH1).

Notes: ANOVA = Analysis of Variance; vs. = versus; MOD = magnitude of difference; % = percent; µS/cm = microSiemens per centimetre; NA = not applicable; - = no significant difference observed; $CaCO_3$ = 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] The antiscalant addition facility was not operating in May 2018, September 2019, or May 2020; consequently, data for these months were excluded from the "after" dataset.

[b] Comparison conducted 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 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$_{\text{observed post-treatment}}$ − GH_GH2$_{\text{predicted post-treatment}}$)/GH_GH2$_{\text{predicted post-treatment}}$ × 100%, where GH_GH2$_{\text{predicted post-treatment}}$ is the geometric mean for GH2 post-treatment and GH_GH2$_{\text{predicted post-treatment}}$ is the predicted mean concentration for GH_GH2 assuming the ratio of concentration of GH_GH1 to GH_GH2 are the same as pre-treatment (i.e., GH_GH2$_{\text{predicted post-treatment}}$ = 10^[$\log_{10}$(GH_GH1$_{\text{post-treatment}}$) + $\log_{10}$(GH_GH2$_{\text{pre-treatment}}$) - $\log_{10}$(GH_GH1$_{\text{pre-treatment}}$)].

Table C.6: Comparison of Relative Monthly Mean Concentrations of Analytes Before (May to September 2017) and After (May to September 2018 to 2021) Calcite Treatment for Stations Upstream (GH_GH1) and Downstream (GH_GH2) of Water Treatment [a]

Analyte		Units	Sample Size [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	2018	2019	2020	2021		P-value	MOD (%) [d]	P-value	MOD (%) [d]	P-value	MOD (%) [d]	P-value	MOD (%) [d]
Total Metals	Chromium (Cr)	mg/L	5	2	3	5	5	0.623	-	-	-	-	-	-	-	-
	Cobalt (Co)	mg/L	2	2	0	1	2	nd	-	-	-	-	-	-	-	-
	Copper (Cu)	mg/L	2	1	1	4	3	nd	-	-	-	-	-	-	-	-
	Iron (Fe)	mg/L	5	4	4	5	5	0.197	-	-	-	-	-	-	-	-
	Lead (Pb)	mg/L	1	1	0	2	3	nd	-	-	-	-	-	-	-	-
	Lithium (Li)	mg/L	5	4	4	5	5	0.585	-	-	-	-	-	-	-	-
	Magnesium (Mg)	mg/L	5	4	4	5	5	0.634	-	-	-	-	-	-	-	-
	Manganese (Mn)	mg/L	5	4	4	5	5	0.329	-	-	-	-	-	-	-	-
	Mercury (Hg)	µg/L	4	3	4	5	5	0.093	-	-	-	-	-	-	-	-
	Methyl Mercury	µg/L	0	4	4	5	5	nd	-	-	-	-	-	-	-	-
	Molybdenum (Mo)	mg/L	5	4	4	5	5	<0.001	0.067	-	<0.001	140	0.075	-	0.005	87
	Nickel (Ni)	mg/L	5	4	4	5	5	0.375	-	-	-	-	-	-	-	-
	Potassium (K)	mg/L	5	4	4	5	5	0.262	-	-	-	-	-	-	-	-
	Selenium (Se)	µg/L	5	4	4	5	5	0.807	-	-	-	-	-	-	-	-
	Silicon (Si)-Total	mg/L	5	4	4	5	5	0.775	-	-	-	-	-	-	-	-
	Silver (Ag)	mg/L	1	0	0	0	0	nd	-	-	-	-	-	-	-	-
	Sodium (Na)	mg/L	5	4	4	5	5	0.889	-	-	-	-	-	-	-	-
	Strontium (Sr)	mg/L	5	4	4	5	5	0.993	-	-	-	-	-	-	-	-
	Thallium (Tl)	mg/L	5	4	0	1	1	0.372	-	-	-	-	-	-	-	-
	Tin (Sn)	mg/L	0	0	0	1	0	nd	-	-	-	-	-	-	-	-
	Titanium (Ti)	mg/L	0	0	0	0	5	nd	-	-	-	-	-	-	-	-
	Uranium (U)	mg/L	5	4	4	5	5	0.423	-	-	-	-	-	-	-	-
	Vanadium (V)	mg/L	2	0	1	2	2	nd	-	-	-	-	-	-	-	-
	Zinc (Zn)	mg/L	2	1	1	5	4	nd	-	-	-	-	-	-	-	-
Dissolved Metals	Aluminum (Al)	mg/L	3	1	1	1	4	0.451	-	-	-	-	-	-	-	-
	Antimony (Sb)	mg/L	5	4	4	5	5	0.179	-	-	-	-	-	-	-	-
	Arsenic (As)	mg/L	5	4	4	5	5	0.877	-	-	-	-	-	-	-	-
	Barium (Ba)	mg/L	5	4	4	5	5	0.040	0.207	-	0.715	-	1.000	-	0.980	-
	Beryllium (Be)	mg/L	0	0	0	0	0	nd	-	-	-	-	-	-	-	-
	Bismuth (Bi)	mg/L	0	0	0	0	0	nd	-	-	-	-	-	-	-	-
	Boron (B)	mg/L	5	3	3	3	4	0.880	-	-	-	-	-	-	-	-
	Cadmium (Cd)	mg/L	4	4	4	5	5	0.223	-	-	-	-	-	-	-	-
	Calcium (Ca)	mg/L	5	4	4	5	5	0.228	-	-	-	-	-	-	-	-
	Chromium (Cr)	mg/L	2	0	4	3	3	nd	-	-	-	-	-	-	-	-
	Cobalt (Co)	mg/L	2	2	0	0	0	nd	-	-	-	-	-	-	-	-
	Copper (Cu)	mg/L	3	1	0	5	5	0.401	-	-	-	-	-	-	-	-
	Iron (Fe)	mg/L	1	0	0	1	1	nd	-	-	-	-	-	-	-	-

P-value <0.05.

Positive MOD (increase in concentration of analyte at GH_GH2 relative to GH_GH1).

Negative MOD (decrease in concentration of analyte at GH_GH2 relative to GH_GH1).

Notes: ANOVA = Analysis of Variance; vs. = versus; MOD = magnitude of difference; % = percent; µS/cm = microSiemens per centimetre; NA = not applicable; - = no significant difference observed; $CaCO_3$ = 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] The antiscalant addition facility was not operating in May 2018, September 2019, or May 2020; consequently, data for these months were excluded from the "after" dataset.

[b] Comparison conducted 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 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 GH2 post-treatment and $GH\_GH2_{predicted\ post\text{-}treatment}$ is the predicted mean concentration for GH_GH2 assuming the ratio of concentration of GH_GH1 to GH_GH2 are 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 C.6: Comparison of Relative Monthly Mean Concentrations of Analytes Before (May to September 2017) and After (May to September 2018 to 2021) Calcite Treatment for Stations Upstream (GH_GH1) and Downstream (GH_GH2) of Water Treatment [a]

Analyte	Units	Sample Size [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	2018	2019	2020	2021		P-value	MOD (%) [d]	P-value	MOD (%) [d]	P-value	MOD (%) [d]	P-value	MOD (%) [d]
Lead (Pb)	mg/L	1	0	0	0	1	nd	-	-	-	-	-	-	-	-
Lithium (Li)	mg/L	5	4	4	5	5	0.176	-	-	-	-	-	-	-	-
Magnesium (Mg)	mg/L	5	4	4	5	5	0.790	-	-	-	-	-	-	-	-
Manganese (Mn)	mg/L	5	4	4	5	5	0.135	-	-	-	-	-	-	-	-
Mercury (Hg)	µg/L	1	1	0	0	0	nd	-	-	-	-	-	-	-	-
Molybdenum (Mo)	mg/L	5	4	4	5	5	<0.001	0.058	-	<0.001	132	0.059	-	0.002	88
Nickel (Ni)	mg/L	5	4	4	5	5	0.235	-	-	-	-	-	-	-	-
Potassium (K)	mg/L	5	4	4	5	5	0.653	-	-	-	-	-	-	-	-
Selenium (Se)	µg/L	5	4	4	5	5	0.111	-	-	-	-	-	-	-	-
Silicon (Si)	mg/L	5	4	4	5	5	0.766	-	-	-	-	-	-	-	-
Silver (Ag)	mg/L	0	0	0	0	0	nd	-	-	-	-	-	-	-	-
Sodium (Na)	mg/L	5	4	4	5	5	0.542	-	-	-	-	-	-	-	-
Strontium (Sr)	mg/L	5	4	4	5	5	0.993	-	-	-	-	-	-	-	-
Thallium (Tl)	mg/L	3	4	0	0	1	0.544	-	-	-	-	-	-	-	-
Tin (Sn)	mg/L	0	0	0	2	0	nd	-	-	-	-	-	-	-	-
Titanium (Ti)	mg/L	0	0	0	0	1	nd	-	-	-	-	-	-	-	-
Uranium (U)	mg/L	5	4	4	5	5	0.428	-	-	-	-	-	-	-	-
Vanadium (V)	mg/L	0	0	0	0	0	nd	-	-	-	-	-	-	-	-
Zinc (Zn)	mg/L	2	1	1	5	4	nd	-	-	-	-	-	-	-	-

P-value <0.05.

Positive MOD (increase in concentration of analyte at GH_GH2 relative to GH_GH1).

Negative MOD (decrease in concentration of analyte at GH_GH2 relative to GH_GH1).

Notes: ANOVA = Analysis of Variance; vs. = versus; MOD = magnitude of difference; % = percent; µS/cm = microSiemens per centimetre; NA = not applicable; - = no significant difference observed; $CaCO_3$ = 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] The antiscalant addition facility was not operating in May 2018, September 2019, or May 2020; consequently, data for these months were excluded from the "after" dataset.

[b] Comparison conducted 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 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 ($GH\_GH2_{observed\ post\text{-}treatment}$ − $GH\_GH2_{predicted\ post\text{-}treatment}$)/$GH\_GH2_{predicted\ post\text{-}treatment}$ × 100%, where $GH\_GH2_{predicted\ post\text{-}treatment}$ is the geometric mean for GH2 post-treatment and $GH\_GH2_{predicted\ post\text{-}treatment}$ is the predicted mean concentration for GH_GH2 assuming the ratio of concentration of GH_GH1 to GH_GH2 are the same as pre-treatment (i.e., $GH\_GH2_{predicted\ post\text{-}treatment} = 10^{[\log_{10}(GH\_GH1_{post\text{-}treatment}) + \log_{10}(GH\_GH2_{pre\text{-}treatment}) - \log_{10}(GH\_GH1_{pre\text{-}treatment})]}$).

APPENDIX D
SUBSTRATE QUALITY

Table D.1: Pebble Counts and Calcite Measurements at RG_GHUT on Upper Greenhills Creek, September 2021

RG_GHUT-1					RG_GHUT-2					RG_GHUT-3				
13-Sep-21					13-Sep-21					13-Sep-21				
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	4.5	**1**	2	1	1	calcite
2	2	1	1	calcite	**2**	0	1	1	1.2	**2**	2	1	1	calcite
3	2	1	1	calcite	**3**	0	1	0.5	4.0	**3**	0	1	0.7	1.5
4	2	1	1	calcite	**4**	0	1	1	2.5	**4**	0	1	0.8	1.6
5	2	1	1	calcite	**5**	0	1	1	3.6	**5**	0	1	0.5	0.8
6	2	1	1	calcite	**6**	0	1	1	7.0	**6**	0	1	0.9	1.0
7	2	1	1	calcite	**7**	2	1	1	calcite	**7**	1	1	0.9	11.2
8	2	1	1	calcite	**8**	0	1	1	silt	**8**	2	1	1	calcite
9	0	1	1	silt	**9**	0	1	1	silt	**9**	0	1	0.6	2.6
10	2	1	1	calcite	**10**	1	1	1	4.0	**10**	0	1	0.7	3.0
11	2	1	1	calcite	**11**	0	1	1	3.5	**11**	1	1	0.8	1.8
12	1	1	1	4.7	**12**	0	1	1	3.0	**12**	2	1	0.9	8.8
13	1	1	1	2.5	**13**	0	1	1	2.4	**13**	2	1	1	calcite
14	2	1	1	calcite	**14**	0	1	0.8	3.3	**14**	0	1	1	5.1
15	2	1	1	calcite	**15**	0	1	1	2.7	**15**	0	1	0.9	2.2
16	2	1	1	calcite	**16**	2	1	1	calcite	**16**	0	1	0.8	3.7
17	2	1	1	calcite	**17**	2	1	1	9.5	**17**	0	1	0.9	1.8
18	1	1	1	5.1	**18**	0	1	1	5.7	**18**	0	1	1	1.1
19	2	1	1	calcite	**19**	2	1	1	calcite	**19**	0	1	1	0.9
20	2	1	1	calcite	**20**	0	1	1	silt	**20**	1	1	1	2.5
21	2	1	1	calcite	**21**	0	1	1	5.0	**21**	1	1	1	3.9
22	0	1	1	silt	**22**	0	1	1	4.9	**22**	0	1	1	1.2
23	2	1	1	calcite	**23**	2	1	1	calcite	**23**	0	1	1	3.4
24	2	1	1	calcite	**24**	2	1	1	calcite	**24**	0	1	1	1.4
25	2	1	1	calcite	**25**	2	1	1	calcite	**25**	0	1	1	2.8
26	2	1	1	calcite	**26**	0	1	1	silt	**26**	0	1	1	1.5
27	2	1	1	calcite	**27**	0	1	1	4.0	**27**	0	1	0.8	2.6
28	1	1	1	2.4	**28**	0	1	1	1.5	**28**	0	1	1	silt
29	2	1	1	calcite	**29**	0	1	1	3.4	**29**	0	1	0.5	1.4
30	2	1	1	calcite	**30**	0	1	1	silt	**30**	2	1	0.9	6.2
31	2	1	1	calcite	**31**	0	1	1	5.9	**31**	0	1	1	2.7
32	2	1	1	calcite	**32**	1	1	1	4.6	**32**	1	1	1	2.8
33	2	1	1	calcite	**33**	2	1	1	calcite	**33**	0	1	0.8	2.2
34	0	1	1	silt	**34**	0	1	1	6.7	**34**	2	1	1	8.0
35	2	1	1	calcite	**35**	2	1	1	9.2	**35**	0	1	1	silt
36	2	1	1	calcite	**36**	2	1	1	calcite	**36**	0	1	0.8	2.6
37	2	1	1	calcite	**37**	0	1	1	2.4	**37**	2	1	1	9.2
38	2	1	1	calcite	**38**	2	1	1	calcite	**38**	1	1	1	9.5
39	2	1	1	calcite	**39**	2	1	1	calcite	**39**	2	1	1	9.8
40	2	1	1	calcite	**40**	0	1	1	silt	**40**	2	1	1	8.2
41	0	1	1	silt	**41**	0	1	1	2.5	**41**	2	1	1	6.5
42	2	1	1	calcite	**42**	0	1	1	silt	**42**	0	1	1	silt
43	0	1	1	silt	**43**	0	1	1	2.0	**43**	0	1	1	2.6
44	2	1	1	calcite	**44**	0	1	1	2.5	**44**	0	1	0.8	4.2
45	1	1	1	7.5	**45**	0	1	1	silt	**45**	0	1	0.7	1.9
46	2	1	1	calcite	**46**	0	1	1	8.4	**46**	0	1	0.6	1.8
47	2	1	1	calcite	**47**	2	1	1	calcite	**47**	0	1	0.8	1.7
48	1	1	1	3.2	**48**	2	1	1	5.2	**48**	2	1	1	3.5
49	2	1	1	calcite	**49**	2	1	1	9.8	**49**	0	1	1	2.7
50	2	1	1	calcite	**50**	0	1	1	2.6	**50**	0	1	1	3.0
Cc, Cp, and Cp' =	**1.68**	**1.00**	**1.00**	**-**	**Cc, Cp, and Cp' =**	**0.64**	**1.00**	**0.99**	**-**	**Cc, Cp, and Cp' =**	**0.60**	**1.00**	**0.90**	**-**
Calcite Index (CI) =			**2.68**		**Calcite Index (CI) =**			**1.64**		**Calcite Index (CI) =**			**1.60**	
Calcite Index Prime (CI') =			**2.68**		**Calcite Index Prime (CI') =**			**1.63**		**Calcite Index Prime (CI') =**			**1.50**	

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 D.1: Pebble Counts and Calcite Measurements at RG_GHUT on Upper Greenhills Creek, September 2021

RG_GHUT-4				
13-Sep-21				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	2	1	1	4.6
2	1	1	1	6.3
3	2	1	1	calcite
4	2	1	1	7.2
5	2	1	1	5.9
6	0	1	0.8	1.5
7	2	1	1	calcite
8	0	1	0.3	1.7
9	2	1	1	calcite
10	2	1	1	8.5
11	0	1	1	5.3
12	1	1	1	5.8
13	2	1	1	4.2
14	0	1	1	5.8
15	2	1	1	calcite
16	0	1	1	4.5
17	2	1	1	7.5
18	2	1	1	3.2
19	1	1	1	3.6
20	2	1	1	3.0
21	1	1	0.7	7.7
22	0	1	1	3.0
23	2	1	1	calcite
24	0	0	0	2.2
25	2	1	1	calcite
26	0	1	1	silt
27	0	1	0.4	1.5
28	0	1	1	2.0
29	2	1	1	calcite
30	2	1	1	calcite
31	0	1	1	4.4
32	0	1	1	silt
33	0	1	1	2.9
34	2	1	1	6.0
35	2	1	1	4.8
36	0	1	1	4.6
37	2	1	1	4.4
38	2	1	1	3.8
39	2	1	1	calcite
40	2	1	1	6.5
41	2	1	1	4.2
42	2	1	1	calcite
43	0	1	1	silt
44	2	1	1	calcite
45	2	1	1	6.8
46	2	1	1	2.5
47	2	1	1	calcite
48	2	1	1	calcite
49	0	1	1	silt
50	2	1	1	5.2
Cc, Cp, and Cp' =	**1.28**	**0.98**	**0.94**	**-**
Calcite Index (CI) =		**2.26**		
Calcite Index Prime (CI') =		**2.22**		

RG_GHUT-5				
13-Sep-21				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	0	1	1	3.5
2	2	1	0.9	4.4
3	0	1	1	silt
4	2	1	1	calcite
5	0	1	1	1.5
6	0	1	1	2.0
7	0	1	1	3.1
8	0	1	1	7.5
9	0	1	1	silt
10	2	1	1	6.8
11	0	1	1	2.0
12	2	1	1	5.7
13	0	1	0.9	2.7
14	0	1	1	2.2
15	0	1	0.5	1.5
16	0	1	1	2.9
17	0	1	1	2.3
18	0	1	1	0.8
19	0	1	1	silt
20	2	1	1	7.7
21	2	1	1	calcite
22	2	1	1	calcite
23	0	1	0.9	1.3
24	0	1	1	3.4
25	2	1	1	calcite
26	2	1	1	calcite
27	1	1	1	silt
28	0	1	1	1.2
29	0	1	0.7	1.0
30	0	1	1	1.0
31	0	1	1	0.8
32	0	1	1	1.7
33	2	1	1	calcite
34	0	1	0.8	1.9
35	2	1	1	calcite
36	2	1	1	calcite
37	0	1	1	silt
38	0	1	1	2.2
39	0	1	1	1.9
40	2	1	0.9	2.3
41	2	1	1	13.7
42	2	1	1	10.1
43	0	1	1	4.2
44	0	1	1	silt
45	0	1	1	2.7
46	0	1	1	1.5
47	2	1	1	calcite
48	2	1	1	calcite
49	0	1	1	4.9
50	0	1	0.7	4.7
Cc, Cp, and Cp' =	**0.70**	**1.00**	**0.97**	**-**
Calcite Index (CI) =		**1.70**		
Calcite Index Prime (CI') =		**1.67**		

RG_GHUT-6				
13-Sep-21				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	0	1	0.9	2.2
2	2	1	1	6.8
3	0	1	1	1.3
4	2	1	1	9.6
5	2	1	1	7.5
6	0	1	1	6.0
7	0	1	1	silt
8	0	1	1	2.3
9	0	1	0.6	2.0
10	2	1	1	3.9
11	2	1	1	3.9
12	0	1	1	2.5
13	0	1	1	3.0
14	2	1	1	9.0
15	0	1	1	silt
16	2	1	1	calcite
17	0	1	0.6	2.6
18	0	1	1	7.0
19	2	1	1	calcite
20	2	1	1	6.0
21	2	1	1	calcite
22	2	1	1	calcite
23	0	1	1	3.6
24	0	1	1	0.8
25	0	1	1	4.0
26	2	1	1	7.6
27	2	1	1	5.2
28	2	1	1	calcite
29	0	1	1	silt
30	0	1	1	2.0
31	2	1	1	5.0
32	2	1	1	5.6
33	0	1	1	silt
34	0	1	0.3	1.7
35	0	1	1	silt
36	2	1	1	6.0
37	2	1	1	calcite
38	0	1	1	silt
39	0	1	0.5	1.8
40	2	1	1	calcite
41	0	1	0.4	1.7
42	0	1	0.3	2.0
43	0	1	1	silt
44	0	1	0.5	2.7
45	2	1	1	9.2
46	0	1	0.2	2.4
47	0	1	0.5	2.2
48	0	1	1	8.5
49	2	1	1	6.5
50	2	1	1	4.5
Cc, Cp, and Cp' =	**0.88**	**1.00**	**0.90**	**-**
Calcite Index (CI) =		**1.88**		
Calcite Index Prime (CI') =		**1.78**		

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 D.2: Pebble Counts and Calcite Measurements at RG_GHNF on Upper Greenhills Creek, September 2021

RG_GHNF-1					RG_GHNF-2					RG_GHNF-3				
10-Sep-21					10-Sep-21					10-Sep-21				
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	0.8	14.7	**1**	0	1	1	silt	**1**	2	1	1	calcite
2	0	1	1	10.2	**2**	1	1	1	3.0	**2**	2	1	1	calcite
3	2	1	1	calcite	**3**	0	1	1	silt	**3**	0	1	1	silt
4	2	1	1	calcite	**4**	0	1	1	silt	**4**	2	1	1	calcite
5	1	1	0.6	6.4	**5**	1	1	1	2.0	**5**	0	1	1	silt
6	1	1	1	4.0	**6**	2	1	1	calcite	**6**	2	1	1	calcite
7	1	1	1	5.6	**7**	0	1	1	silt	**7**	2	1	1	calcite
8	2	1	1	calcite	**8**	0	1	1	silt	**8**	2	1	1	calcite
9	2	1	1	calcite	**9**	0	1	1	silt	**9**	0	1	1	silt
10	1	1	1	6.5	**10**	0	1	1	silt	**10**	0	1	1	2.1
11	2	1	1	calcite	**11**	1	1	1	7.0	**11**	0	1	1	silt
12	2	1	1	calcite	**12**	1	1	1	8.0	**12**	0	1	1	silt
13	2	1	1	calcite	**13**	0	1	1	silt	**13**	0	1	1	3.7
14	1	1	1	5.0	**14**	0	1	1	6.0	**14**	2	1	1	calcite
15	1	1	1	1.8	**15**	1	1	1	7.0	**15**	2	1	1	calcite
16	2	1	1	calcite	**16**	1	1	1	4.0	**16**	1	1	1	3.8
17	2	1	1	calcite	**17**	2	1	1	calcite	**17**	2	1	1	calcite
18	0	1	1	5.8	**18**	2	1	1	calcite	**18**	2	1	1	calcite
19	1	1	1	6.2	**19**	2	1	1	calcite	**19**	0	1	1	silt
20	0	1	1	4.8	**20**	2	1	1	calcite	**20**	1	1	1	5.4
21	2	1	1	calcite	**21**	0	1	1	silt	**21**	0	1	1	silt
22	2	1	1	calcite	**22**	0	1	1	silt	**22**	2	1	1	calcite
23	2	1	1	calcite	**23**	1	1	1	4.0	**23**	1	1	1	4.0
24	1	1	1	3.1	**24**	2	1	1	calcite	**24**	2	1	1	calcite
25	2	1	1	calcite	**25**	0	1	1	silt	**25**	0	1	1	silt
26	2	1	1	calcite	**26**	2	1	1	calcite	**26**	2	1	1	calcite
27	2	1	1	calcite	**27**	0	1	1	2.0	**27**	0	1	1	5.8
28	0	1	0.3	20.4	**28**	0	1	1	1.5	**28**	0	1	1	silt
29	2	1	1	calcite	**29**	0	1	1	2.5	**29**	2	1	1	calcite
30	2	1	1	calcite	**30**	0	1	1	silt	**30**	2	1	1	calcite
31	2	1	1	calcite	**31**	2	1	1	calcite	**31**	2	1	1	calcite
32	1	1	1	2.5	**32**	0	1	1	silt	**32**	2	1	1	calcite
33	2	1	1	calcite	**33**	0	1	1	silt	**33**	0	1	1	silt
34	2	1	1	calcite	**34**	0	1	1	4.5	**34**	1	1	1	7.4
35	2	1	1	calcite	**35**	1	1	1	4.0	**35**	1	1	1	4.6
36	1	1	1	1.7	**36**	1	1	1	6.0	**36**	0	1	1	silt
37	2	1	1	calcite	**37**	2	1	1	calcite	**37**	1	1	1	8.4
38	2	1	1	calcite	**38**	1	1	1	2.5	**38**	2	1	1	calcite
39	0	1	1	4.4	**39**	1	1	1	3.0	**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**	0	1	1	silt	**41**	0	1	1	silt
42	2	1	1	calcite	**42**	0	1	1	3.5	**42**	2	1	1	calcite
43	2	1	1	calcite	**43**	2	1	1	calcite	**43**	0	1	1	silt
44	0	1	1	silt	**44**	2	1	1	calcite	**44**	2	1	1	calcite
45	2	1	1	calcite	**45**	2	1	1	calcite	**45**	2	1	1	calcite
46	0	1	1	silt	**46**	2	1	1	calcite	**46**	2	1	1	calcite
47	2	1	1	calcite	**47**	0	1	1	silt	**47**	0	1	1	silt
48	2	1	1	calcite	**48**	0	1	1	silt	**48**	2	1	1	calcite
49	0	1	1	silt	**49**	2	1	1	calcite	**49**	2	1	1	calcite
50	2	1	1	calcite	**50**	2	1	1	calcite	**50**	2	1	1	calcite
Cc, Cp, and Cp' =	**1.44**	**1.00**	**0.97**	**-**	**Cc, Cp, and Cp' =**	**0.86**	**1.00**	**1.00**	**-**	**Cc, Cp, and Cp' =**	**1.20**	**1.00**	**1.00**	**-**
Calcite Index (CI) =		**2.44**			**Calcite Index (CI) =**		**1.86**			**Calcite Index (CI) =**		**2.20**		
Calcite Index Prime (CI') =		**2.41**			**Calcite Index Prime (CI') =**		**1.86**			**Calcite Index Prime (CI') =**		**2.20**		

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 D.2: Pebble Counts and Calcite Measurements at RG_GHNF on Upper Greenhills Creek, September 2021

RG_GHNF-4				
10-Sep-21				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	2	1	1	14.0
2	2	1	1	calcite
3	2	1	1	calcite
4	2	1	1	calcite
5	2	1	1	8.5
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	0	1	1	2.0
15	0	1	1	1.0
16	2	1	1	calcite
17	2	1	1	calcite
18	0	1	1	1.5
19	2	1	1	calcite
20	2	1	1	calcite
21	2	1	1	calcite
22	0	1	1	3.0
23	0	1	1	1.5
24	2	1	1	calcite
25	1	1	1	2.0
26	1	1	1	1.5
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	1	1	1	0.7
37	2	1	1	calcite
38	0	1	1	silt
39	2	1	1	calcite
40	0	1	1	silt
41	1	1	1	7.5
42	2	1	1	10.1
43	2	1	1	calcite
44	1	1	1	3.3
45	2	1	1	calcite
46	0	1	1	silt
47	2	1	1	calcite
48	2	1	1	3.5
49	1	1	1	2.5
50	0	1	1	silt
Cc, Cp, and Cp' =	**1.52**	**1.00**	**1.00**	**-**
Calcite Index (CI) =		**2.52**		
Calcite Index Prime (CI') =		**2.52**		

RG_GHNF-5				
11-Sep-21				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	2	1	1	calcite
2	0	1	1	2.0
3	0	1	1	2.2
4	0	1	1	1.5
5	0	1	1	1.0
6	1	1	1	7.0
7	2	1	1	calcite
8	2	1	1	calcite
9	0	1	1	silt
10	0	1	1	4.0
11	0	1	1	6.0
12	0	1	1	silt
13	0	1	1	4.5
14	0	1	1	2.7
15	2	1	1	calcite
16	2	1	1	calcite
17	0	1	1	silt
18	2	1	1	calcite
19	2	1	1	calcite
20	0	1	1	silt
21	0	1	1	silt
22	2	1	1	calcite
23	1	1	1	5.4
24	1	1	1	11.3
25	0	1	1	silt
26	1	1	1	2.7
27	2	1	1	calcite
28	2	1	1	calcite
29	0	1	1	silt
30	1	1	1	11.8
31	1	1	1	5.8
32	0	1	1	silt
33	0	1	1	silt
34	0	1	1	4.6
35	0	1	1	2.5
36	2	1	1	calcite
37	2	1	1	calcite
38	1	1	1	2.0
39	1	1	1	2.0
40	0	1	1	silt
41	2	1	1	calcite
42	1	1	1	6.0
43	2	1	1	calcite
44	0	1	1	silt
45	2	1	1	calcite
46	0	1	1	silt
47	2	1	1	calcite
48	2	1	1	calcite
49	1	1	1	1.0
50	0	1	1	4.0
Cc, Cp, and Cp' =	**0.88**	**1.00**	**1.00**	**-**
Calcite Index (CI) =		**1.88**		
Calcite Index Prime (CI') =		**1.88**		

RG_GHNF-6				
11-Sep-21				
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	silt
5	2	1	1	calcite
6	0	1	1	silt
7	2	1	1	calcite
8	2	1	1	calcite
9	0	1	1	2.4
10	2	1	1	calcite
11	2	1	1	calcite
12	2	1	1	calcite
13	0	1	1	silt
14	2	1	1	calcite
15	2	1	1	calcite
16	2	1	1	calcite
17	1	1	1	4.0
18	0	1	1	silt
19	2	1	1	calcite
20	0	1	1	silt
21	0	1	1	silt
22	2	1	1	calcite
23	2	1	1	calcite
24	2	1	1	calcite
25	0	1	1	silt
26	0	1	1	2.2
27	2	1	1	calcite
28	2	1	1	calcite
29	0	1	1	silt
30	1	1	1	4.0
31	2	1	1	calcite
32	2	1	1	calcite
33	2	1	1	calcite
34	0	1	1	silt
35	2	1	1	calcite
36	2	1	1	calcite
37	0	1	1	silt
38	0	1	1	silt
39	2	1	1	calcite
40	2	1	1	calcite
41	0	1	1	silt
42	2	1	1	calcite
43	0	1	1	silt
44	0	1	1	silt
45	0	1	1	3.6
46	0	1	1	4.8
47	2	1	1	calcite
48	2	1	1	calcite
49	0	1	1	3.5
50	0	1	1	silt
Cc, Cp, and Cp' =	**1.16**	**1.00**	**1.00**	**-**
Calcite Index (CI) =		**2.16**		
Calcite Index Prime (CI') =		**2.16**		

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 D.3: Pebble Counts and Calcite Measurements at RG_GHFF on Upper Greenhills Creek, September 2021

RG_GHFF-1					RG_GHFF-2					RG_GHFF-3				
09-Sep-21					09-Sep-21					09-Sep-21				
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	0.3	5.0	**1**	1	1	1	8.6	**1**	0	1	1	9.0
2	2	1	0.6	14.1	**2**	2	1	0.9	16.0	**2**	0	1	1	7.9
3	1	1	0.9	10.5	**3**	0	1	0.9	11.3	**3**	2	1	1	7.2
4	1	1	0.9	8.2	**4**	2	1	0.7	6.3	**4**	2	1	0.9	20.2
5	1	1	0.8	8.6	**5**	2	1	0.8	5.8	**5**	2	1	0.9	4.3
6	0	1	0.4	11.1	**6**	2	1	0.6	6.8	**6**	2	1	0.8	8.5
7	1	1	0.7	8.5	**7**	2	1	0.9	5.6	**7**	2	1	1	23.5
8	0	1	0.6	8.2	**8**	2	1	0.9	13.4	**8**	2	1	1	10.4
9	0	0	0	3.7	**9**	2	1	0.9	7.0	**9**	2	1	1	6.6
10	2	1	0.5	7.6	**10**	2	1	0.9	11.1	**10**	2	1	1	5.5
11	1	1	0.3	11.8	**11**	2	1	0.9	11.3	**11**	1	1	0.6	7.6
12	2	1	0.5	5.5	**12**	0	1	0.8	2.4	**12**	0	1	0.8	5.0
13	1	1	1	10.4	**13**	2	1	1	8.3	**13**	1	1	1	9.5
14	2	1	0.6	4.0	**14**	1	1	0.9	10.9	**14**	0	1	0.7	4.9
15	2	1	0.6	7.6	**15**	2	1	0.8	14.9	**15**	0	1	0.4	4.0
16	1	1	0.5	6.0	**16**	2	1	1	9.7	**16**	2	1	1	19.7
17	1	1	0.8	24.4	**17**	2	1	1	23.5	**17**	2	1	0.8	12.6
18	1	1	1	13.8	**18**	2	1	0.9	6.7	**18**	2	1	0.6	5.8
19	1	1	0.7	15.3	**19**	2	1	1	9.6	**19**	2	1	1	13.0
20	0	1	0.9	9.3	**20**	2	1	0.9	7.9	**20**	0	1	1	3.0
21	1	1	0.6	11.6	**21**	2	1	0.9	8.7	**21**	0	1	1	4.0
22	0	1	1	3.2	**22**	2	1	0.9	9.9	**22**	0	1	0.8	6.0
23	2	1	0.8	7.0	**23**	2	1	1	11.4	**23**	1	1	0.9	17.0
24	0	1	0.7	3.9	**24**	2	1	0.9	2.0	**24**	0	1	0.9	3.6
25	1	1	0.5	6.0	**25**	2	1	0.9	22.3	**25**	2	1	1	7.0
26	1	1	0.8	10.6	**26**	2	1	1	7.3	**26**	2	1	0.9	8.0
27	2	1	1	5.6	**27**	2	1	1	10.8	**27**	2	1	0.9	6.6
28	0	1	0.6	9.0	**28**	1	1	0.8	5.9	**28**	2	1	0.8	13.6
29	2	1	0.9	22.0	**29**	2	1	1	9.5	**29**	0	1	1	10.0
30	2	1	1	10.7	**30**	1	1	1	6.4	**30**	2	1	1	6.6
31	2	1	0.9	6.7	**31**	1	1	1	3.8	**31**	0	1	0.5	5.0
32	2	1	1	14.1	**32**	2	1	0.9	4.2	**32**	2	1	0.8	9.6
33	1	1	1	13.2	**33**	2	1	0.9	6.3	**33**	1	1	0.6	7.5
34	2	1	0.9	12.0	**34**	2	1	0.9	7.9	**34**	1	1	0.8	3.5
35	0	1	0.9	11.6	**35**	1	1	0.9	7.1	**35**	2	1	1	14.3
36	2	1	0.9	14.4	**36**	2	1	1	2.5	**36**	2	1	1	8.0
37	0	1	0.6	1.8	**37**	2	1	1	15.5	**37**	2	1	1	12.5
38	2	1	0.7	8.1	**38**	2	1	0.9	16.3	**38**	2	1	1	11.5
39	0	1	0.9	2.0	**39**	1	1	0.9	10.0	**39**	0	1	1	3.6
40	2	1	0.5	14.0	**40**	2	1	0.9	8.6	**40**	1	1	0.7	8.5
41	1	1	0.6	7.3	**41**	2	1	1	3.9	**41**	2	1	1	10.4
42	2	1	0.8	8.5	**42**	2	1	0.9	4.7	**42**	2	1	1	5.0
43	2	1	0.9	6.2	**43**	2	1	0.9	7.4	**43**	2	1	1	30.0
44	2	1	0.9	10.1	**44**	1	1	0.9	13.1	**44**	1	1	1	3.0
45	1	1	0.5	7.5	**45**	2	1	0.9	9.4	**45**	0	1	1	8.5
46	2	1	0.6	24.4	**46**	2	1	0.9	13.2	**46**	2	1	0.8	9.4
47	2	1	1	4.6	**47**	0	1	0.8	2.5	**47**	0	1	0.9	10.0
48	2	1	0.6	9.6	**48**	1	1	0.8	11.4	**48**	1	1	1	7.5
49	2	1	0.8	25.6	**49**	2	1	0.9	10.5	**49**	2	1	1	12.0
50	1	1	0.6	12.9	**50**	1	1	0.7	4.0	**50**	2	1	1	5.0
Cc, Cp, and Cp' =	**1.26**	**0.98**	**0.72**	**-**	**Cc, Cp, and Cp' =**	**1.68**	**1.00**	**0.90**	**-**	**Cc, Cp, and Cp' =**	**1.28**	**1.00**	**0.90**	**-**
Calcite Index (CI) =		**2.24**			**Calcite Index (CI) =**		**2.68**			**Calcite Index (CI) =**		**2.28**		
Calcite Index Prime (CI') =		**1.98**			**Calcite Index Prime (CI') =**		**2.58**			**Calcite Index Prime (CI') =**		**2.18**		

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 D.3: Pebble Counts and Calcite Measurements at RG_GHFF on Upper Greenhills Creek, September 2021

RG_GHFF-4					RG_GHFF-5					RG_GHFF-6				
09-Sep-21					10-Sep-21					10-Sep-21				
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	7.5	**1**	2	1	0.9	27.1	**1**	0	1	1	7.2
2	2	1	1	6.9	**2**	2	1	0.9	13.4	**2**	2	1	1	8.9
3	2	1	1	5.0	**3**	2	1	1	7.7	**3**	2	1	1	7.8
4	2	1	1	25.6	**4**	2	1	0.8	4.5	**4**	2	1	1	19.0
5	2	1	1	9.8	**5**	2	1	0.9	15.0	**5**	1	1	1	11.0
6	2	1	0.9	11.4	**6**	2	1	1	10.6	**6**	2	1	1	7.5
7	2	1	0.7	24.0	**7**	1	1	0.7	8.5	**7**	2	1	0.9	27.0
8	2	1	0.8	9.6	**8**	1	1	0.8	7.3	**8**	2	1	0.6	19.5
9	2	1	0.7	10.7	**9**	2	1	0.9	10.4	**9**	2	1	1	6.7
10	2	1	0.9	11.8	**10**	1	1	0.7	11.3	**10**	2	1	1	12.6
11	0	1	0.7	10.7	**11**	2	1	0.8	4.1	**11**	2	1	0.8	14.0
12	2	1	1	12.2	**12**	2	1	0.7	9.0	**12**	2	1	1	11.5
13	1	1	1	6.0	**13**	2	1	0.8	11.0	**13**	0	1	0.6	14.4
14	2	1	1	13.4	**14**	2	1	0.9	5.4	**14**	2	1	1	9.6
15	2	1	0.4	16.0	**15**	1	1	0.8	8.8	**15**	0	1	0.9	19.4
16	2	1	1	14.5	**16**	2	1	0.9	15.2	**16**	0	1	1	9.6
17	1	1	0.9	12.0	**17**	2	1	1	11.1	**17**	0	1	0.9	14.2
18	0	1	1	5.0	**18**	2	1	1	18.8	**18**	1	1	0.8	12.6
19	1	1	0.9	7.0	**19**	1	1	0.6	6.4	**19**	1	0	1	11.0
20	1	1	1	8.0	**20**	2	1	0.9	5.6	**20**	2	1	1	11.9
21	0	1	1	5.6	**21**	0	1	0.5	4.7	**21**	2	1	1	10.0
22	2	1	1	9.5	**22**	1	1	0.7	14.1	**22**	2	1	1	4.9
23	2	1	1	11.6	**23**	1	1	0.7	4.4	**23**	2	1	1	9.6
24	2	1	0.9	7.8	**24**	0	1	0.8	19.8	**24**	2	1	1	8.4
25	2	1	0.8	3.6	**25**	2	1	0.9	5.1	**25**	2	1	0.8	13.0
26	2	1	0.9	5.0	**26**	2	1	1	8.7	**26**	2	1	1	12.6
27	2	1	1	11.6	**27**	2	1	0.9	6.0	**27**	2	1	0.7	21.1
28	2	1	1	10.4	**28**	2	1	1	11.6	**28**	2	1	1	9.2
29	2	1	1	21.2	**29**	0	1	0.4	5.0	**29**	2	1	1	13.5
30	2	1	1	5.4	**30**	2	1	1	3.8	**30**	2	1	1	21.1
31	2	1	1	15.0	**31**	2	1	0.9	11.1	**31**	1	1	1	5.0
32	2	1	1	12.0	**32**	2	1	1	8.5	**32**	2	1	1	8.2
33	2	1	0.9	4.3	**33**	2	1	0.8	12.4	**33**	1	1	1	8.0
34	2	1	1	7.6	**34**	0	1	1	3.5	**34**	1	1	1	11.4
35	2	1	0.9	10.6	**35**	2	1	1	7.0	**35**	2	1	1	16.1
36	1	1	0.9	10.5	**36**	2	1	0.9	4.9	**36**	2	1	1	5.5
37	0	1	1	8.4	**37**	2	1	1	10.9	**37**	1	1	0.8	8.7
38	1	1	0.5	5.5	**38**	2	1	0.9	8.3	**38**	1	1	0.7	7.6
39	2	1	1	8.2	**39**	2	1	0.8	7.5	**39**	2	1	1	7.4
40	2	1	1	12.2	**40**	2	1	0.9	5.0	**40**	0	1	1	14.2
41	2	1	1	17.0	**41**	2	1	1	9.8	**41**	2	1	1	7.3
42	2	1	1	11.5	**42**	2	1	1	6.1	**42**	2	1	1	9.2
43	0	1	1	4.4	**43**	1	1	0.7	11.0	**43**	1	1	0.4	23.0
44	2	1	0.7	20.0	**44**	2	1	0.9	9.0	**44**	1	1	0.9	3.0
45	2	1	1	28.6	**45**	2	1	0.9	4.3	**45**	2	1	0.7	8.2
46	2	1	1	12.4	**46**	2	1	1	3.3	**46**	2	1	1	7.4
47	0	1	1	7.5	**47**	2	1	0.8	6.2	**47**	0	1	1	11.2
48	2	1	0.8	6.8	**48**	2	1	0.9	8.3	**48**	0	1	1	3.4
49	2	1	1	8.3	**49**	2	1	0.9	1.3	**49**	2	1	1	4.6
50	2	1	1	6.8	**50**	2	1	1	7.1	**50**	2	1	0.9	7.1
Cc, Cp, and Cp' =	**1.64**	**1.00**	**0.92**	**-**	**Cc, Cp, and Cp' =**	**1.68**	**1.00**	**0.86**	**-**	**Cc, Cp, and Cp' =**	**1.46**	**1.00**	**0.93**	**-**
Calcite Index (CI) =			**2.64**		**Calcite Index (CI) =**			**2.68**		**Calcite Index (CI) =**			**2.46**	
Calcite Index Prime (CI') =			**2.56**		**Calcite Index Prime (CI') =**			**2.54**		**Calcite Index Prime (CI') =**			**2.39**	

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 D.4: Pebble Counts and Calcite Measurements at RG_GHBP on Lower Greenhills Creek, September 2021

RG_GHBP-1					RG_GHBP-2					RG_GHBP-3				
11-Sep-21					14-Sep-21					11-Sep-21				
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	0.6	10.5	**1**	0	1	1	8.4	**1**	0	1	0.5	16.7
2	0	1	0.4	5.5	**2**	0	1	0.5	13.6	**2**	0	1	0.6	10.2
3	0	0	0	3.2	**3**	0	1	0.9	6.6	**3**	0	1	0.8	9.0
4	0	1	0.2	6.4	**4**	0	1	0.2	7.3	**4**	0	1	0.6	9.5
5	0	1	0.4	12.0	**5**	0	1	0.3	8.7	**5**	0	1	0.1	5.1
6	0	1	0.5	10.3	**6**	0	1	0.8	6.5	**6**	0	1	0.9	8.1
7	0	1	0.1	4.2	**7**	0	1	0.7	7.9	**7**	0	1	0.1	3.6
8	0	1	0.2	3.5	**8**	0	1	0.4	5.9	**8**	0	1	0.4	6.9
9	0	1	0.1	2.1	**9**	0	1	1	9.6	**9**	0	1	0.7	7.0
10	0	0	0	1.8	**10**	0	1	0.4	5.9	**10**	0	1	0.8	7.3
11	0	0	0	0.9	**11**	0	0	0	4.4	**11**	0	1	0.5	12.5
12	0	0	0	0.5	**12**	0	1	0.3	11.0	**12**	0	1	0.3	11.2
13	0	0	0	0.7	**13**	0	1	0.5	5.3	**13**	0	1	0.2	10.3
14	0	1	0.2	9.2	**14**	0	1	0.6	9.5	**14**	0	1	0.5	5.4
15	0	1	0.6	7.8	**15**	0	1	0.4	5.5	**15**	0	0	0	4.6
16	0	1	0.8	6.5	**16**	0	1	0.5	6.0	**16**	0	1	0.1	2.3
17	0	0	0	5.2	**17**	0	1	0.4	7.2	**17**	0	1	0.6	9.4
18	0	1	0.3	6.1	**18**	0	1	0.2	7.5	**18**	0	1	0.4	8.9
19	0	1	0.8	9.4	**19**	0	1	0.1	4.9	**19**	0	1	0.5	11.7
20	0	1	0.6	9.2	**20**	0	1	0.6	7.0	**20**	0	1	0.7	7.8
21	0	1	0.1	4.7	**21**	0	1	0.4	10.4	**21**	0	1	0.3	4.7
22	0	1	0.7	8.9	**22**	0	1	1	9.5	**22**	0	1	0.8	3.1
23	0	1	1	11.0	**23**	0	0	0	3.2	**23**	0	1	0.5	4.7
24	0	1	0.1	6.0	**24**	0	1	0.2	9.0	**24**	0	1	0.7	12.3
25	0	1	0.3	10.1	**25**	0	1	0.1	3.5	**25**	0	1	0.4	9.5
26	0	1	0.6	7.6	**26**	0	1	1	7.4	**26**	0	1	0.3	6.2
27	0	1	0.9	8.7	**27**	0	1	0.5	10.0	**27**	0	0	0	1.1
28	0	1	0.5	8.5	**28**	0	1	0.6	7.3	**28**	0	0	0	0.8
29	0	1	0.4	4.5	**29**	0	1	0.2	7.0	**29**	0	1	0.1	1.5
30	0	1	0.4	10.6	**30**	0	1	1	7.0	**30**	0	1	0.2	3.1
31	0	1	0.6	3.5	**31**	0	1	1	13.7	**31**	0	0	0	1.7
32	0	1	0.7	8.5	**32**	0	1	0.1	6.9	**32**	0	1	0.1	2.3
33	0	1	0.6	7.2	**33**	0	1	1	16.4	**33**	0	0	0	6.8
34	0	1	0.1	4.9	**34**	0	1	1	7.2	**34**	0	1	0.7	6.7
35	0	1	0.4	8.3	**35**	0	1	0.4	9.5	**35**	0	1	0.8	10.5
36	0	1	0.3	5.4	**36**	0	1	0.3	6.9	**36**	0	1	0.7	13.3
37	0	1	0.2	7.8	**37**	0	1	0.5	3.2	**37**	0	1	0.2	4.7
38	0	1	0.5	7.5	**38**	0	1	0.3	9.2	**38**	0	1	0.3	3.8
39	0	1	0.6	9.1	**39**	0	0	0	8.7	**39**	0	1	0.9	12.4
40	0	1	0.6	14.1	**40**	0	1	1	6.2	**40**	0	1	0.7	10.5
41	0	1	0.1	4.6	**41**	0	1	0.3	6.4	**41**	0	1	0.6	4.7
42	0	1	0.2	6.1	**42**	0	1	0.1	7.0	**42**	0	1	0.4	5.8
43	0	1	0.5	10.0	**43**	0	1	0.1	5.5	**43**	0	1	0.2	6.5
44	0	1	0.4	13.2	**44**	0	1	1	13.9	**44**	0	1	0.6	10.9
45	0	1	0.5	14.5	**45**	0	1	0.9	10.1	**45**	0	1	0.5	10.3
46	0	1	0.1	3.1	**46**	0	0	0	3.0	**46**	0	1	0.5	5.8
47	0	0	0	2.3	**47**	0	0	0	3.7	**47**	0	1	0.6	9.9
48	0	1	0.2	3.7	**48**	0	1	0.1	6.8	**48**	0	1	1	10.3
49	0	1	0.1	4.2	**49**	0	1	0.2	7.6	**49**	0	1	0.7	9.1
50	0	1	0.4	9.0	**50**	0	1	0.4	6.9	**50**	0	1	0.3	7.3
Cc, Cp, and Cp' =	**0.00**	**0.86**	**0.36**	**-**	**Cc, Cp, and Cp' =**	**0.00**	**0.90**	**0.47**	**-**	**Cc, Cp, and Cp' =**	**0.00**	**0.90**	**0.45**	**-**
Calcite Index (CI) =		**0.86**			**Calcite Index (CI) =**		**0.90**			**Calcite Index (CI) =**		**0.90**		
Calcite Index Prime (CI') =		**0.36**			**Calcite Index Prime (CI') =**		**0.47**			**Calcite Index Prime (CI') =**		**0.45**		

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 D.4: Pebble Counts and Calcite Measurements at RG_GHBP on Lower Greenhills Creek, September 2021

RG_GHBP-4				
14-Sep-21				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	0	1	0.3	8.4
2	0	1	1	8.6
3	0	1	0.5	10.2
4	0	1	0.2	10.2
5	0	1	0.3	12.7
6	0	1	0.2	8.2
7	0	0	0	4.9
8	0	1	0.1	4.5
9	0	1	0.1	2.9
10	0	1	0.4	8.7
11	0	1	0.5	9.4
12	0	1	0.6	5.2
13	0	1	1	16.3
14	0	1	0.9	6.0
15	0	1	0.1	3.0
16	0	1	0.8	8.7
17	0	1	0.3	7.0
18	0	1	0.5	10.7
19	0	1	1	9.2
20	0	1	0.8	10.8
21	0	1	0.4	9.0
22	0	1	0.3	9.9
23	0	1	0.1	11.8
24	0	0	0	4.5
25	0	0	0	6.9
26	0	1	0.7	5.4
27	0	1	0.6	9.2
28	0	1	0.3	6.4
29	0	1	0.1	9.0
30	0	1	0.3	5.4
31	0	1	0.3	13.4
32	0	1	0.1	8.2
33	0	0	0	6.2
34	0	1	0.1	8.4
35	0	1	0.1	9.7
36	0	1	0.3	7.5
37	0	1	0.4	10.4
38	0	1	0.2	10.6
39	0	0	0	3.5
40	0	1	0.4	10.6
41	0	1	0.8	14.5
42	0	1	0.6	10.9
43	0	1	0.3	10.7
44	0	1	0.5	5.4
45	0	1	1	10.4
46	0	1	1	6.4
47	0	1	0.9	12.2
48	0	1	0.7	11.9
49	0	1	0.5	11.7
50	0	1	0.3	7.5
Cc, Cp, and Cp' =	**0.00**	**0.90**	**0.42**	**-**
Calcite Index (CI) =		**0.90**		
Calcite Index Prime (CI') =		**0.42**		

RG_GHBP-5				
11-Sep-21				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	0	1	0.5	7.1
2	0	1	0.2	12.2
3	0	1	0.1	7.3
4	0	1	0.3	7.0
5	0	1	0.7	11.9
6	0	1	0.8	9.9
7	0	0	0	4.7
8	0	1	0.9	2.3
9	0	1	0.1	5.1
10	0	1	0.2	3.7
11	0	1	1	10.6
12	0	1	0.6	6.2
13	0	1	0.4	5.4
14	0	1	0.2	1.3
15	0	1	0.4	2.4
16	0	1	1	10.5
17	0	1	1	3.2
18	0	1	0.5	6.1
19	0	1	0.4	6.3
20	0	1	1	5.3
21	0	1	0.7	4.7
22	0	1	0.8	6.1
23	0	1	0.2	5.3
24	0	1	0.4	2.2
25	0	1	0.5	10.3
26	0	1	0.5	9.3
27	0	1	0.3	7.2
28	0	1	0.2	5.8
29	0	1	0.1	4.9
30	0	1	0.7	3.5
31	0	0	0	2.2
32	0	1	0.1	6.0
33	0	1	0.8	2.1
34	0	0	0	1.9
35	0	1	0.4	3.8
36	0	1	0.5	8.7
37	0	0	0	2.5
38	0	1	0.3	8.8
39	0	1	0.4	4.8
40	0	1	0.5	6.9
41	0	1	0.4	9.1
42	0	1	0.2	8.2
43	0	1	0.7	9.5
44	0	1	0.2	6.2
45	0	1	0.4	5.8
46	0	1	0.2	4.1
47	0	1	0.6	9.2
48	0	1	0.5	6.1
49	0	1	0.3	3.1
50	0	1	1	10.3
Cc, Cp, and Cp' =	**0.00**	**0.92**	**0.44**	**-**
Calcite Index (CI) =		**0.92**		
Calcite Index Prime (CI') =		**0.44**		

RG_GHBP-6				
14-Sep-21				
Pebble	**Concreted Status [a]**	**Calcite Presence [b]**	**Proportional Calcite Presence [c]**	**Intermediate Axis (cm)**
1	1	1	1	13.1
2	0	1	1	8.8
3	0	1	0.6	8.5
4	0	1	1	9.3
5	0	1	0.8	6.7
6	0	1	0.4	5.2
7	0	1	0.4	3.2
8	0	1	1	7.2
9	0	1	0.3	5.4
10	0	1	0.2	5.0
11	0	1	0.4	7.5
12	0	1	0.5	5.9
13	0	1	0.7	9.2
14	0	1	1	3.2
15	0	1	0.7	7.1
16	0	1	0.9	5.7
17	0	1	0.8	4.2
18	0	1	1	2.3
19	1	1	0.9	4.3
20	0	1	0.6	6.5
21	0	1	0.9	10.7
22	0	1	0.7	4.5
23	0	1	0.8	2.6
24	0	1	0.6	13.4
25	2	1	1	9.6
26	0	1	0.6	5.2
27	0	1	1	5.5
28	0	1	0.8	5.3
29	1	1	0.9	6.3
30	0	1	0.9	6.3
31	1	1	1	7.4
32	2	1	1	6.9
33	0	1	0.8	1.5
34	0	1	1	1.2
35	0	1	0.6	2.3
36	0	1	0.8	2.6
37	2	1	1	9.5
38	0	1	0.7	2.5
39	0	1	1	1.9
40	1	1	0.8	8.9
41	0	1	1	6.8
42	0	1	0.7	4.3
43	0	1	0.9	5.7
44	0	1	0.8	2.7
45	0	1	0.6	2.3
46	0	1	0.9	6.4
47	1	1	0.6	6.2
48	0	1	0.9	7.1
49	0	1	0.9	2.3
50	0	1	0.9	4.2
Cc, Cp, and Cp' =	**0.24**	**1.00**	**0.79**	**-**
Calcite Index (CI) =		**1.24**		
Calcite Index Prime (CI') =		**1.03**		

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 D.5: 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 2021 [a]

Calcite	P-values			Year	Calcite Presence/ Concretion Score				Area Contrasts							Temporal Contrasts							
	Year x Area	Year	Area						Letter Contrasts				MOD (%) [b]			RG_GHBP		RG_GHUT		RG_GHNF		RG_GHFF	
					RG_GHBP	RG_GHUT	RG_GHNF	RG_GHFF	RG_GHBP	RG_GHUT	RG_GHNF	RG_GHFF	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	0.008	<0.001	2017	0.69	1.0	1.0	1.0	B	A	A	A	44	45	44	B	-	A	-	A	-	A	-
				2018	0.63	1.0	1.0	1.0	B	A	A	A	57	57	57	BC	-8.1	A	0.34	A	0	A	0.33
				2019	0.75	1.0	1.0	1.0	B	A	A	A	33	33	33	B	8.8	A	0.0028	A	0	A	0.33
				2020	0.58	1.0	1.0	1.0	B	A	A	A	72	74	74	C	-17	A	-0.33	A	0	A	0.33
				2021	0.91	1.0	1.0	1.0	A	A	A	A	10	10	9.4	A	32	A	0.33	A	0	A	0
Concretion Score (C_c)	<0.001	<0.001	<0.001	2017	0.089	1.1	1.8	1.2	B	A	A	A	1,160	1,920	1,201	A	-	C	-	AB	-	C	-
				2018	0.085	1.5	1.6	1.6	B	A	A	A	1,718	1,815	1,785	AB	-5.2	AB	37	B	-10	A	37
				2019	0.064	1.8	2.0	1.6	B	A	A	A	2,694	2,997	2,396	BC	-29	A	58	A	9.0	AB	36
				2020	0.055	1.5	1.7	1.3	B	A	A	A	2,559	3,061	2,329	C	-39	B	29	AB	40	BC	14
				2021	0.010	1.0	1.2	1.5	B	A	A	A	9,265	11,284	14,522	D	-89	C	-15	C	-36	AB	29

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; - = not calculated/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 present scores than areas assigned 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 = $(Score_{year}-Scoree2017)/Score_{2017}$.

[d] Binomial 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 2021) but not the latter (i.e., 2021 only).

Table D.6: Pebble Counts and Calcite Measurements at RG_GAUT on Upper Gardine Creek, September 2021

RG_GAUT-1					RG_GAUT-2					RG_GAUT-3				
16-Sep-21					16-Sep-21					16-Sep-21				
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	0	0	6.4	**1**	0	0	0	1.7	**1**	0	0	0	4.9
2	0	0	0	3.5	**2**	0	0	0	4.9	**2**	0	0	0	6.2
3	0	0	0	silt	**3**	0	0	0	2.5	**3**	0	0	0	7.6
4	0	0	0	8.7	**4**	0	0	0	silt	**4**	0	0	0	3.3
5	0	0	0	3.2	**5**	0	0	0	1.4	**5**	0	0	0	2.5
6	0	0	0	4.5	**6**	0	0	0	3.9	**6**	0	0	0	3.0
7	0	0	0	2.1	**7**	0	0	0	1.9	**7**	0	0	0	2.2
8	0	0	0	3.1	**8**	0	0	0	1.3	**8**	0	0	0	2.0
9	0	0	0	3.3	**9**	0	0	0	1.5	**9**	0	0	0	2.5
10	0	0	0	1.7	**10**	0	0	0	1.4	**10**	0	0	0	2.4
11	0	0	0	1.0	**11**	0	0	0	2.6	**11**	0	0	0	1.1
12	0	0	0	1.2	**12**	0	0	0	0.9	**12**	0	0	0	3.7
13	0	0	0	10.5	**13**	0	0	0	2.1	**13**	0	0	0	0.7
14	0	1	0.2	9.9	**14**	0	0	0	silt	**14**	0	0	0	silt
15	0	0	0	3.3	**15**	0	0	0	1.9	**15**	0	0	0	2.5
16	0	0	0	0.7	**16**	0	0	0	2.7	**16**	0	0	0	2.0
17	0	0	0	3.5	**17**	0	0	0	1.1	**17**	0	0	0	8.9
18	0	0	0	11.1	**18**	0	0	0	2.2	**18**	0	0	0	2.7
19	0	0	0	9.4	**19**	0	0	0	2.4	**19**	0	0	0	1.8
20	0	0	0	2.0	**20**	0	0	0	3.1	**20**	0	0	0	3.4
21	0	0	0	1.4	**21**	0	0	0	1.6	**21**	0	0	0	1.5
22	0	0	0	2.3	**22**	0	0	0	1.9	**22**	0	0	0	4.1
23	0	0	0	11.3	**23**	0	0	0	2.1	**23**	0	0	0	1.6
24	0	0	0	7.1	**24**	0	0	0	1.9	**24**	0	0	0	4.2
25	0	0	0	3.3	**25**	0	0	0	1.8	**25**	0	0	0	2.2
26	0	0	0	9.1	**26**	0	0	0	0.8	**26**	0	0	0	1.7
27	0	0	0	2.5	**27**	0	0	0	2.2	**27**	0	0	0	3.1
28	0	0	0	10.0	**28**	0	0	0	2.5	**28**	0	0	0	1.8
29	0	0	0	6.3	**29**	0	0	0	2.0	**29**	0	0	0	2.3
30	0	0	0	1.2	**30**	0	0	0	1.2	**30**	0	0	0	2.4
31	0	1	1	3.5	**31**	0	0	0	silt	**31**	0	0	0	1.7
32	0	1	0.3	2.7	**32**	0	0	0	0.9	**32**	0	0	0	5.2
33	0	0	0	4.5	**33**	0	0	0	silt	**33**	0	0	0	1.5
34	0	1	0.1	2.3	**34**	0	0	0	0.6	**34**	0	0	0	3.0
35	0	0	0	6.7	**35**	0	0	0	1.8	**35**	0	0	0	2.8
36	0	0	0	1.1	**36**	0	0	0	1.5	**36**	0	0	0	4.8
37	0	1	0.1	3.1	**37**	0	0	0	4.5	**37**	0	0	0	2.7
38	0	0	0	3.1	**38**	0	0	0	1.3	**38**	0	0	0	1.9
39	0	0	0	1.7	**39**	0	0	0	1.5	**39**	0	0	0	3.9
40	0	0	0	8.5	**40**	0	0	0	1.9	**40**	0	0	0	2.2
41	0	0	0	2.1	**41**	0	0	0	1.7	**41**	0	0	0	silt
42	0	0	0	4.3	**42**	0	0	0	1.7	**42**	0	0	0	3.1
43	0	1	0.2	1.7	**43**	0	0	0	silt	**43**	0	0	0	1.2
44	0	0	0	1.4	**44**	0	0	0	2.0	**44**	0	0	0	4.1
45	0	0	0	2.3	**45**	0	0	0	1.3	**45**	0	0	0	1.6
46	0	0	0	4.2	**46**	0	0	0	2.2	**46**	0	0	0	2.4
47	0	1	0.1	2.1	**47**	0	0	0	silt	**47**	0	0	0	1.5
48	0	0	0	2.5	**48**	0	0	0	1.1	**48**	0	0	0	1.3
49	0	0	0	2.6	**49**	0	0	0	1.8	**49**	0	0	0	0.7
50	0	0	0	2.5	**50**	0	0	0	0.6	**50**	0	0	0	2.8
Cc, Cp, and Cp' =	**0.00**	**0.14**	**0.04**	**-**	**Cc, Cp, and Cp' =**	**0.00**	**0.00**	**0.00**	**-**	**Cc, Cp, and Cp' =**	**0.00**	**0.00**	**0.00**	**-**
Calcite Index (CI) =		**0.14**			**Calcite Index (CI) =**		**0.00**			**Calcite Index (CI) =**		**0.00**		
Calcite Index Prime (CI') =		**0.04**			**Calcite Index Prime (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 D.6: Pebble Counts and Calcite Measurements at RG_GAUT on Upper Gardine Creek, September 2021

RG_GAUT-4				
16-Sep-21				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	0	0	0	18.5
2	0	0	0	6.2
3	0	0	0	3.7
4	0	0	0	2.1
5	0	0	0	1.7
6	0	0	0	6.4
7	0	0	0	2.6
8	0	0	0	6.1
9	0	0	0	6.2
10	0	0	0	9.5
11	0	0	0	7.4
12	0	0	0	2.2
13	0	0	0	5.3
14	0	0	0	1.5
15	0	0	0	2.1
16	0	0	0	3.2
17	0	0	0	1.2
18	0	0	0	2.7
19	0	0	0	2.1
20	0	0	0	4.9
21	0	0	0	4.7
22	0	0	0	3.2
23	0	0	0	2.5
24	0	0	0	1.7
25	0	0	0	1.6
26	0	0	0	10.2
27	0	0	0	2.9
28	0	0	0	1.5
29	0	0	0	1.7
30	0	0	0	2.4
31	0	0	0	silt
32	0	0	0	6.1
33	0	0	0	9.8
34	0	0	0	3.0
35	0	0	0	11.7
36	0	0	0	10.9
37	0	0	0	1.9
38	0	0	0	2.8
39	0	0	0	3.2
40	0	0	0	5.8
41	0	0	0	silt
42	0	0	0	4.0
43	0	0	0	3.4
44	0	0	0	2.5
45	0	0	0	1.9
46	0	0	0	10.4
47	0	0	0	2.3
48	0	0	0	3.7
49	0	0	0	1.5
50	0	0	0	6.4
Cc, Cp, and Cp' =	**0.00**	**0.00**	**0.00**	-
Calcite Index (CI) =			**0.00**	
Calcite Index Prime (CI') =			**0.00**	

RG_GAUT-5				
16-Sep-21				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	0	0	0	9.2
2	0	0	0	10.7
3	0	0	0	13.4
4	0	0	0	8.8
5	0	0	0	9.2
6	0	0	0	silt
7	0	0	0	1.6
8	0	0	0	2.5
9	0	0	0	2.9
10	0	0	0	2.2
11	0	0	0	1.8
12	0	0	0	0.9
13	0	0	0	1.0
14	0	0	0	4.2
15	0	0	0	2.3
16	0	0	0	silt
17	0	0	0	1.1
18	0	0	0	0.8
19	0	0	0	0.5
20	0	0	0	2.5
21	0	0	0	2.1
22	0	0	0	1.3
23	0	0	0	1.2
24	0	0	0	2.3
25	0	0	0	2.9
26	0	0	0	2.1
27	0	0	0	3.2
28	0	0	0	1.5
29	0	0	0	silt
30	0	0	0	1.9
31	0	0	0	2.4
32	0	0	0	2.8
33	0	0	0	1.2
34	0	0	0	0.7
35	0	0	0	0.5
36	0	0	0	1.6
37	0	0	0	2.1
38	0	0	0	silt
39	0	0	0	4.4
40	0	0	0	1.7
41	0	0	0	1.9
42	0	0	0	1.6
43	0	0	0	10.3
44	0	0	0	4.8
45	0	0	0	2.9
46	0	0	0	silt
47	0	0	0	2.2
48	0	0	0	2.3
49	0	0	0	1.6
50	0	0	0	1.1
Cc, Cp, and Cp' =	**0.00**	**0.00**	**0.00**	-
Calcite Index (CI) =			**0.00**	
Calcite Index Prime (CI') =			**0.00**	

RG_GAUT-6				
16-Sep-21				
Pebble	Concreted Status [a]	Calcite Presence [b]	Proportional Calcite Presence [c]	Intermediate Axis (cm)
1	0	0	0	3.4
2	0	0	0	1.9
3	0	0	0	2.4
4	0	0	0	1.9
5	0	0	0	1.5
6	0	0	0	3.8
7	0	0	0	3.3
8	0	0	0	1.6
9	0	0	0	2.3
10	0	0	0	0.8
11	0	0	0	2.1
12	0	0	0	1.8
13	0	0	0	1.7
14	0	0	0	3.7
15	0	0	0	2.1
16	0	0	0	3.6
17	0	0	0	1.8
18	0	0	0	2.1
19	0	0	0	1.5
20	0	0	0	1.9
21	0	0	0	2.2
22	0	0	0	1.3
23	0	0	0	1.9
24	0	0	0	1.0
25	0	0	0	0.9
26	0	0	0	0.6
27	0	0	0	2.1
28	0	0	0	0.5
29	0	0	0	3.4
30	0	0	0	1.1
31	0	0	0	4.1
32	0	0	0	silt
33	0	0	0	2.5
34	0	0	0	1.7
35	0	0	0	1.5
36	0	0	0	0.9
37	0	0	0	2.2
38	0	0	0	1.2
39	0	0	0	2.4
40	0	0	0	2.0
41	0	0	0	1.5
42	0	0	0	1.2
43	0	0	0	0.9
44	0	0	0	4.4
45	0	0	0	silt
46	0	0	0	2.9
47	0	0	0	2.7
48	0	0	0	2.2
49	0	0	0	3.1
50	0	0	0	1.4
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 D.7: **Pebble Counts and Calcite Measurements at RG_GANF on Lower Gardine Creek, September 2021**

RG_GANF-1					RG_GANF-2					RG_GANF-3				
15-Sep-21					15-Sep-21					15-Sep-21				
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	0.8	19.2	**1**	0	1	0.4	10.2	**1**	0	1	0.2	4.1
2	0	1	0.7	12.7	**2**	0	1	0.6	11.9	**2**	0	1	0.3	4.5
3	0	1	0.9	12.1	**3**	0	1	0.4	12.8	**3**	0	1	0.1	2.2
4	0	1	0.3	5.9	**4**	0	1	0.5	6.5	**4**	0	1	0.2	5.0
5	0	1	0.4	10.5	**5**	0	1	0.2	3.4	**5**	0	0	0	1.1
6	0	1	0.8	1.7	**6**	0	1	0.5	10.6	**6**	2	1	0.9	21.0
7	0	1	0.1	3.5	**7**	0	1	0.4	13.1	**7**	0	1	0.7	6.8
8	0	1	0.1	3.5	**8**	0	1	0.4	5.7	**8**	0	1	0.9	3.4
9	0	1	0.4	5.6	**9**	0	1	0.7	2.5	**9**	0	1	0.4	4.9
10	0	1	0.7	3.1	**10**	0	1	0.7	5.1	**10**	0	1	0.8	5.9
11	0	1	0.5	8.2	**11**	0	1	0.8	6.5	**11**	0	1	0.7	12.5
12	0	1	0.8	8.4	**12**	0	1	0.71	6.0	**12**	0	1	0.4	3.7
13	0	1	0.8	4.1	**13**	0	1	0.2	3.2	**13**	0	1	0.8	12.8
14	1	1	0.6	6.9	**14**	0	1	0.1	4.7	**14**	0	1	0.7	14.5
15	0	1	0.5	5.0	**15**	0	1	0.4	3.0	**15**	0	1	0.4	11.2
16	0	1	0.9	3.0	**16**	0	1	0.8	4.9	**16**	0	1	0.6	4.2
17	0	1	0.8	5.2	**17**	0	1	0.6	2.8	**17**	0	1	0.3	8.9
18	0	1	0.7	5.4	**18**	0	1	0.5	2.2	**18**	0	1	0.2	8.1
19	0	1	0.5	7.5	**19**	0	1	0.8	6.9	**19**	0	1	0.5	8.2
20	0	1	0.6	3.8	**20**	0	1	0.2	7.4	**20**	0	1	0.5	17.5
21	0	1	0.4	4.6	**21**	0	1	0.7	6.5	**21**	0	1	0.8	19.5
22	0	1	0.3	8.2	**22**	0	1	0.4	7.3	**22**	0	1	0.4	5.1
23	0	1	0.1	3.2	**23**	0	1	0.5	6.2	**23**	0	1	1	11.0
24	0	1	0.2	2.4	**24**	0	1	0.8	11.1	**24**	0	0	0	1.3
25	0	1	0.2	4.9	**25**	0	1	0.7	8.7	**25**	0	0	0	0.6
26	0	1	0.4	5.4	**26**	0	1	0.8	9.3	**26**	0	1	1	4.2
27	0	1	0.3	4.0	**27**	0	1	0.3	3.3	**27**	0	1	0.3	2.5
28	0	1	0.4	3.8	**28**	0	0	0	3.9	**28**	0	1	0.9	3.8
29	0	1	0.7	6.3	**29**	0	1	0.1	2.1	**29**	0	1	0.1	4.5
30	0	1	0.5	2.5	**30**	0	1	0.5	6.5	**30**	0	1	0.8	2.5
31	0	1	1	4.4	**31**	0	0	0	1.2	**31**	0	1	0.1	3.1
32	1	1	0.9	7.8	**32**	0	1	0.2	2.2	**32**	0	1	1	5.4
33	0	1	0.9	3.0	**33**	0	1	0.6	4.9	**33**	0	1	0.5	2.3
34	0	1	0.4	5.2	**34**	0	1	0.3	2.9	**34**	0	1	1	4.1
35	0	1	0.8	4.1	**35**	0	1	0.8	12.1	**35**	0	1	0.6	5.9
36	1	1	0.5	8.7	**36**	0	1	0.8	18.5	**36**	0	1	0.7	4.0
37	0	1	0.6	6.1	**37**	0	1	0.9	8.4	**37**	0	1	0.8	4.9
38	0	1	0.5	5.2	**38**	0	1	0.7	3.4	**38**	0	1	0.6	7.2
39	0	1	0.4	9.2	**39**	0	1	0.1	3.3	**39**	0	1	0.8	5.5
40	0	1	0.1	3.4	**40**	0	1	0.6	5.6	**40**	0	1	0.1	3.5
41	0	1	0.5	11.2	**41**	0	1	0.2	3.2	**41**	0	1	0.5	12.6
42	0	1	0.9	5.6	**42**	0	1	0.3	10.1	**42**	0	1	0.9	5.7
43	0	1	0.8	26.5	**43**	0	1	0.8	3.0	**43**	0	1	0.8	7.1
44	1	1	0.9	4.4	**44**	0	1	0.3	3.6	**44**	0	1	0.5	3.0
45	2	1	0.8	10.1	**45**	0	1	0.1	4.1	**45**	0	1	0.1	3.5
46	0	1	0.2	21.2	**46**	0	1	0.7	7.2	**46**	0	1	0.2	2.3
47	0	1	0.5	7.1	**47**	0	1	0.5	4.7	**47**	0	1	0.6	8.4
48	0	-	-	17.2	**48**	0	1	0.8	9.5	**48**	0	1	0.6	8.9
49	0	1	1	7.9	**49**	0	1	0.8	11.2	**49**	0	1	0.1	4.4
50	0	1	0.4	5.5	**50**	0	1	0.8	7.9	**50**	0	1	0.2	3.4
Cc, Cp, and Cp' =	**0.12**	**0.98**	**0.55**	**-**	**Cc, Cp, and Cp' =**	**0.00**	**0.96**	**0.50**	**-**	**Cc, Cp, and Cp' =**	**0.04**	**0.94**	**0.51**	**-**
Calcite Index (CI) =		**1.10**			**Calcite Index (CI) =**		**0.96**			**Calcite Index (CI) =**		**0.98**		
Calcite Index Prime (CI') =		**0.67**			**Calcite Index Prime (CI') =**		**0.50**			**Calcite Index Prime (CI') =**		**0.55**		

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 D.7: Pebble Counts and Calcite Measurements at RG_GANF on Lower Gardine Creek, September 2021

RG_GANF-4					RG_GANF-5					RG_GANF-6				
15-Sep-21					16-Sep-21					16-Sep-21				
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	0.1	3.4	**1**	0	1	0.8	8.7	**1**	0	1	0.8	4.9
2	0	1	0.8	9.5	**2**	0	1	1	7.6	**2**	2	1	0.8	10.5
3	0	1	0.9	3.2	**3**	0	1	0.9	5.1	**3**	2	1	1	10.2
4	0	0	0	10.0	**4**	2	1	1	5.5	**4**	2	1	1	6.2
5	0	1	0.9	6.4	**5**	0	1	1	3.0	**5**	0	1	0.2	3.3
6	0	1	0.8	7.5	**6**	0	1	1	1.7	**6**	2	1	1	5.4
7	1	1	0.6	17.4	**7**	1	1	1	7.2	**7**	0	1	0.6	4.2
8	2	1	0.8	5.5	**8**	0	1	1	2.6	**8**	2	1	1	10.4
9	0	1	0.6	14.2	**9**	0	1	0.9	30.5	**9**	0	1	0.4	2.4
10	0	1	0.6	11.2	**10**	1	1	0.9	6.7	**10**	2	1	1	9.2
11	0	1	0.9	8.0	**11**	0	1	1	6.5	**11**	2	1	1	5.3
12	0	1	0.8	8.7	**12**	0	1	0.8	11.1	**12**	2	1	1	8.5
13	0	1	0.6	8.2	**13**	2	1	0.8	11.5	**13**	0	1	0.9	2.5
14	2	1	1	10.5	**14**	1	1	0.9	7.2	**14**	1	1	1	5.6
15	0	1	1	8.5	**15**	2	1	1	6.5	**15**	0	1	0.8	3.1
16	1	1	0.7	8.7	**16**	2	1	1	7.2	**16**	0	1	0.7	6.6
17	0	1	0.1	7.9	**17**	2	1	1	4.2	**17**	0	1	1	1.1
18	1	1	0.6	19.8	**18**	1	1	1	9.3	**18**	0	1	0.6	7.5
19	0	1	1	2.3	**19**	2	1	1	10.9	**19**	1	1	1	1.0
20	2	1	1	11.2	**20**	2	1	1	5.5	**20**	0	1	0.8	7.8
21	0	1	0.6	5.3	**21**	2	1	0.8	12.7	**21**	0	1	1	2.5
22	0	1	1	9.0	**22**	2	1	1	3.9	**22**	1	1	1	22.2
23	1	1	0.7	15.5	**23**	2	1	1	6.0	**23**	2	1	1	10.3
24	0	1	0.4	14.0	**24**	2	1	0.9	4.1	**24**	1	1	1	7.2
25	0	1	0.4	11.2	**25**	0	1	0.9	5.1	**25**	1	1	0.7	23.5
26	2	1	0.8	13.5	**26**	0	1	0.9	7.2	**26**	1	1	0.8	6.5
27	1	1	0.8	20.3	**27**	2	1	1	5.9	**27**	2	1	1	9.3
28	1	1	0.9	5.2	**28**	2	1	1	6.3	**28**	1	1	0.9	7.2
29	1	1	1	7.6	**29**	2	1	1	6.5	**29**	2	1	1	6.1
30	0	1	1	3.2	**30**	0	1	0.4	7.3	**30**	0	1	1	7.9
31	1	1	0.2	2.8	**31**	0	1	1	4.4	**31**	1	1	0.9	11.2
32	2	1	1	11.2	**32**	0	1	1	2.1	**32**	2	1	1	11.5
33	1	1	0.4	8.4	**33**	0	1	0.7	5.2	**33**	1	1	1	3.9
34	0	1	0.8	3.5	**34**	2	1	1	9.1	**34**	0	1	0.5	2.2
35	0	0	0	4.0	**35**	2	1	1	22.5	**35**	2	1	1	5.7
36	0	1	0.7	9.9	**36**	2	1	1	8.8	**36**	2	1	0.9	8.3
37	0	1	0.3	7.6	**37**	2	1	1	3.3	**37**	2	1	1	17.5
38	0	1	0.4	3.3	**38**	2	1	1	10.5	**38**	2	1	0.9	7.3
39	0	1	0.2	7.6	**39**	0	1	0.8	8.1	**39**	0	1	1	9.8
40	0	1	1	2.8	**40**	2	1	1	6.1	**40**	0	1	0.9	2.3
41	0	0	0	6.1	**41**	0	1	0.7	7.9	**41**	2	1	0.8	12.2
42	0	1	1	3.0	**42**	0	1	0.9	5.8	**42**	0	1	1	3.7
43	2	1	0.8	9.4	**43**	1	1	1	10.3	**43**	0	1	1	3.7
44	0	0	0	-	**44**	2	1	1	12.4	**44**	0	1	0.8	2.8
45	0	1	0.1	1.5	**45**	0	1	1	4.3	**45**	0	1	0.9	6.9
46	0	1	1	4.0	**46**	2	1	1	5.4	**46**	0	1	1	3.2
47	0	1	1	1.4	**47**	2	1	1	11.7	**47**	2	1	1	-
48	0	1	0.5	6.1	**48**	2	1	1	4.2	**48**	0	1	1	2.8
49	0	1	0.1	4.4	**49**	0	1	1	4.7	**49**	2	1	0.7	7.1
50	0	1	0.7	10.2	**50**	1	1	1	6.6	**50**	2	1	1	5.6
Cc, Cp, and Cp' =	**0.42**	**0.92**	**0.63**	**-**	**Cc, Cp, and Cp' =**	**1.08**	**1.00**	**0.94**	**-**	**Cc, Cp, and Cp' =**	**0.98**	**1.00**	**0.89**	**-**
Calcite Index (CI) =			**1.34**		**Calcite Index (CI) =**			**2.08**		**Calcite Index (CI) =**			**1.98**	
Calcite Index Prime (CI') =			**1.05**		**Calcite Index Prime (CI') =**			**2.02**		**Calcite Index Prime (CI') =**			**1.87**	

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 D.8: Bulk Sediment Quality at Biological Monitoring Areas on Greenhills and Gardine Creeks, September 2021

Analyte		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	%	-	-	85.8	87.6	64.0	85.8	84.0
	pH (1:2)	pH	-	-	7.99	8.06	8.17	8.12	8.10
Particle Size	% Gravel (>2 mm)	%	-	-	<1	4.70	9.30	<1	<1
	% Sand (2.00 mm to 1.00 mm)	%	-	-	2.50	19.9	12.0	<1	5.20
	% Sand (1.00 mm to 0.50 mm)	%	-	-	3.00	10.2	11.3	<1	8.30
	% Sand (0.50 mm to 0.25 mm)	%	-	-	3.30	6.70	10.3	2.10	6.40
	% Sand (0.25 mm to 0.125 mm)	%	-	-	5.70	5.40	8.50	3.30	4.70
	% Sand (0.125 mm to 0.063 mm)	%	-	-	8.10	3.90	6.70	4.50	3.70
	% Silt (0.063 mm to 0.0312 mm)	%	-	-	26.8	17.2	14.8	28.8	22.5
	% Silt (0.0312 mm to 0.004 mm)	%	-	-	37.4	23.7	19.8	43.1	36.7
	% Clay (<4 µm)	%	-	-	12.3	8.30	7.30	17.4	12.5
	Texture	-	-	-	Silt loam	Sandy loam	Sandy loam	Silt loam	Silt loam
Organic Carbon	Total Organic Carbon	%	-	-	17.9	10.9	5.87	22.3	20.3
Metals	Aluminum (Al)	mg/kg	-	-	4,590	4,870	8,200	4,800	3,900
	Antimony (Sb)	mg/kg	-	-	0.630	0.640	0.760	0.690	0.590
	Arsenic (As)	mg/kg	5.90	17.0	3.06	2.74	5.87	2.88	2.64
	Barium (Ba)	mg/kg	-	-	176	176	267	180	177
	Beryllium (Be)	mg/kg	-	-	0.440	0.410	0.670	0.420	0.360
	Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2
	Boron (B)	mg/kg	-	-	<5	5.40	6.70	6.20	<5
	Cadmium (Cd)	mg/kg	0.600	3.50	1.47	1.41	1.06	1.20	1.30
	Calcium (Ca)	mg/kg	-	-	68,500	82,000	32,200	64,100	109,000
	Chromium (Cr)	mg/kg	37.3	90.0	7.51	7.60	15.2	8.10	6.36
	Cobalt (Co)	mg/kg	-	-	6.56	7.27	7.63	6.51	6.13
	Copper (Cu)	mg/kg	35.7	197	18.1	17.0	20.5	17.9	14.5
	Iron (Fe)	mg/kg	21,200	43,766	9,150	8,200	17,800	8,900	7,820
	Lead (Pb)	mg/kg	35.0	91.3	8.22	7.43	11.5	7.74	6.63
	Lithium (Li)	mg/kg	-	-	6.00	5.50	11.5	6.20	5.10
	Magnesium (Mg)	mg/kg	-	-	5,020	4,920	6,960	4,750	4,970
	Manganese (Mn)	mg/kg	460	1,100	377	304	542	466	458
	Mercury (Hg)	mg/kg	0.170	0.486	0.0717	0.0829	0.0760	0.0651	0.0632
	Molybdenum (Mo)	mg/kg	25.0	23,000	1.05	0.930	1.38	0.950	0.940
	Nickel (Ni)	mg/kg	16.0	75.0	118	116	68.1	117	99.9
	Phosphorus (P)	mg/kg	-	-	778	727	1,150	763	715
	Potassium (K)	mg/kg	-	-	1,060	1,230	2,030	1,240	1,100
	Selenium (Se)	mg/kg	2 [b]		29.5	32.6	11.9	20.7	19.2
	Silver (Ag)	mg/kg	0.500	-	0.240	0.220	0.280	0.220	0.180
	Sodium (Na)	mg/kg	-	-	64.0	69.0	72.0	69.0	70.0
	Strontium (Sr)	mg/kg	-	-	51.2	53.9	44.1	50.9	65.9
	Sulfur (S)	mg/kg	-	-	1,900	2,100	<1,000	1,900	2,100
	Thallium (Tl)	mg/kg	-	-	0.124	0.121	0.208	0.107	0.106
	Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2
	Titanium (Ti)	mg/kg	-	-	7.30	7.60	5.70	7.50	5.00
	Tungsten (W)	mg/kg	-	-	<0.5	<0.5	<0.5	<0.5	<0.5
	Uranium (U)	mg/kg	-	-	1.89	2.09	1.28	1.67	2.01
	Vanadium (V)	mg/kg	-	-	16.0	16.5	30.0	17.2	14.6
	Zinc (Zn)	mg/kg	123	315	147	150	137	141	129
	Zirconium (Zr)	mg/kg	-	-	1.10	1.10	<1	<1	<1
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	0.00671	0.0889	<0.43	<0.24	<0.19	<0.64	<0.6
	Acenaphthylene	mg/kg	0.00587	0.128	<0.055	<0.03	<0.025	0.0860	0.0300
	Acridine	mg/kg	-	-	<0.85	<0.54	0.379	<1.2	<1.2
	Anthracene	mg/kg	0.0469	0.245	0.0170	<0.035	<0.004	0.0200	<0.01
	Benz(a)anthracene	mg/kg	0.0317	0.385	<0.28	<0.52	<0.11	<0.39	<0.35
	Benzo(a)pyrene	mg/kg	0.0319	0.782	0.175	<0.18	0.0830	0.194	0.222
	Benzo(b&j)fluoranthene	mg/kg	-	-	0.511	0.434	0.207	0.601	0.626
	Benzo(b+j+k)fluoranthene	mg/kg	-	-	0.551	0.471	0.207	0.658	0.626
	Benzo(e)pyrene	mg/kg	-	-	0.564	0.462	0.221	0.711	0.699
	Benzo(g,h,i)perylene	mg/kg	0.170	3.20	0.255	0.191	0.0930	0.328	0.308
	Benzo(k)fluoranthene	mg/kg	0.240	13.4	0.0400	0.0370	<0.01	0.0570	<0.025
	Chrysene	mg/kg	0.0571	0.862	0.682	0.451	<0.49	<0.89	<1.5
	Dibenz(a,h)anthracene	mg/kg	0.00622	0.135	<0.11	<0.075	<0.045	0.128	0.142
	Fluoranthene	mg/kg	0.111	2.36	0.214	0.143	0.0780	0.229	0.268
	Fluorene	mg/kg	0.0212	0.144	1.06	0.761	0.457	1.61	1.53
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.200	3.20	0.0640	<0.035	<0.01	0.0480	0.0540
	1-Methylnaphthalene	mg/kg	-	-	5.22	4.01	2.16	7.85	7.36
	2-Methylnaphthalene	mg/kg	0.0202	0.201	9.74	6.69	4.06	14.8	13.7
	Naphthalene	mg/kg	0.0346	0.391	3.02	2.15	1.26	4.79	4.50
	Perylene	mg/kg	-	-	<0.035	<0.035	<0.01	<0.025	<0.025
	Phenanthrene	mg/kg	0.0419	0.515	4.00	3.30	1.65	5.69	5.36
	Pyrene	mg/kg	0.0530	0.875	0.364	0.273	0.143	0.477	0.450
	Quinoline	mg/kg	-	-	<0.035	0.0360	<0.05	<0.025	<0.025

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 Guideline; % = percent; - = no data/not applicable; > = greater than; mm = millimetres; < = less than; µm = micrometres; mg/kg = milligrams per kilogram; PAHs = polycyclic aromatic hydrocarbons; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

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

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

Table D.8: Bulk Sediment Quality at Biological Monitoring Areas on Greenhills and Gardine Creeks, September 2021

	Analyte	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	%	-	-	31.7	44.5	91.6	55.5	67.7
	pH (1:2)	pH	-	-	7.53	7.54	7.38	7.46	7.53
Particle Size	% Gravel (>2 mm)	%	-	-	5.50	4.00	2.30	15.9	6.50
	% Sand (2.00 mm to 1.00 mm)	%	-	-	13.7	11.4	12.2	4.30	9.40
	% Sand (1.00 mm to 0.50 mm)	%	-	-	16.8	13.8	20.1	6.20	12.8
	% Sand (0.50 mm to 0.25 mm)	%	-	-	15.9	19.9	15.9	9.30	16.8
	% Sand (0.25 mm to 0.125 mm)	%	-	-	12.2	15.2	10.4	10.5	15.0
	% Sand (0.125 mm to 0.063 mm)	%	-	-	8.10	7.50	6.30	8.20	8.00
	% Silt (0.063 mm to 0.0312 mm)	%	-	-	9.20	8.20	10.5	16.8	10.2
	% Silt (0.0312 mm to 0.004 mm)	%	-	-	12.0	12.2	15.5	21.4	14.4
	% Clay (<4 µm)	%	-	-	6.50	7.70	6.90	7.40	6.90
	Texture	-	-	-	Sandy loam	Sandy loam	Sandy loam	Loam / Sandy loam	Sandy loam
Organic Carbon	Total Organic Carbon	%	-	-	5.44	6.47	8.44	11.1	7.24
Metals	Aluminum (Al)	mg/kg	-	-	8,590	8,340	8,550	7,710	8,210
	Antimony (Sb)	mg/kg	-	-	0.870	1.01	2.02	1.17	1.50
	Arsenic (As)	mg/kg	5.90	17.0	6.71	5.31	5.11	5.43	5.33
	Barium (Ba)	mg/kg	-	-	223	219	303	239	253
	Beryllium (Be)	mg/kg	-	-	0.750	0.730	0.830	0.730	0.810
	Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2
	Boron (B)	mg/kg	-	-	7.00	7.40	8.40	7.00	8.90
	Cadmium (Cd)	mg/kg	0.600	3.50	0.638	0.636	1.29	0.755	0.850
	Calcium (Ca)	mg/kg	-	-	9,380	8,750	16,000	10,100	11,500
	Chromium (Cr)	mg/kg	37.3	90.0	12.1	12.2	12.8	11.8	12.3
	Cobalt (Co)	mg/kg	-	-	10.9	10.2	11.6	10.9	10.7
	Copper (Cu)	mg/kg	35.7	197	14.9	14.9	23.2	16.6	17.4
	Iron (Fe)	mg/kg	21,200	43,766	22,400	17,700	14,900	16,700	16,000
	Lead (Pb)	mg/kg	35.0	91.3	13.0	10.8	12.3	11.3	11.9
	Lithium (Li)	mg/kg	-	-	15.1	12.9	11.9	11.7	12.9
	Magnesium (Mg)	mg/kg	-	-	3,240	2,920	3,130	2,860	2,800
	Manganese (Mn)	mg/kg	460	1,100	579	440	767	669	492
	Mercury (Hg)	mg/kg	0.170	0.486	0.0492	0.0577	0.126	0.0770	0.0823
	Molybdenum (Mo)	mg/kg	25.0	23,000	1.15	1.09	1.10	1.08	1.03
	Nickel (Ni)	mg/kg	16.0	75.0	35.0	33.7	47.7	35.1	37.7
	Phosphorus (P)	mg/kg	-	-	1,270	1,090	1,030	1,070	1,020
	Potassium (K)	mg/kg	-	-	1,770	1,810	1,650	1,640	1,720
	Selenium (Se)	mg/kg	2 [b]		0.870	1.09	2.86	1.32	1.65
	Silver (Ag)	mg/kg	0.500	-	0.190	0.230	0.510	0.270	0.300
	Sodium (Na)	mg/kg	-	-	60.0	60.0	68.0	55.0	59.0
	Strontium (Sr)	mg/kg	-	-	42.8	42.0	66.0	47.5	53.4
	Sulfur (S)	mg/kg	-	-	<1,000	<1,000	1,200	<1,000	<1,000
	Thallium (Tl)	mg/kg	-	-	0.162	0.153	0.211	0.156	0.172
	Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2
	Titanium (Ti)	mg/kg	-	-	12.2	16.5	14.1	14.7	17.9
	Tungsten (W)	mg/kg	-	-	<0.5	<0.5	<0.5	<0.5	<0.5
	Uranium (U)	mg/kg	-	-	0.667	0.618	0.911	0.753	0.725
	Vanadium (V)	mg/kg	-	-	26.8	26.1	26.6	25.6	25.9
	Zinc (Zn)	mg/kg	123	315	104	93.9	99.9	94.5	94.8
	Zirconium (Zr)	mg/kg	-	-	1.00	<1	1.40	1.00	1.10
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	0.00671	0.0889	0.0423	0.105	0.586	0.191	0.206
	Acenaphthylene	mg/kg	0.00587	0.128	<0.005	0.0195	0.103	0.0330	0.0330
	Acridine	mg/kg	-	-	0.0740	0.176	0.867	0.352	0.322
	Anthracene	mg/kg	0.0469	0.245	<0.004	<0.004	0.0192	<0.004	<0.008
	Benz(a)anthracene	mg/kg	0.0317	0.385	0.0260	0.0560	0.319	0.119	0.118
	Benzo(a)pyrene	mg/kg	0.0319	0.782	0.0120	0.0320	0.151	0.0650	0.0670
	Benzo(b&j)fluoranthene	mg/kg	-	-	0.0760	0.147	0.752	0.303	0.301
	Benzo(b+j+k)fluoranthene	mg/kg	-	-	0.0760	0.158	0.789	0.329	0.325
	Benzo(e)pyrene	mg/kg	-	-	0.0720	0.141	0.747	0.302	0.296
	Benzo(g,h,i)perylene	mg/kg	0.170	3.20	0.0270	0.0520	0.319	0.112	0.126
	Benzo(k)fluoranthene	mg/kg	0.240	13.4	<0.01	0.0120	0.0370	0.0260	0.0230
	Chrysene	mg/kg	0.0571	0.862	0.144	0.340	1.71	0.655	0.663
	Dibenz(a,h)anthracene	mg/kg	0.00622	0.135	0.0178	0.0274	0.128	0.0544	0.0450
	Fluoranthene	mg/kg	0.111	2.36	0.0340	0.0590	0.263	0.101	0.105
	Fluorene	mg/kg	0.0212	0.144	0.0910	0.234	1.26	0.428	0.437
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.200	3.20	0.0100	0.0150	0.0500	0.0290	0.0300
	1-Methylnaphthalene	mg/kg	-	-	0.480	1.27	6.68	2.09	2.38
	2-Methylnaphthalene	mg/kg	0.0202	0.201	0.891	2.40	12.7	3.89	4.43
	Naphthalene	mg/kg	0.0346	0.391	0.252	0.695	3.66	1.09	1.34
	Perylene	mg/kg	-	-	<0.01	0.0110	0.0500	0.0100	0.0240
	Phenanthrene	mg/kg	0.0419	0.515	0.414	1.08	5.66	1.98	2.14
	Pyrene	mg/kg	0.0530	0.875	0.0670	0.150	0.717	0.245	0.282
	Quinoline	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.0220

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 Guideline; % = percent; - = no data/not applicable; > = greater than; mm = millimetres; < = less than; µm = micrometres; mg/kg = milligrams per kilogram; PAHs = polycyclic aromatic hydrocarbons; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

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

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

Table D.8: Bulk Sediment Quality at Biological Monitoring Areas on Greenhills and Gardine Creeks, September 2021

Analyte		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	%	-	-	78.4	59.8	67.9	82.8	71.3
	pH (1:2)	pH	-	-	7.62	7.41	7.69	7.46	7.42
Particle Size	% Gravel (>2 mm)	%	-	-	<1	<1	<1	5.90	2.70
	% Sand (2.00 mm to 1.00 mm)	%	-	-	5.90	4.60	3.10	5.50	8.90
	% Sand (1.00 mm to 0.50 mm)	%	-	-	9.60	6.20	4.60	8.70	10.6
	% Sand (0.50 mm to 0.25 mm)	%	-	-	14.3	13.8	12.6	14.6	13.0
	% Sand (0.25 mm to 0.125 mm)	%	-	-	17.2	19.0	19.7	17.5	14.5
	% Sand (0.125 mm to 0.063 mm)	%	-	-	11.4	12.4	12.4	10.1	10.9
	% Silt (0.063 mm to 0.0312 mm)	%	-	-	14.4	16.1	16.5	13.8	14.2
	% Silt (0.0312 mm to 0.004 mm)	%	-	-	19.6	20.3	22.2	17.4	19.0
	% Clay (<4 µm)	%	-	-	7.70	7.70	8.90	6.60	6.20
	Texture	-	-	-	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam
Organic Carbon	Total Organic Carbon	%	-	-	9.72	8.66	9.93	8.75	9.41
Metals	Aluminum (Al)	mg/kg	-	-	5,270	5,590	6,280	5,300	5,300
	Antimony (Sb)	mg/kg	-	-	1.03	0.840	0.910	0.810	0.840
	Arsenic (As)	mg/kg	5.90	17.0	3.71	4.13	3.85	3.98	3.29
	Barium (Ba)	mg/kg	-	-	228	200	225	223	195
	Beryllium (Be)	mg/kg	-	-	0.610	0.640	0.650	0.630	0.480
	Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2
	Boron (B)	mg/kg	-	-	<5	<5	6.50	<5	5.60
	Cadmium (Cd)	mg/kg	0.600	3.50	0.757	0.651	0.635	0.710	0.566
	Calcium (Ca)	mg/kg	-	-	85,700	76,300	92,300	91,500	104,000
	Chromium (Cr)	mg/kg	37.3	90.0	8.46	8.78	9.58	8.67	7.98
	Cobalt (Co)	mg/kg	-	-	6.32	6.90	6.30	6.49	5.29
	Copper (Cu)	mg/kg	35.7	197	13.7	12.7	12.7	12.9	11.7
	Iron (Fe)	mg/kg	21,200	43,766	10,900	12,600	11,900	11,900	9,710
	Lead (Pb)	mg/kg	35.0	91.3	8.40	9.00	8.62	8.95	7.26
	Lithium (Li)	mg/kg	-	-	8.20	9.10	9.60	9.10	8.40
	Magnesium (Mg)	mg/kg	-	-	3,950	3,760	4,090	3,860	3,860
	Manganese (Mn)	mg/kg	460	1,100	365	409	371	389	330
	Mercury (Hg)	mg/kg	0.170	0.486	0.0721	0.0696	0.0809	0.0660	0.0690
	Molybdenum (Mo)	mg/kg	25.0	23,000	0.810	0.830	0.890	0.810	0.700
	Nickel (Ni)	mg/kg	16.0	75.0	25.5	24.4	23.2	23.7	20.4
	Phosphorus (P)	mg/kg	-	-	894	969	974	963	749
	Potassium (K)	mg/kg	-	-	1,090	1,190	1,420	1,090	1,210
	Selenium (Se)	mg/kg	2 [b]		2.56	1.56	2.05	1.96	1.35
	Silver (Ag)	mg/kg	0.500	-	0.270	0.220	0.230	0.250	0.220
	Sodium (Na)	mg/kg	-	-	70.0	65.0	75.0	72.0	73.0
	Strontium (Sr)	mg/kg	-	-	76.5	67.2	79.4	78.6	81.7
	Sulfur (S)	mg/kg	-	-	2,000	1,400	1,700	1,800	1,900
	Thallium (Tl)	mg/kg	-	-	0.147	0.144	0.181	0.159	0.127
	Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2
	Titanium (Ti)	mg/kg	-	-	9.00	10.7	13.2	11.9	14.0
	Tungsten (W)	mg/kg	-	-	<0.5	<0.5	<0.5	<0.5	<0.5
	Uranium (U)	mg/kg	-	-	0.852	0.742	0.851	0.915	0.728
	Vanadium (V)	mg/kg	-	-	16.8	17.7	20.1	16.7	16.9
	Zinc (Zn)	mg/kg	123	315	74.8	78.1	74.7	75.3	59.0
	Zirconium (Zr)	mg/kg	-	-	1.10	<1	<1	1.20	<1
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	0.00671	0.0889	0.285	0.136	0.155	0.291	0.223
	Acenaphthylene	mg/kg	0.00587	0.128	0.0440	0.0231	0.0283	0.0420	0.0358
	Acridine	mg/kg	-	-	0.512	0.201	0.248	0.556	0.375
	Anthracene	mg/kg	0.0469	0.245	<0.008	<0.004	<0.004	<0.008	<0.004
	Benz(a)anthracene	mg/kg	0.0317	0.385	0.166	0.0650	0.0820	0.168	0.125
	Benzo(a)pyrene	mg/kg	0.0319	0.782	0.102	0.0310	0.0460	0.0870	0.0710
	Benzo(b&j)fluoranthene	mg/kg	-	-	0.363	0.145	0.193	0.434	0.300
	Benzo(b+j+k)fluoranthene	mg/kg	-	-	0.403	0.159	0.209	0.459	0.314
	Benzo(e)pyrene	mg/kg	-	-	0.386	0.145	0.191	0.405	0.294
	Benzo(g,h,i)perylene	mg/kg	0.170	3.20	0.153	0.0550	0.0800	0.147	0.103
	Benzo(k)fluoranthene	mg/kg	0.240	13.4	0.0400	0.0140	0.0160	0.0250	0.0140
	Chrysene	mg/kg	0.0571	0.862	0.854	0.340	0.435	0.903	0.670
	Dibenz(a,h)anthracene	mg/kg	0.00622	0.135	0.0660	0.0208	0.0351	0.0690	0.0469
	Fluoranthene	mg/kg	0.111	2.36	0.133	0.0600	0.0740	0.154	0.119
	Fluorene	mg/kg	0.0212	0.144	0.651	0.301	0.349	0.750	0.515
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.200	3.20	0.0310	0.0150	0.0240	0.0450	0.0150
	1-Methylnaphthalene	mg/kg	-	-	3.58	1.66	1.82	3.84	2.70
	2-Methylnaphthalene	mg/kg	0.0202	0.201	6.70	3.16	3.42	7.27	5.20
	Naphthalene	mg/kg	0.0346	0.391	2.05	0.999	1.02	2.15	1.55
	Perylene	mg/kg	-	-	0.0290	0.0140	0.0170	0.0440	0.0200
	Phenanthrene	mg/kg	0.0419	0.515	2.87	1.36	1.51	3.32	2.34
	Pyrene	mg/kg	0.0530	0.875	0.336	0.153	0.188	0.379	0.270
	Quinoline	mg/kg	-	-	<0.02	<0.05	<0.05	<0.02	<0.05

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 Guideline; % = percent; - = no data/not applicable; > = greater than; mm = millimetres; < = less than; µm = micrometres; mg/kg = milligrams per kilogram; PAHs = polycyclic aromatic hydrocarbons; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

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

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

Table D.8: Bulk Sediment Quality at Biological Monitoring Areas on Greenhills and Gardine Creeks, September 2021

	Analyte	Units	BC WSQG [a]		Greenhills Sediment Pond				
					RG_GHP				
			Lower	Upper	RG_GHP-1	RG_GHP-3	RG_GHP-4	RG_GHP-5	RG_GHP-6
Physical Tests	Moisture	%	-	-	60.5	57.8	61.7	61.1	59.6
	pH (1:2)	pH	-	-	8.02	8.21	8.31	8.07	8.13
Particle Size	% Gravel (>2 mm)	%	-	-	<1	<1	<1	<1	<1
	% Sand (2.00 mm to 1.00 mm)	%	-	-	<1	<1	<1	<1	<1
	% Sand (1.00 mm to 0.50 mm)	%	-	-	<1	<1	<1	<1	<1
	% Sand (0.50 mm to 0.25 mm)	%	-	-	<1	<1	<1	<1	<1
	% Sand (0.25 mm to 0.125 mm)	%	-	-	<1	<1	1.10	<1	<1
	% Sand (0.125 mm to 0.063 mm)	%	-	-	1.20	<1	2.70	<1	1.10
	% Silt (0.063 mm to 0.0312 mm)	%	-	-	19.0	14.7	15.1	4.70	15.5
	% Silt (0.0312 mm to 0.004 mm)	%	-	-	53.5	56.0	51.7	52.7	49.1
	% Clay (<4 µm)	%	-	-	25.0	28.1	28.9	42.1	33.6
	Texture	-	-	-	Silt loam	Silt loam	Silt loam	Silty clay loam	Silt loam / Silty clay loam
Organic Carbon	Total Organic Carbon	%	-	-	16.6	17.1	21.3	18.2	22.3
Metals	Aluminum (Al)	mg/kg	-	-	7,930	8,210	8,620	11,100	8,520
	Antimony (Sb)	mg/kg	-	-	1.03	1.01	0.790	1.12	1.03
	Arsenic (As)	mg/kg	5.90	17.0	5.70	5.93	5.01	6.51	5.77
	Barium (Ba)	mg/kg	-	-	365	310	308	361	310
	Beryllium (Be)	mg/kg	-	-	0.840	0.740	0.750	0.930	0.780
	Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	0.200	<0.2
	Boron (B)	mg/kg	-	-	<5	<5	6.00	7.80	<5
	Cadmium (Cd)	mg/kg	0.600	3.50	1.48	1.39	1.15	1.54	1.44
	Calcium (Ca)	mg/kg	-	-	54,300	43,200	60,500	53,200	60,900
	Chromium (Cr)	mg/kg	37.3	90.0	12.6	12.8	13.1	16.8	13.1
	Cobalt (Co)	mg/kg	-	-	9.99	11.1	8.77	12.1	9.97
	Copper (Cu)	mg/kg	35.7	197	24.9	25.6	22.4	30.5	26.1
	Iron (Fe)	mg/kg	21,200	43,766	13,700	14,500	12,200	16,400	13,200
	Lead (Pb)	mg/kg	35.0	91.3	11.8	12.2	10.8	14.1	12.3
	Lithium (Li)	mg/kg	-	-	9.10	8.90	8.30	10.6	8.00
	Magnesium (Mg)	mg/kg	-	-	5,390	5,020	4,730	5,150	4,630
	Manganese (Mn)	mg/kg	460	1,100	195	673	308	688	567
	Mercury (Hg)	mg/kg	0.170	0.486	0.103	0.130	0.0971	0.135	0.108
	Molybdenum (Mo)	mg/kg	25.0	23,000	1.36	1.63	1.32	1.75	1.66
	Nickel (Ni)	mg/kg	16.0	75.0	65.7	64.5	56.3	72.8	64.5
	Phosphorus (P)	mg/kg	-	-	957	967	919	1,020	923
	Potassium (K)	mg/kg	-	-	1,780	1,870	2,150	2,790	2,070
	Selenium (Se)	mg/kg	2 [b]		46.4	8.38	13.8	16.0	8.70
	Silver (Ag)	mg/kg	0.500	-	0.370	0.380	0.340	0.470	0.360
	Sodium (Na)	mg/kg	-	-	73.0	77.0	82.0	83.0	71.0
	Strontium (Sr)	mg/kg	-	-	59.0	54.3	62.1	67.7	62.3
	Sulfur (S)	mg/kg	-	-	2,400	1,600	2,000	1,700	1,800
	Thallium (Tl)	mg/kg	-	-	0.139	0.125	0.111	0.122	0.0920
	Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2
	Titanium (Ti)	mg/kg	-	-	5.00	6.80	6.90	10.2	7.30
	Tungsten (W)	mg/kg	-	-	<0.5	<0.5	<0.5	<0.5	<0.5
	Uranium (U)	mg/kg	-	-	1.76	1.13	1.14	1.22	1.09
	Vanadium (V)	mg/kg	-	-	30.5	31.1	32.3	41.2	33.4
	Zinc (Zn)	mg/kg	123	315	138	137	117	156	135
	Zirconium (Zr)	mg/kg	-	-	1.10	<1	<1	<1	<1
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	0.00671	0.0889	<0.32	<0.44	<0.53	<0.46	<0.67
	Acenaphthylene	mg/kg	0.00587	0.128	0.426	0.0166	<0.02	<0.03	0.0347
	Acridine	mg/kg	-	-	<0.59	<0.8	<1	<0.82	<1.1
	Anthracene	mg/kg	0.0469	0.245	<0.004	<0.004	0.00740	<0.004	0.00640
	Benz(a)anthracene	mg/kg	0.0317	0.385	0.483	<0.22	<0.27	<0.56	<0.76
	Benzo(a)pyrene	mg/kg	0.0319	0.782	0.0770	0.0970	0.137	0.0890	0.133
	Benzo(b&j)fluoranthene	mg/kg	-	-	0.386	0.478	0.496	0.475	0.514
	Benzo(b+j+k)fluoranthene	mg/kg	-	-	0.408	0.515	0.536	0.508	0.540
	Benzo(e)pyrene	mg/kg	-	-	0.364	0.458	0.480	0.452	0.511
	Benzo(g,h,i)perylene	mg/kg	0.170	3.20	0.101	0.120	<0.13	0.122	0.142
	Benzo(k)fluoranthene	mg/kg	0.240	13.4	0.0220	0.0370	0.0390	0.0330	0.0260
	Chrysene	mg/kg	0.0571	0.862	<0.62	<0.72	<0.96	<0.59	<0.87
	Dibenz(a,h)anthracene	mg/kg	0.00622	0.135	0.0655	<0.08	0.0879	0.0818	<0.08
	Fluoranthene	mg/kg	0.111	2.36	<0.18	0.193	0.239	0.220	0.215
	Fluorene	mg/kg	0.0212	0.144	0.807	0.851	1.47	1.15	1.39
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.200	3.20	0.0380	0.0440	0.0490	0.0470	0.0520
	1-Methylnaphthalene	mg/kg	-	-	3.84	5.14	6.81	5.23	7.39
	2-Methylnaphthalene	mg/kg	0.0202	0.201	7.09	9.45	13.1	9.70	13.9
	Naphthalene	mg/kg	0.0346	0.391	2.18	2.92	4.61	3.02	4.68
	Perylene	mg/kg	-	-	<0.01	<0.01	<0.01	0.0150	<0.01
	Phenanthrene	mg/kg	0.0419	0.515	3.13	4.04	4.84	4.04	5.34
	Pyrene	mg/kg	0.0530	0.875	<0.35	0.432	0.459	0.437	0.493
	Quinoline	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	<0.05

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 Guideline; % = percent; - = no data/not applicable; > = greater than; mm = millimetres; < = less than; µm = micrometres; mg/kg = milligrams per kilogram; PAHs = polycyclic aromatic hydrocarbons; BCMOECCS = British Columbia Ministry of Environment and Climate Change Strategy.

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

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

Table D.9: Differences in Concentrations of Sediment Quality Analytes Among Sampling Areas on Greenhills and Gardine Creeks, 2019 to 2021

ANOVA Model [a]							Area Magnitude of Difference											
							Area Effects [b]						Area Effects by Year [c]					
													2019					
Analyte		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
Physical Tests	Moisture	%	lognormal	<0.001	<0.001	0.007	nc	nc	nc	nc	nc	nc	ns	-26	-26	-41	-41	ns
	pH (1:2 soil:water)	pH units	lognormal	0.198	0.538	<0.001	nc	nc	nc	nc	nc	nc	-4.6	3.8	ns	8.8	6.2	-2.3
	Silt (0.0312 mm to 0.004 mm)	%	lognormal	<0.001	0.642	0.005	nc	nc	nc	nc	nc	nc	-47	-67	-51	-37	ns	48
	Silt (0.063 mm to 0.004 mm)	%	lognormal	<0.001	0.738	0.039	nc	nc	nc	nc	nc	nc	74	ns	93	ns	ns	ns
	Clay (<4 µm)	%	lognormal	<0.001	0.589	<0.001	nc	nc	nc	nc	nc	nc	-75	-85	-83	-39	-31	ns
	Sand (0.125 mm to 0.063 mm)	%	lognormal	<0.001	0.999	0.015	nc	nc	nc	nc	nc	nc	599	797	786	ns	ns	ns
	Sand (0.25 mm to 0.125 mm)	%	lognormal	<0.001	0.622	0.029	nc	nc	nc	nc	nc	nc	ns	ns	ns	105	ns	ns
	Sand (0.50 mm to 0.25 mm)	%	lognormal	<0.001	0.261	0.321	ns	ns	ns	224	118	ns	nc	nc	nc	nc	nc	nc
	Sand (1.00 mm to 0.50 mm)	%	lognormal	<0.001	0.205	0.354	ns	ns	ns	176	ns	-57	nc	nc	nc	nc	nc	nc
	Sand (2.00 mm to 1.00 mm)	%	lognormal	<0.001	0.158	0.214	ns	ns	ns	ns	ns	-57	nc	nc	nc	nc	nc	nc
	Gravel (>2 mm)	%	lognormal	<0.001	0.389	0.535	ns	ns	ns	ns	ns	-69	nc	nc	nc	nc	nc	nc
Organic Carbon	Total Organic Carbon	%	lognormal	<0.001	0.750	0.667	-23	-61	-50	-50	-36	28	nc	nc	nc	nc	nc	nc
Metals	Aluminum (Al)	mg/kg	lognormal	<0.001	<0.001	0.264	-40	ns	-25	64	25	-24	nc	nc	nc	nc	nc	nc
	Antimony (Sb)	mg/kg	lognormal	<0.001	0.007	0.003	nc	nc	nc	nc	nc	nc	-44	ns	-52	ns	ns	-33
	Arsenic (As)	mg/kg	lognormal	<0.001	0.001	0.964	-40	ns	-28	64	ns	-27	nc	nc	nc	nc	nc	nc
	Barium (Ba)	mg/kg	lognormal	<0.001	<0.001	0.767	-37	-23	-29	22	ns	ns	nc	nc	nc	nc	nc	nc
	Beryllium (Be)	mg/kg	lognormal	<0.001	0.136	0.798	-43	ns	-31	53	21	-21	nc	nc	nc	nc	nc	nc
	Boron (B)	mg/kg	lognormal	0.041	<0.001	0.043	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Cadmium (Cd)	mg/kg	lognormal	<0.001	0.503	0.080	ns	-51	-56	-42	-49	ns	nc	nc	nc	nc	nc	nc
	Calcium (Ca)	mg/kg	lognormal	<0.001	0.755	0.295	60	-75	53	-84	ns	514	nc	nc	nc	nc	nc	nc
	Chromium (Cr)	mg/kg	lognormal	<0.001	<0.001	0.861	-36	ns	-30	35	ns	-20	nc	nc	nc	nc	nc	nc
	Cobalt (Co)	mg/kg	lognormal	<0.001	<0.001	0.345	-36	ns	-33	71	ns	-39	nc	nc	nc	nc	nc	nc
	Copper (Cu)	mg/kg	lognormal	<0.001	0.225	0.381	-41	-40	-53	ns	-20	-21	nc	nc	nc	nc	nc	nc
	Iron (Fe)	mg/kg	lognormal	<0.001	0.007	0.967	-29	31	ns	85	28	-31	nc	nc	nc	nc	nc	nc
	Lead (Pb)	mg/kg	lognormal	<0.001	0.065	0.647	-42	ns	-37	51	ns	-27	nc	nc	nc	nc	nc	nc
	Lithium (Li)	mg/kg	lognormal	<0.001	0.051	0.876	-23	52	ns	97	46	-26	nc	nc	nc	nc	nc	nc
	Magnesium (Mg)	mg/kg	lognormal	<0.001	<0.001	0.810	17	-33	-15	-43	-28	26	nc	nc	nc	nc	nc	nc
	Manganese (Mn)	mg/kg	lognormal	0.002	0.612	0.411	ns	39	ns	30	ns	-23	nc	nc	nc	nc	nc	nc
	Mercury (Hg)	mg/kg	lognormal	<0.001	<0.001	0.041	nc	nc	nc	nc	nc	nc	-60	-57	-52	ns	ns	ns
	Molybdenum (Mo)	mg/kg	lognormal	<0.001	0.131	0.771	-34	-35	-47	ns	-20	-19	nc	nc	nc	nc	nc	nc
	Nickel (Ni)	mg/kg	lognormal	<0.001	0.271	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-48	-36	-58	-35
	Phosphorus (P)	mg/kg	lognormal	0.006	0.002	0.994	ns	ns	ns	27	ns	ns	nc	nc	nc	nc	nc	nc
	Potassium (K)	mg/kg	lognormal	<0.001	<0.001	0.639	-38	-18	-36	32	ns	-22	nc	nc	nc	nc	nc	nc
	Selenium (Se)	mg/kg	lognormal	<0.001	0.843	0.189	ns	-89	-89	-92	-92	ns	nc	nc	nc	nc	nc	nc
	Silver (Ag)	mg/kg	lognormal	<0.001	0.440	0.325	-50	-43	-49	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Sodium (Na)	mg/kg	lognormal	0.012	<0.001	0.021	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Strontium (Sr)	mg/kg	lognormal	<0.001	0.642	0.383	ns	-19	ns	ns	ns	38	nc	nc	nc	nc	nc	nc
	Sulphur (S)	mg/kg	lognormal	<0.001	0.385	0.009	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Thallium (Tl)	mg/kg	lognormal	0.004	<0.001	0.028	nc	nc	nc	nc	nc	nc	46	45	ns	ns	ns	ns
	Tin (Sn)	mg/kg	lognormal	0.179	<0.001	<0.001	nc	nc	nc	nc	nc	nc	36	113	ns	56	-35	-58
	Titanium (Sn)	mg/kg	lognormal	0.179	<0.001	<0.001	nc	nc	nc	nc	nc	nc	36	113	ns	56	-35	-58
	Uranium (U)	mg/kg	lognormal	<0.001	0.305	0.395	37	-43	-38	-58	-55	ns	nc	nc	nc	nc	nc	nc
	Vanadium (V)	mg/kg	lognormal	<0.001	<0.001	0.758	-44	-22	-40	41	ns	-23	nc	nc	nc	nc	nc	nc
	Zinc (Zn)	mg/kg	lognormal	<0.001	0.009	<0.001	nc	nc	nc	nc	nc	nc	-27	-25	-41	ns	-19	-21
	Zirconium (Zr)	mg/kg	lognormal	0.078	<0.001	0.030	nc	nc	nc	nc	nc	nc	ns	ns	ns	56	ns	ns

P-value <0.05.
Positive MOD (higher concentration of analyte at second biological monitoring area relative to the first).
Negative MOD (lower concentration of analyte at second biological monitoring area relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; % = percent; < = less than; nc = no comparison; ns = not significant; mm = millimetres;µm = micrometres; > = greater than; mg/kg = milligrams per kilogram dry weight; HSD = Honestly Significant Difference; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors *Area*, *Year* and *Area:Year*. Post-hoc contrasts were corrected using a Tukey's HSD Test. Analytes that had >75% censored data were excluded from the analyses

[b] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1}$*100 for all years combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1}$*100 for each year when the *Area:Year* term was significant (α = 0.05).

Table D.9: Differences in Concentrations of Sediment Quality Analytes Among Sampling Areas on Greenhills and Gardine Creeks, 2019 to 2021

ANOVA Model [a]							Area Magnitude of Difference											
							Area Effects [b]						Area Effects by Year [c]					
													2019					
Analyte		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
Polycyclic Aromatic Hydrocarbons	Acenaphthylene	mg/kg	lognormal	0.107	<0.001	0.648	ns	-61	ns	ns	ns	ns	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	-70	ns	ns	ns
	Benzo(a)pyrene	mg/kg	lognormal	<0.001	0.001	0.001	nc	nc	nc	nc	nc	nc	-66	-88	-60	-66	ns	240
	Benzo(b&j)fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.009	nc	nc	nc	nc	nc	nc	-62	-86	-62	-63	ns	167
	Benzo(b+j+k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.011	nc	nc	nc	nc	nc	nc	-63	-86	-62	-62	ns	167
	Benzo(e)pyrene	mg/kg	lognormal	<0.001	<0.001	0.003	nc	nc	nc	nc	nc	nc	-63	-87	-61	-64	ns	194
	Benzo(g,h,i)perylene	mg/kg	lognormal	<0.001	<0.001	0.002	nc	nc	nc	nc	nc	nc	ns	-81	-69	-66	ns	ns
	Benzo(k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.013	nc	nc	nc	nc	nc	nc	ns	ns	-59	ns	ns	ns
	Chrysene	mg/kg	lognormal	0.002	0.017	<0.001	nc	nc	nc	nc	nc	nc	-65	-87	-72	-62	ns	111
	Dibenz(a,h)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-69	ns	ns	ns
	Fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.012	nc	nc	nc	nc	nc	nc	-62	-87	-79	-66	ns	ns
	Fluorene	mg/kg	lognormal	<0.001	<0.001	0.042	nc	nc	nc	nc	nc	nc	-65	-89	-75	-68	ns	122
	Indeno(1,2,3-c,d)pyrene	mg/kg	lognormal	<0.001	0.006	0.002	nc	nc	nc	nc	nc	nc	-70	ns	-82	ns	ns	ns
	1-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	0.107	-47	-82	-70	-67	-43	71	nc	nc	nc	nc	nc	nc
	2-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	0.140	-47	-82	-69	-66	-42	71	nc	nc	nc	nc	nc	nc
	Naphthalene	mg/kg	lognormal	<0.001	<0.001	0.246	-48	-83	-71	-67	-43	74	nc	nc	nc	nc	nc	nc
	Perylene	mg/kg	lognormal	0.019	<0.001	0.364	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Phenanthrene	mg/kg	lognormal	<0.001	<0.001	0.087	-45	-81	-69	-65	-43	62	nc	nc	nc	nc	nc	nc
	Pyrene	mg/kg	lognormal	<0.001	<0.001	0.065	-48	-74	-64	-49	ns	ns	nc	nc	nc	nc	nc	nc

P-value <0.05.
Positive MOD (higher concentration of analyte at second biological monitoring area relative to the first).
Negative MOD (lower concentration of analyte at second biological monitoring area relative to the first).
Notes: ANOVA = Analysis of Variance; vs = versus; % = percent; < = less than; nc = no comparison; ns = not significant; mm = millimetres;µm = micrometres; > = greater than; mg/kg = milligrams per kilogram dry weight; HSD = Honestly Significant Difference; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors *Area*, *Year* and *Area:Year*. Post-hoc contrasts were corrected using a Tukey's HSD Test. Analytes that had >75% censored data were excluded from the analyses

[b] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1}*100$ for all years combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1}*100$ for each year when the *Area:Year* term was significant (α = 0.05).

Table D.9: Differences in Concentrations of Sediment Quality Analytes Among Sampling Areas on Greenhills and Gardine Creeks, 2019 to 2021

ANOVA Model [a]							Area Magnitude of Difference Area Effects by Year [c]												
							2020						2021					
Analyte		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
Physical Tests	Moisture	%	lognormal	<0.001	<0.001	0.007	56	ns	ns	-49	-29	40	35	ns	ns	-33	ns	31
	pH (1:2 soil:water)	pH units	lognormal	0.198	0.538	<0.001	nc	nc	nc	nc	nc	nc	ns	-8.1	-7.7	-7.4	-7.0	ns
	Silt (0.0312 mm to 0.004 mm)	%	lognormal	<0.001	0.642	0.005	ns	-80	-55	-74	-40	127	-41	-72	-63	-52	-36	ns
	Silt (0.063 mm to 0.004 mm)	%	lognormal	<0.001	0.738	0.039	101	ns	ns	-71	ns	196	ns	ns	ns	-50	ns	ns
	Clay (<4 µm)	%	lognormal	<0.001	0.589	<0.001	-57	-86	-83	-66	-60	ns	-65	-77	-76	-36	-33	ns
	Sand (0.125 mm to 0.063 mm)	%	lognormal	<0.001	0.999	0.015	287	506	1,469	ns	305	159	332	540	863	ns	123	ns
	Sand (0.25 mm to 0.125 mm)	%	lognormal	<0.001	0.622	0.029	486	1,696	2,566	206	355	ns	616	1,598	2,277	137	232	ns
	Sand (0.50 mm to 0.25 mm)	%	lognormal	<0.001	0.261	0.321	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sand (1.00 mm to 0.50 mm)	%	lognormal	<0.001	0.205	0.354	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sand (2.00 mm to 1.00 mm)	%	lognormal	<0.001	0.158	0.214	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Gravel (>2 mm)	%	lognormal	<0.001	0.389	0.535	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Organic Carbon	Total Organic Carbon	%	lognormal	<0.001	0.750	0.667	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Metals	Aluminum (Al)	mg/kg	lognormal	<0.001	<0.001	0.264	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Antimony (Sb)	mg/kg	lognormal	<0.001	0.007	0.003	-32	ns	-48	ns	ns	ns	-33	ns	ns	90	ns	-30
	Arsenic (As)	mg/kg	lognormal	<0.001	0.001	0.964	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Barium (Ba)	mg/kg	lognormal	<0.001	<0.001	0.767	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Beryllium (Be)	mg/kg	lognormal	<0.001	0.136	0.798	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Boron (B)	mg/kg	lognormal	0.041	<0.001	0.043	38	ns	ns	ns	ns	ns	ns	45	ns	43	ns	-35
	Cadmium (Cd)	mg/kg	lognormal	<0.001	0.503	0.080	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Calcium (Ca)	mg/kg	lognormal	<0.001	0.755	0.295	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Chromium (Cr)	mg/kg	lognormal	<0.001	<0.001	0.861	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Cobalt (Co)	mg/kg	lognormal	<0.001	<0.001	0.345	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Copper (Cu)	mg/kg	lognormal	<0.001	0.225	0.381	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Iron (Fe)	mg/kg	lognormal	<0.001	0.007	0.967	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Lead (Pb)	mg/kg	lognormal	<0.001	0.065	0.647	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Lithium (Li)	mg/kg	lognormal	<0.001	0.051	0.876	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Magnesium (Mg)	mg/kg	lognormal	<0.001	<0.001	0.810	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Manganese (Mn)	mg/kg	lognormal	0.002	0.612	0.411	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Mercury (Hg)	mg/kg	lognormal	<0.001	<0.001	0.041	-36	-46	-51	ns	ns	ns	-37	-35	-37	ns	ns	ns
	Molybdenum (Mo)	mg/kg	lognormal	<0.001	0.131	0.771	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Nickel (Ni)	mg/kg	lognormal	<0.001	0.271	<0.001	109	-31	-53	-67	-78	-33	58	-42	-64	-63	-77	-38
	Phosphorus (P)	mg/kg	lognormal	0.006	0.002	0.994	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Potassium (K)	mg/kg	lognormal	<0.001	<0.001	0.639	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Selenium (Se)	mg/kg	lognormal	<0.001	0.843	0.189	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Silver (Ag)	mg/kg	lognormal	<0.001	0.440	0.325	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sodium (Na)	mg/kg	lognormal	0.012	<0.001	0.021	34	ns	ns	-21	ns	ns	ns	-22	ns	ns	ns	ns
	Strontium (Sr)	mg/kg	lognormal	<0.001	0.642	0.383	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sulphur (S)	mg/kg	lognormal	<0.001	0.385	0.009	135	ns	ns	ns	-47	ns	ns	-59	ns	-54	ns	124
	Thallium (Tl)	mg/kg	lognormal	0.004	<0.001	0.028	ns	ns	ns	ns	ns	ns	ns	45	ns	32	ns	ns
	Tin (Sn)	mg/kg	lognormal	0.179	<0.001	<0.001	ns	ns	ns	ns	ns	ns	ns	112	65	129	78	ns
	Titanium (Sn)	mg/kg	lognormal	0.179	<0.001	<0.001	ns	ns	ns	ns	ns	ns	ns	112	65	129	78	ns
	Uranium (U)	mg/kg	lognormal	<0.001	0.305	0.395	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Vanadium (V)	mg/kg	lognormal	<0.001	<0.001	0.758	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Zinc (Zn)	mg/kg	lognormal	<0.001	0.009	<0.001	ns	-28	-45	-38	-53	-24	ns	-28	-47	-31	-49	-26
	Zirconium (Zr)	mg/kg	lognormal	0.078	<0.001	0.030	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

P-value <0.05.
Positive MOD (higher concentration of analyte at second biological monitoring area relative to the first).
Negative MOD (lower concentration of analyte at second biological monitoring area relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; % = percent; < = less than; nc = no comparison; ns = not significant; mm = millimetres;µm = micrometres; > = greater than; mg/kg = milligrams per kilogram dry weight; HSD = Honestly Significant Difference; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors *Area*, *Year* and *Area:Year*. Post-hoc contrasts were corrected using a Tukey's HSD Test. Analytes that had >75% censored data were excluded from the analyses

[b] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1} * 100$ for all years combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1} * 100$ for each year when the *Area:Year* term was significant (α = 0.05).

Table D.9: Differences in Concentrations of Sediment Quality Analytes Among Sampling Areas on Greenhills and Gardine Creeks, 2019 to 2021

ANOVA Model [a]							Area Magnitude of Difference Area Effects by Year [c]											
							2020						2021					
Analyte		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
Polycyclic Aromatic Hydrocarbons	Acenaphthylene	mg/kg	lognormal	0.107	<0.001	0.648	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	-84	ns	-79	ns	ns	ns	ns	ns	ns	ns	ns
	Benzo(a)pyrene	mg/kg	lognormal	<0.001	0.001	0.001	ns	-87	-75	-81	-65	ns	ns	-54	ns	-68	-59	ns
	Benzo(b&j)fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.009	ns	-83	-72	-69	ns	ns	ns	-49	ns	ns	ns	ns
	Benzo(b+j+k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.011	ns	-84	-72	-69	ns	ns	ns	-50	ns	ns	ns	ns
	Benzo(e)pyrene	mg/kg	lognormal	<0.001	<0.001	0.003	ns	-83	-72	-72	-54	ns	ns	ns	ns	-53	ns	ns
	Benzo(g,h,i)perylene	mg/kg	lognormal	<0.001	<0.001	0.002	ns	-81	-66	-75	-56	ns	ns	ns	ns	-58	-53	ns
	Benzo(k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.013	ns	-78	-69	-68	-54	ns	ns	ns	ns	ns	ns	ns
	Chrysene	mg/kg	lognormal	0.002	0.017	<0.001	ns	-81	ns	-76	ns	ns	ns	ns	ns	ns	ns	ns
	Dibenz(a,h)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	-84	-73	-72	-53	ns	ns	ns	ns	ns	ns	ns
	Fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.012	ns	-87	-78	-77	-60	ns	ns	-55	ns	ns	ns	ns
	Fluorene	mg/kg	lognormal	<0.001	<0.001	0.042	ns	-90	-82	-81	-67	ns	ns	-69	-56	-65	ns	ns
	Indeno(1,2,3-c,d)pyrene	mg/kg	lognormal	<0.001	0.006	0.002	ns	-83	-73	-77	-63	ns	ns	ns	ns	ns	ns	ns
	1-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	0.107	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	2-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	0.140	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Naphthalene	mg/kg	lognormal	<0.001	<0.001	0.246	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	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	0.087	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Pyrene	mg/kg	lognormal	<0.001	<0.001	0.065	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

P-value <0.05.

Positive MOD (higher concentration of analyte at second biological monitoring area relative to the first).

Negative MOD (lower concentration of analyte at second biological monitoring area relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; % = percent; < = less than; nc = no comparison; ns = not significant; mm = millimetres;µm = micrometres; > = greater than; mg/kg = milligrams per kilogram dry weight; HSD = Honestly Significant Difference; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors *Area*, *Year* and *Area:Year*. Post-hoc contrasts were corrected using a Tukey's HSD Test. Analytes that had >75% censored data were excluded from the analyses

[b] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1}*100$ for all years combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1}*100$ for each year when the *Area:Year* term was significant (α = 0.05).

Table D.10: Differences in Concentrations of Sediment Quality Analytes Among Years for Sampling Areas on Greenhills and Gardine Creeks, 2019 to 2021

ANOVA Model [a]							Yearly Magnitude of Difference								
							Year Effects [b]			Year Effects by Area [c]					
										RG_GHP			RG_GHBP		
	Analyte	Units	Assumed Distribution	Area	Year	Area:Year	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021
Physical Tests	Moisture	%	lognormal	<0.001	<0.001	0.007	nc	nc	nc	ns	ns	ns	ns	ns	ns
	pH (1:2 soil:water)	pH units	lognormal	0.198	0.538	<0.001	nc	nc	nc	nc	3.7	nc	nc	7.9	nc
	Silt (0.0312 mm to 0.004 mm)	%	lognormal	<0.001	0.642	0.005	nc	nc	nc	ns	ns	ns	45	ns	ns
	Silt (0.063 mm to 0.004 mm)	%	lognormal	<0.001	0.738	0.039	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Clay (<4 µm)	%	lognormal	<0.001	0.589	<0.001	nc	nc	nc	ns	-24	ns	60	ns	-33
	Sand (0.125 mm to 0.063 mm)	%	lognormal	<0.001	0.999	0.015	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Sand (0.25 mm to 0.125 mm)	%	lognormal	<0.001	0.622	0.029	nc	nc	nc	ns	ns	ns	-47	ns	ns
	Sand (0.50 mm to 0.25 mm)	%	lognormal	<0.001	0.261	0.321	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Sand (1.00 mm to 0.50 mm)	%	lognormal	<0.001	0.205	0.354	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Sand (2.00 mm to 1.00 mm)	%	lognormal	<0.001	0.158	0.214	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Gravel (>2 mm)	%	lognormal	<0.001	0.389	0.535	ns	ns	ns	nc	nc	nc	nc	nc	nc
Organic Carbon	Total Organic Carbon	%	lognormal	<0.001	0.750	0.667	ns	ns	ns	nc	nc	nc	nc	nc	nc
Metals	Aluminum (Al)	mg/kg	lognormal	<0.001	<0.001	0.264	ns	-22	-31	nc	nc	nc	nc	nc	nc
	Antimony (Sb)	mg/kg	lognormal	<0.001	0.007	0.003	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Arsenic (As)	mg/kg	lognormal	<0.001	0.001	0.964	ns	-22	-16	nc	nc	nc	nc	nc	nc
	Barium (Ba)	mg/kg	lognormal	<0.001	<0.001	0.767	ns	-17	-10	nc	nc	nc	nc	nc	nc
	Beryllium (Be)	mg/kg	lognormal	<0.001	0.136	0.798	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Boron (B)	mg/kg	lognormal	0.041	<0.001	0.043	nc	nc	nc	48	ns	-37	62	-25	-54
	Cadmium (Cd)	mg/kg	lognormal	<0.001	0.503	0.080	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Calcium (Ca)	mg/kg	lognormal	<0.001	0.755	0.295	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Chromium (Cr)	mg/kg	lognormal	<0.001	<0.001	0.861	ns	-15	-24	nc	nc	nc	nc	nc	nc
	Cobalt (Co)	mg/kg	lognormal	<0.001	<0.001	0.345	ns	-15	-12	nc	nc	nc	nc	nc	nc
	Copper (Cu)	mg/kg	lognormal	<0.001	0.225	0.381	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Iron (Fe)	mg/kg	lognormal	<0.001	0.007	0.967	ns	-20	ns	nc	nc	nc	nc	nc	nc
	Lead (Pb)	mg/kg	lognormal	<0.001	0.065	0.647	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Lithium (Li)	mg/kg	lognormal	<0.001	0.051	0.876	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Magnesium (Mg)	mg/kg	lognormal	<0.001	<0.001	0.810	ns	-18	ns	nc	nc	nc	nc	nc	nc
	Manganese (Mn)	mg/kg	lognormal	0.002	0.612	0.411	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Mercury (Hg)	mg/kg	lognormal	<0.001	<0.001	0.041	nc	nc	nc	ns	ns	ns	86	52	ns
	Molybdenum (Mo)	mg/kg	lognormal	<0.001	0.131	0.771	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Nickel (Ni)	mg/kg	lognormal	<0.001	0.271	<0.001	nc	nc	nc	ns	ns	ns	52	ns	ns
	Phosphorus (P)	mg/kg	lognormal	0.006	0.002	0.994	ns	-17	ns	nc	nc	nc	nc	nc	nc
	Potassium (K)	mg/kg	lognormal	<0.001	<0.001	0.639	24	-14	-31	nc	nc	nc	nc	nc	nc
	Selenium (Se)	mg/kg	lognormal	<0.001	0.843	0.189	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Silver (Ag)	mg/kg	lognormal	<0.001	0.440	0.325	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Sodium (Na)	mg/kg	lognormal	0.012	<0.001	0.021	nc	nc	nc	ns	ns	ns	23	ns	-31
	Strontium (Sr)	mg/kg	lognormal	<0.001	0.642	0.383	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Sulphur (S)	mg/kg	lognormal	<0.001	0.385	0.009	nc	nc	nc	ns	ns	77	ns	ns	ns
	Thallium (Tl)	mg/kg	lognormal	0.004	<0.001	0.028	nc	nc	nc	47	ns	-34	ns	-26	-41
	Tin (Sn)	mg/kg	lognormal	0.179	<0.001	<0.001	nc	nc	nc	374	ns	-80	203	-36	-79
	Titanium (Sn)	mg/kg	lognormal	0.179	<0.001	<0.001	nc	nc	nc	374	ns	-80	203	-36	-79
	Uranium (U)	mg/kg	lognormal	<0.001	0.305	0.395	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Vanadium (V)	mg/kg	lognormal	<0.001	<0.001	0.758	ns	-18	-27	nc	nc	nc	nc	nc	nc
	Zinc (Zn)	mg/kg	lognormal	<0.001	0.009	<0.001	nc	nc	nc	ns	ns	ns	53	22	-20
	Zirconium (Zr)	mg/kg	lognormal	0.078	<0.001	0.030	nc	nc	nc	ns	ns	-37	54	ns	-26

P-value <0.05.

Positive MOD (higher concentration of analyte in second year relative to the first).

Negative MOD (lower concentration of analyte in second year relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; % = percent; < = less than; nc = no comparison; ns = not significant; mm = millimetres; µm = micrometres; > = greater than; mg/kg = milligrams per kilogram dry weight; HSD = Honestly Significant Difference; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors *Area*, *Year* and *Area:Year*. Post-hoc contrasts were corrected using a Tukey's HSD Test. Analytes 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 areas combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{year\ 2} - EMM_{year\ 1}]/EMM_{year\ 1} * 100$ for each area when the *Area:Year* term was significant (α = 0.05).

Table D.10: Differences in Concentrations of Sediment Quality Analytes Among Years for Sampling Areas on Greenhills and Gardine Creeks, 2019 to 2021

ANOVA Model Testing for Difference Among Years [a]							Yearly Magnitude of Difference								
							Year Effects [b]			Year Effects by Area [c]					
Analyte		Units	Assumed Distribution	Area	Area	Area	2019 vs 2020	2019 vs 2021	2020 vs 2021	RG_GHP			RG_GHBP		
										2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021
Polycyclic Aromatic Hydrocarbons	Acenaphthylene	mg/kg	log-normal	<0.001	<0.001	<0.001	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Benz(a)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Benzo(a)pyrene	mg/kg	lognormal	<0.001	0.001	0.001	nc	nc	nc	ns	ns	ns	127	260	ns
	Benzo(b&j)fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.009	nc	nc	nc	ns	ns	ns	122	222	ns
	Benzo(b+j+k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.011	nc	nc	nc	ns	ns	ns	124	222	ns
	Benzo(e)pyrene	mg/kg	lognormal	<0.001	<0.001	0.003	nc	nc	nc	ns	ns	ns	132	228	ns
	Benzo(g,h,i)perylene	mg/kg	lognormal	<0.001	<0.001	0.002	nc	nc	nc	ns	ns	ns	137	268	ns
	Benzo(k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.013	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Chrysene	mg/kg	lognormal	0.002	0.017	<0.001	nc	nc	nc	ns	ns	ns	114	ns	ns
	Dibenz(a,h)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	89	ns	ns	ns	ns	ns
	Fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.012	nc	nc	nc	ns	ns	ns	138	201	ns
	Fluorene	mg/kg	lognormal	<0.001	<0.001	0.042	nc	nc	nc	ns	ns	ns	177	294	ns
	Indeno(1,2,3-c,d)pyrene	mg/kg	lognormal	<0.001	0.006	0.002	nc	nc	nc	ns	ns	ns	156	ns	ns
	1-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	0.107	72	184	65	nc	nc	nc	nc	nc	nc
	2-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	0.140	74	192	68	nc	nc	nc	nc	nc	nc
	Naphthalene	mg/kg	lognormal	<0.001	<0.001	0.246	89	214	67	nc	nc	nc	nc	nc	nc
	Perylene	mg/kg	lognormal	0.019	<0.001	0.364	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Phenanthrene	mg/kg	lognormal	<0.001	<0.001	0.087	68	173	63	nc	nc	nc	nc	nc	nc
	Pyrene	mg/kg	lognormal	<0.001	<0.001	0.065	82	165	45	nc	nc	nc	nc	nc	nc

P-value <0.05.

Positive MOD (higher concentration of analyte in second year relative to the first).

Negative MOD (lower concentration of analyte in second year relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; % = percent; < = less than; nc = no comparison; ns = not significant; mm = millimetres; µm = micrometres; > = greater than; mg/kg = milligrams per kilogram dry weight; HSD = Honestly Significant Difference; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors *Area*, *Year* and *Area:Year*. Post-hoc contrasts were corrected using a Tukey's HSD Test. Analytes 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 areas combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{year\ 2} - EMM_{year\ 1}]/EMM_{year\ 1}*100$ for each area when the *Area:Year* term was significant (α = 0.05).

Table D.10: Differences in Concentrations of Sediment Quality Analytes Among Years for Sampling Areas on Greenhills and Gardine Creeks, 2019 to 2021

ANOVA Model [a]							Yearly Magnitude of Difference					
							Year Effects by Area [c]					
Analyte		Units	Assumed Distribution	Area	Year	Area:Year	RG_GAUT			RG_GANF		
							2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021
Physical Tests	Moisture	%	lognormal	<0.001	<0.001	0.007	ns	36	38	38	78	29
	pH (1:2 soil:water)	pH units	lognormal	0.198	0.538	<0.001	nc	-8.2	nc	nc	-5.6	nc
	Silt (0.0312 mm to 0.004 mm)	%	lognormal	<0.001	0.642	0.005	-39	ns	56	ns	ns	ns
	Silt (0.063 mm to 0.004 mm)	%	lognormal	<0.001	0.738	0.039	-48	ns	ns	ns	ns	ns
	Clay (<4 µm)	%	lognormal	<0.001	0.589	<0.001	ns	ns	ns	ns	ns	ns
	Sand (0.125 mm to 0.063 mm)	%	lognormal	<0.001	0.999	0.015	ns	ns	ns	97	ns	ns
	Sand (0.25 mm to 0.125 mm)	%	lognormal	<0.001	0.622	0.029	ns	ns	ns	ns	ns	ns
	Sand (0.50 mm to 0.25 mm)	%	lognormal	<0.001	0.261	0.321	nc	nc	nc	nc	nc	nc
	Sand (1.00 mm to 0.50 mm)	%	lognormal	<0.001	0.205	0.354	nc	nc	nc	nc	nc	nc
	Sand (2.00 mm to 1.00 mm)	%	lognormal	<0.001	0.158	0.214	nc	nc	nc	nc	nc	nc
	Gravel (>2 mm)	%	lognormal	<0.001	0.389	0.535	nc	nc	nc	nc	nc	nc
Organic Carbon	Total Organic Carbon	%	lognormal	<0.001	0.750	0.667	nc	nc	nc	nc	nc	nc
Metals	Aluminum (Al)	mg/kg	lognormal	<0.001	<0.001	0.264	nc	nc	nc	nc	nc	nc
	Antimony (Sb)	mg/kg	lognormal	<0.001	0.007	0.003	ns	62	51	ns	71	51
	Arsenic (As)	mg/kg	lognormal	<0.001	0.001	0.964	nc	nc	nc	nc	nc	nc
	Barium (Ba)	mg/kg	lognormal	<0.001	<0.001	0.767	nc	nc	nc	nc	nc	nc
	Beryllium (Be)	mg/kg	lognormal	<0.001	0.136	0.798	nc	nc	nc	nc	nc	nc
	Boron (B)	mg/kg	lognormal	0.041	<0.001	0.043	41	ns	-23	47	ns	-45
	Cadmium (Cd)	mg/kg	lognormal	<0.001	0.503	0.080	nc	nc	nc	nc	nc	nc
	Calcium (Ca)	mg/kg	lognormal	<0.001	0.755	0.295	nc	nc	nc	nc	nc	nc
	Chromium (Cr)	mg/kg	lognormal	<0.001	<0.001	0.861	nc	nc	nc	nc	nc	nc
	Cobalt (Co)	mg/kg	lognormal	<0.001	<0.001	0.345	nc	nc	nc	nc	nc	nc
	Copper (Cu)	mg/kg	lognormal	<0.001	0.225	0.381	nc	nc	nc	nc	nc	nc
	Iron (Fe)	mg/kg	lognormal	<0.001	0.007	0.967	nc	nc	nc	nc	nc	nc
	Lead (Pb)	mg/kg	lognormal	<0.001	0.065	0.647	nc	nc	nc	nc	nc	nc
	Lithium (Li)	mg/kg	lognormal	<0.001	0.051	0.876	nc	nc	nc	nc	nc	nc
	Magnesium (Mg)	mg/kg	lognormal	<0.001	<0.001	0.810	nc	nc	nc	nc	nc	nc
	Manganese (Mn)	mg/kg	lognormal	0.002	0.612	0.411	nc	nc	nc	nc	nc	nc
	Mercury (Hg)	mg/kg	lognormal	<0.001	<0.001	0.041	43	47	ns	ns	ns	ns
	Molybdenum (Mo)	mg/kg	lognormal	<0.001	0.131	0.771	nc	nc	nc	nc	nc	nc
	Nickel (Ni)	mg/kg	lognormal	<0.001	0.271	<0.001	ns	-26	ns	ns	-30	ns
	Phosphorus (P)	mg/kg	lognormal	0.006	0.002	0.994	nc	nc	nc	nc	nc	nc
	Potassium (K)	mg/kg	lognormal	<0.001	<0.001	0.639	nc	nc	nc	nc	nc	nc
	Selenium (Se)	mg/kg	lognormal	<0.001	0.843	0.189	nc	nc	nc	nc	nc	nc
	Silver (Ag)	mg/kg	lognormal	<0.001	0.440	0.325	nc	nc	nc	nc	nc	nc
	Sodium (Na)	mg/kg	lognormal	0.012	<0.001	0.021	ns	ns	-23	ns	ns	ns
	Strontium (Sr)	mg/kg	lognormal	<0.001	0.642	0.383	nc	nc	nc	nc	nc	nc
	Sulphur (S)	mg/kg	lognormal	<0.001	0.385	0.009	ns	ns	ns	ns	ns	ns
	Thallium (Tl)	mg/kg	lognormal	0.004	<0.001	0.028	ns	ns	ns	ns	ns	ns
	Tin (Sn)	mg/kg	lognormal	0.179	<0.001	<0.001	86	ns	-50	362	75	-62
	Titanium (Sn)	mg/kg	lognormal	0.179	<0.001	<0.001	86	ns	-50	362	75	-62
	Uranium (U)	mg/kg	lognormal	<0.001	0.305	0.395	nc	nc	nc	nc	nc	nc
	Vanadium (V)	mg/kg	lognormal	<0.001	<0.001	0.758	nc	nc	nc	nc	nc	nc
	Zinc (Zn)	mg/kg	lognormal	<0.001	0.009	<0.001	ns	-18	ns	ns	-23	ns
	Zirconium (Zr)	mg/kg	lognormal	0.078	<0.001	0.030	ns	ns	ns	ns	ns	ns

P-value <0.05.
Positive MOD (higher concentration of analyte in second year relative to the first).
Negative MOD (lower concentration of analyte in second year relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; % = percent; < = less than; nc = no comparison; ns = not significant; mm = millimetres; µm = micrometres; > = greater than; mg/kg = milligrams per kilogram dry weight; HSD = Honestly Significant Difference; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors *Area* , *Year* and *Area:Year* . Post-hoc contrasts were corrected using a Tukey's HSD Test. Analytes 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 areas combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{year\ 2}- EMM_{year\ 1}]/EMM_{year\ 1}*100$ for each area when the *Area:Year* term was significant (α = 0.05).

Table D.10: Differences in Concentrations of Sediment Quality Analytes Among Years for Sampling Areas on Greenhills and Gardine Creeks, 2019 to 2021

ANOVA Model Testing for Difference Among Years [a]							Yearly Magnitude of Difference Year Effects by Area [c]					
							RG_GAUT			RG_GANF		
Analyte		Units	Assumed Distribution	Area	Area	Area	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021
Polycyclic Aromatic Hydrocarbons	Acenaphthylene	mg/kg	log-normal	<0.001	<0.001	<0.001	ns	ns	ns	ns	ns	ns
	Benz(a)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	241	ns	121	ns
	Benzo(a)pyrene	mg/kg	lognormal	<0.001	0.001	0.001	ns	242	173	ns	ns	ns
	Benzo(b&j)fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.009	87	364	148	ns	94	ns
	Benzo(b+j+k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.011	ns	353	153	ns	93	ns
	Benzo(e)pyrene	mg/kg	lognormal	<0.001	<0.001	0.003	ns	335	143	ns	ns	ns
	Benzo(g,h,i)perylene	mg/kg	lognormal	<0.001	<0.001	0.002	ns	364	162	88	208	ns
	Benzo(k)fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.013	ns	ns	121	ns	ns	ns
	Chrysene	mg/kg	lognormal	0.002	0.017	<0.001	ns	356	228	ns	151	ns
	Dibenz(a,h)anthracene	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	ns	142	ns	135	ns
	Fluoranthene	mg/kg	lognormal	<0.001	<0.001	0.012	ns	358	184	ns	216	90
	Fluorene	mg/kg	lognormal	<0.001	<0.001	0.042	ns	332	168	ns	171	113
	Indeno(1,2,3-c,d)pyrene	mg/kg	lognormal	<0.001	0.006	0.002	ns	ns	ns	ns	ns	ns
	1-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	0.107	nc	nc	nc	nc	nc	nc
	2-Methylnaphthalene	mg/kg	lognormal	<0.001	<0.001	0.140	nc	nc	nc	nc	nc	nc
	Naphthalene	mg/kg	lognormal	<0.001	<0.001	0.246	nc	nc	nc	nc	nc	nc
	Perylene	mg/kg	lognormal	0.019	<0.001	0.364	nc	nc	nc	nc	nc	nc
	Phenanthrene	mg/kg	lognormal	<0.001	<0.001	0.087	nc	nc	nc	nc	nc	nc
	Pyrene	mg/kg	lognormal	<0.001	<0.001	0.065	nc	nc	nc	nc	nc	nc

P-value <0.05.

Positive MOD (higher concentration of analyte in second year relative to the first).

Negative MOD (lower concentration of analyte in second year relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; % = percent; < = less than; nc = no comparison; ns = not significant; mm = millimetres; µm = micrometres; > = greater than; mg/kg = milligrams per kilogram dry weight; HSD = Honestly Significant Difference; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors *Area*, *Year* and *Area:Year*. Post-hoc contrasts were corrected using a Tukey's HSD Test. Analytes 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 areas combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{year\ 2} - EMM_{year\ 1}]/EMM_{year\ 1} * 100$ for each area when the *Area:Year* term was significant (α = 0.05).

Table D.11: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHBP-1 on Lower Greenhills Creek, September 2021

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	265	506	5,620	871	6,491	315	4,590
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.370	0.400	0.770	0.200	0.630
Arsenic (As)	mg/kg	5.90	17.0	0.0740	0.0710	0.394	0.333	3.14	0.872	4.01	0.465	3.06
Barium (Ba)	mg/kg	-	-	19.6	47.7	39.6	12.0	103	119	222	87.3	176
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	0.220	0.800	1.02	0.400	0.440
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	<5
Cadmium (Cd)	mg/kg	0.600	3.50	<0.05	0.382	1.68	0.0910	0.0580	2.20	2.26	2.06	1.47
Calcium (Ca)	mg/kg	-	-	3,130	48,100	64,700	2,140	1,310	118,070	119,380	112,800	68,500
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	1.16	1.91	8.90	8.57	17.5	6.16	7.51
Cobalt (Co)	mg/kg	-	-	0.180	0.740	1.25	0.660	1.46	2.83	4.29	1.99	6.56
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	4.01	5.82	5.51	11.3	1.00	18.1
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,700	1,160	7,040	3,960	11,000	2,750	9,150
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.22	<0.5	2.71	4.72	7.43	3.72	8.22
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	7.10	20.0	27.1	10.0	6.00
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	5,020
Manganese (Mn)	mg/kg	460	1,100	82.3	120	221	9.70	33.0	433	466	341	377
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0717
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.800	2.00	2.80	1.00	1.05
Nickel (Ni)	mg/kg	16.0	75.0	1.37	4.80	8.85	4.63	7.10	19.6	26.8	13.6	118
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	73.0	-	-	173	173	123	778
Potassium (K)	mg/kg	-	-	120	-	-	-	-	120	120	-	1,060
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	0.640	2.71	0.410	3.75	4.16	0.840	29.5
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	<0.1	0.400	0.500	0.200	0.240
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	64.0
Strontium (Sr)	mg/kg	-	-	5.46	22.3	39.6	3.41	17.9	70.8	88.7	61.9	51.2
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,900
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.138	0.200	0.338	0.100	0.124
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	8.80	32.0	15.8	47.8	6.00	7.30
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.154	0.216	0.113	0.401	0.533	0.934	0.370	1.89
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.98	2.21	17.0	5.59	22.6	3.18	16.0
Zinc (Zn)	mg/kg	123	315	<1	27.4	68.7	6.10	37.3	103	140	96.1	147

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 2021a).

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

Table D.12: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHBP-2 on Lower Greenhills Creek, September 2021

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	278	856	5,560	1,234	6,794	328	4,870
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.420	0.400	0.820	0.200	0.640
Arsenic (As)	mg/kg	5.90	17.0	0.0720	0.0940	0.521	0.513	2.92	1.20	4.12	0.615	2.74
Barium (Ba)	mg/kg	-	-	29.2	48.1	29.5	9.45	96.9	116	213	77.6	176
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	0.240	0.800	1.04	0.400	0.410
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	5.40
Cadmium (Cd)	mg/kg	0.600	3.50	<0.05	0.161	3.56	0.245	0.0670	4.02	4.08	3.72	1.41
Calcium (Ca)	mg/kg	-	-	4,030	44,500	42,100	2,000	1,040	92,630	93,670	86,600	82,000
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	1.04	2.92	9.00	9.46	18.5	6.04	7.60
Cobalt (Co)	mg/kg	-	-	0.240	0.890	1.22	0.980	1.46	3.33	4.79	2.11	7.27
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	5.70	6.48	7.20	13.7	1.00	17.0
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,830	1,950	6,560	4,880	11,440	2,880	8,200
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.08	<0.5	3.26	4.58	7.84	3.58	7.43
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	6.90	20.0	26.9	10.0	5.50
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	4,920
Manganese (Mn)	mg/kg	460	1,100	99.3	117	207	10.8	31.0	434	465	324	304
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0829
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.830	2.00	2.83	1.00	0.930
Nickel (Ni)	mg/kg	16.0	75.0	1.09	6.30	11.2	8.20	6.90	26.8	33.7	17.5	116
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	93.0	-	-	193	193	143	727
Potassium (K)	mg/kg	-	-	<100	-	-	-	-	100	100	-	1,230
Selenium (Se) [b]	mg/kg	2.00		0.280	<0.2	1.33	4.74	0.660	6.55	7.21	1.53	32.6
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.100	0.400	0.500	0.200	0.220
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	69.0
Strontium (Sr)	mg/kg	-	-	7.55	23.2	27.3	4.16	17.8	62.2	80.0	50.5	53.9
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	2,100
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.153	0.200	0.353	0.100	0.121
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	13.3	23.7	20.3	44.0	6.00	7.60
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.257	0.288	0.211	0.349	0.806	1.16	0.545	2.09
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.90	3.23	17.7	6.53	24.2	3.10	16.5
Zinc (Zn)	mg/kg	123	315	<1	28.0	107	11.7	38.6	148	186	135	150

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 2021a).

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

Table D.13: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHBP-3 on Lower Greenhills Creek, September 2021

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	274	807	5,670	1,181	6,851	324	8,200
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.430	0.400	0.830	0.200	0.760
Arsenic (As)	mg/kg	5.90	17.0	0.0850	0.0510	0.491	0.540	2.98	1.17	4.15	0.542	5.87
Barium (Ba)	mg/kg	-	-	22.4	46.6	38.8	14.5	100	122	222	85.4	267
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	0.230	0.800	1.03	0.400	0.670
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	6.70
Cadmium (Cd)	mg/kg	0.600	3.50	<0.05	0.229	3.46	0.257	0.0660	4.00	4.06	3.69	1.06
Calcium (Ca)	mg/kg	-	-	3,840	45,200	50,100	2,290	964	101,430	102,394	95,300	32,200
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	1.01	3.07	9.40	9.58	19.0	6.01	15.2
Cobalt (Co)	mg/kg	-	-	0.180	0.830	1.38	1.15	1.50	3.54	5.04	2.21	7.63
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	6.01	6.37	7.51	13.9	1.00	20.5
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,690	2,020	6,730	4,810	11,540	2,740	17,800
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.11	<0.5	3.29	4.61	7.90	3.61	11.5
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	6.80	20.0	26.8	10.0	11.5
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	6,960
Manganese (Mn)	mg/kg	460	1,100	121	148	237	12.9	33.6	519	552	385	542
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0760
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.780	2.00	2.78	1.00	1.38
Nickel (Ni)	mg/kg	16.0	75.0	1.32	6.30	12.8	9.74	7.10	30.2	37.3	19.1	68.1
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	90.0	-	-	190	190	140	1,150
Potassium (K)	mg/kg	-	-	110	-	-	-	-	110	110	-	2,030
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	0.960	4.06	0.480	5.42	5.90	1.16	11.9
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	<0.1	0.400	0.500	0.200	0.280
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	72.0
Strontium (Sr)	mg/kg	-	-	7.77	22.5	33.3	4.22	17.9	67.8	85.7	55.8	44.1
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	<1,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.148	0.200	0.348	0.100	0.208
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	13.1	24.5	20.1	44.6	6.00	5.70
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.195	0.291	0.195	0.355	0.731	1.09	0.486	1.28
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.79	3.27	17.9	6.46	24.4	2.99	30.0
Zinc (Zn)	mg/kg	123	315	<1	33.0	104	12.0	38.2	150	188	137	137

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 2021a).

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

Table D.14: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHBP-4 on Lower Greenhills Creek, September 2021

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	260	320	5,000	680	5,680	310	4,800
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.340	0.400	0.740	0.200	0.690
Arsenic (As)	mg/kg	5.90	17.0	0.0770	<0.05	0.420	0.254	2.86	0.801	3.66	0.470	2.88
Barium (Ba)	mg/kg	-	-	21.4	47.2	57.2	13.4	84.1	139	223	104	180
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	0.230	0.800	1.03	0.400	0.420
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	6.20
Cadmium (Cd)	mg/kg	0.600	3.50	<0.05	0.593	1.59	0.0910	0.0710	2.32	2.40	2.18	1.20
Calcium (Ca)	mg/kg	-	-	3,120	48,700	88,700	3,140	1,210	143,660	144,870	137,400	64,100
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.990	1.84	7.80	8.33	16.1	5.99	8.10
Cobalt (Co)	mg/kg	-	-	0.200	0.780	1.19	0.750	1.42	2.92	4.34	1.97	6.51
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	5.70	5.47	7.20	12.7	1.00	17.9
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,470	957	6,600	3,527	10,127	2,520	8,900
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.05	<0.5	2.42	4.55	6.97	3.55	7.74
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	6.50	20.0	26.5	10.0	6.20
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	4,750
Manganese (Mn)	mg/kg	460	1,100	83.7	139	213	11.9	30.1	448	478	352	466
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0651
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.670	2.00	2.67	1.00	0.950
Nickel (Ni)	mg/kg	16.0	75.0	1.32	5.60	10.3	6.01	6.30	23.2	29.5	15.9	117
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	80.0	-	-	180	180	130	763
Potassium (K)	mg/kg	-	-	<100	-	-	-	-	100	100	-	1,240
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	0.740	2.95	0.490	4.09	4.58	0.940	20.7
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.100	0.400	0.500	0.200	0.220
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	69.0
Strontium (Sr)	mg/kg	-	-	6.12	19.8	49.2	3.00	16.2	78.1	94.3	69.0	50.9
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,900
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.129	0.200	0.329	0.100	0.107
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	6.90	26.5	13.9	40.4	6.00	7.50
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.155	0.259	0.0890	0.369	0.553	0.922	0.414	1.67
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.73	2.08	15.1	5.21	20.3	2.93	17.2
Zinc (Zn)	mg/kg	123	315	<1	28.0	74.3	6.00	33.5	109	143	102	141

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; BCMOEECS = 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 (BCMOEECS 2021).

[b] The 2 mg/kg alert concentration from BCMOEECS (2019) was applied; there is currently no BC WSQG for selenium.

Table D.15: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHBP-5 on Lower Greenhills Creek, September 2021

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	270	591	5,790	961	6,751	320	3,900
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.520	0.400	0.920	0.200	0.590
Arsenic (As)	mg/kg	5.90	17.0	0.0590	0.0940	0.459	0.248	5.07	0.860	5.93	0.553	2.64
Barium (Ba)	mg/kg	-	-	21.8	33.3	23.2	6.50	82.7	84.8	168	56.5	177
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	0.260	0.800	1.06	0.400	0.360
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	<5
Cadmium (Cd)	mg/kg	0.600	3.50	<0.05	0.482	1.28	0.0910	0.0960	1.90	2.00	1.76	1.30
Calcium (Ca)	mg/kg	-	-	2,210	44,500	32,200	1,470	1,550	80,380	81,930	76,700	109,000
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	1.25	2.04	8.70	8.79	17.5	6.25	6.36
Cobalt (Co)	mg/kg	-	-	0.200	0.980	1.33	0.650	1.60	3.16	4.76	2.31	6.13
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	4.83	10.4	6.33	16.7	1.00	14.5
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,770	1,070	9,480	3,940	13,420	2,820	7,820
Lead (Pb)	mg/kg	35.0	91.3	<0.5	0.510	2.97	<0.5	3.56	4.48	8.04	3.48	6.63
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	7.90	20.0	27.9	10.0	5.10
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	4,970
Manganese (Mn)	mg/kg	460	1,100	86.8	168	222	10.3	37.9	487	525	390	458
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0632
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	0.600	2.94	2.10	5.04	1.00	0.940
Nickel (Ni)	mg/kg	16.0	75.0	0.810	5.10	7.31	4.53	8.80	17.8	26.6	12.4	99.9
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	74.0	-	-	174	174	124	715
Potassium (K)	mg/kg	-	-	<100	-	-	-	-	100	100	-	1,100
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	0.450	1.82	0.540	2.67	3.21	0.650	19.2
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	<0.1	0.400	0.500	0.200	0.180
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	70.0
Strontium (Sr)	mg/kg	-	-	6.78	34.4	22.5	3.47	17.6	67.2	84.8	56.9	65.9
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	2,100
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	0.0880	<0.05	0.286	0.238	0.524	0.138	0.106
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	6.00	25.9	13.0	38.9	6.00	5.00
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.200	0.214	0.147	0.452	0.611	1.06	0.414	2.01
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	3.04	2.84	19.3	6.28	25.6	3.24	14.6
Zinc (Zn)	mg/kg	123	315	<1	24.7	47.2	6.90	53.7	79.8	134	71.9	129

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 2021).

[b] The 2 mg/kg alert concentration from BCMOECCS (2019) was applied; there is currently no BC WSQG for selenium.

Table D.16: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GAUT-1 on Upper Gardine Creek, September 2021

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	1,270	8,250	2,015	10,265	695	8,590
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.710	0.400	1.11	0.200	0.870
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.368	0.155	5.71	0.623	6.33	0.418	6.71
Barium (Ba)	mg/kg	-	-	36.0	36.9	41.0	15.8	118	130	248	77.9	223
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.260	<0.2	0.360	0.860	1.22	0.460	0.750
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	7.00
Cadmium (Cd)	mg/kg	0.600	3.50	0.129	0.117	0.218	<0.05	0.0960	0.514	0.610	0.335	0.638
Calcium (Ca)	mg/kg	-	-	2,510	1,940	2,200	898	1,010	7,548	8,558	4,140	9,380
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	1.09	2.04	11.4	8.63	20.0	6.09	12.1
Cobalt (Co)	mg/kg	-	-	<0.1	0.410	6.65	0.950	3.49	8.11	11.6	7.06	10.9
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.510	1.99	12.9	3.50	16.4	1.01	14.9
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,990	1,090	16,400	5,180	21,580	4,040	22,400
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.29	0.770	7.90	5.06	13.0	3.79	13.0
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	8.60	20.0	28.6	10.0	15.1
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,240
Manganese (Mn)	mg/kg	460	1,100	4.80	65.7	326	23.9	61.9	420	482	392	579
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0492
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	1.02	2.00	3.02	1.00	1.15
Nickel (Ni)	mg/kg	16.0	75.0	<0.5	2.30	13.7	4.60	13.9	21.1	35.0	16.0	35.0
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	129	-	-	229	229	179	1,270
Potassium (K)	mg/kg	-	-	140	-	-	-	-	140	140	-	1,770
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	<0.2	0.450	0.390	1.05	1.44	0.400	0.870
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	<0.1	0.400	0.500	0.200	0.190
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	60.0
Strontium (Sr)	mg/kg	-	-	10.5	<5	4.91	4.37	18.4	24.8	43.2	9.91	42.8
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	<1,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.138	0.200	0.338	0.100	0.162
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	<1	13.8	8.00	21.8	6.00	12.2
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	<0.05	0.107	0.175	0.355	0.382	0.737	0.157	0.667
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.73	2.27	25.4	5.40	30.8	2.93	26.8
Zinc (Zn)	mg/kg	123	315	<1	5.10	25.7	4.70	72.1	36.5	109	30.8	104

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 2021a).

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

Table D.17: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GAUT-2 on Upper Gardine Creek, September 2021

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	656	1,530	8,660	2,286	10,946	706	8,340
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.950	0.400	1.35	0.200	1.01
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.395	0.248	5.62	0.743	6.36	0.445	5.31
Barium (Ba)	mg/kg	-	-	41.0	37.4	44.6	18.1	128	141	269	82.0	219
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.250	<0.2	0.350	0.850	1.20	0.450	0.730
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	7.40
Cadmium (Cd)	mg/kg	0.600	3.50	0.151	0.144	0.232	<0.05	0.0860	0.577	0.663	0.376	0.636
Calcium (Ca)	mg/kg	-	-	3,230	2,470	2,270	935	812	8,905	9,717	4,740	8,750
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.820	2.62	11.1	8.94	20.0	5.82	12.2
Cobalt (Co)	mg/kg	-	-	<0.1	0.500	7.01	1.18	3.37	8.79	12.2	7.51	10.2
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	3.10	13.0	4.60	17.6	1.00	14.9
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,960	1,500	14,700	5,560	20,260	4,010	17,700
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	2.96	0.960	8.27	4.92	13.2	3.46	10.8
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	8.20	20.0	28.2	10.0	12.9
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	2,920
Manganese (Mn)	mg/kg	460	1,100	7.70	87.4	301	24.1	55.4	420	476	388	440
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0577
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.970	2.00	2.97	1.00	1.09
Nickel (Ni)	mg/kg	16.0	75.0	0.520	2.50	13.8	5.59	13.3	22.4	35.7	16.3	33.7
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	125	-	-	225	225	175	1,090
Potassium (K)	mg/kg	-	-	140	-	-	-	-	140	140	-	1,810
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	<0.2	0.610	0.390	1.21	1.60	0.400	1.09
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	<0.1	0.400	0.500	0.200	0.230
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	60.0
Strontium (Sr)	mg/kg	-	-	12.6	6.50	5.45	4.35	18.5	28.9	47.4	12.0	42.0
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	<1,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.152	0.200	0.352	0.100	0.153
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	1.20	17.1	8.20	25.3	6.00	16.5
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	<0.05	0.103	0.206	0.335	0.409	0.744	0.153	0.618
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.66	3.34	26.1	6.40	32.5	2.86	26.1
Zinc (Zn)	mg/kg	123	315	<1	6.00	27.1	5.60	72.1	39.7	112	33.1	93.9

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 2021a).

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

Table D.18: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GAUT-3 on Upper Gardine Creek, September 2021

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	658	3,150	7,140	3,908	11,048	708	8,550
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	0.300	1.76	0.600	2.36	0.200	2.02
Arsenic (As)	mg/kg	5.90	17.0	0.0520	0.138	0.644	1.36	3.23	2.19	5.42	0.782	5.11
Barium (Ba)	mg/kg	-	-	69.9	37.9	69.8	39.4	127	217	344	108	303
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.330	<0.2	0.300	0.930	1.23	0.530	0.830
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	8.40
Cadmium (Cd)	mg/kg	0.600	3.50	0.156	0.279	0.638	0.137	0.0690	1.21	1.28	0.917	1.29
Calcium (Ca)	mg/kg	-	-	8,260	3,400	3,300	1,550	149	16,510	16,659	6,700	16,000
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.590	5.66	9.60	11.8	21.4	5.59	12.8
Cobalt (Co)	mg/kg	-	-	0.590	1.44	5.07	2.76	1.95	9.86	11.8	6.51	11.6
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	14.4	11.1	15.9	27.0	1.00	23.2
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	4,480	5,440	6,510	10,020	16,530	4,530	14,900
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	1.92	3.89	6.40	6.81	13.2	2.42	12.3
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	6.00	20.0	26.0	10.0	11.9
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,130
Manganese (Mn)	mg/kg	460	1,100	227	239	224	33.8	24.7	724	748	463	767
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.126
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.770	2.00	2.77	1.00	1.10
Nickel (Ni)	mg/kg	16.0	75.0	1.17	3.50	17.4	19.3	8.10	41.4	49.5	20.9	47.7
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	107	-	-	207	207	157	1,030
Potassium (K)	mg/kg	-	-	170	-	-	-	-	170	170	-	1,650
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	0.360	2.50	0.500	3.26	3.76	0.560	2.86
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.430	0.400	0.830	0.200	0.510
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	68.0
Strontium (Sr)	mg/kg	-	-	30.0	7.50	7.78	6.28	18.2	51.6	69.8	15.3	66.0
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,200
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.163	0.200	0.363	0.100	0.211
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	1.30	22.4	8.30	30.7	6.00	14.1
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.0870	0.188	0.457	0.226	0.782	1.01	0.275	0.911
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.41	7.85	23.3	10.7	34.0	2.61	26.6
Zinc (Zn)	mg/kg	123	315	<1	9.10	38.6	23.8	41.5	72.5	114	47.7	99.9

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 2021a).

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

Table D.19: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GAUT-4 on Upper Gardine Creek, September 2021

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	685	2,030	7,600	2,815	10,415	735	7,710
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	1.17	0.400	1.57	0.200	1.17
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.0640	0.512	0.573	5.13	1.20	6.33	0.576	5.43
Barium (Ba)	mg/kg	-	-	53.8	36.8	56.7	24.2	122	172	294	93.5	239
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.320	<0.2	0.310	0.920	1.23	0.520	0.730
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	7.00
Cadmium (Cd)	mg/kg	0.600	3.50	0.150	0.171	0.397	0.0650	0.0960	0.783	0.879	0.568	0.755
Calcium (Ca)	mg/kg	-	-	4,600	2,510	2,970	1,230	506	11,310	11,816	5,480	10,100
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.700	3.73	10.3	9.93	20.2	5.70	11.8
Cobalt (Co)	mg/kg	-	-	0.490	1.04	5.68	1.49	3.09	8.70	11.8	6.72	10.9
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	6.79	13.2	8.29	21.5	1.00	16.6
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	4,280	2,560	11,800	6,940	18,740	4,330	16,700
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	2.62	1.55	8.08	5.17	13.2	3.12	11.3
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	6.50	20.0	26.5	10.0	11.7
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	2,860
Manganese (Mn)	mg/kg	460	1,100	211	187	286	25.7	46.6	710	756	473	669
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0770
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.930	2.00	2.93	1.00	1.08
Nickel (Ni)	mg/kg	16.0	75.0	0.900	2.60	14.8	8.59	12.2	26.9	39.1	17.4	35.1
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	127	-	-	227	227	177	1,070
Potassium (K)	mg/kg	-	-	150	-	-	-	-	150	150	-	1,640
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	<0.2	1.09	0.440	1.69	2.13	0.400	1.32
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.200	0.400	0.600	0.200	0.270
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	55.0
Strontium (Sr)	mg/kg	-	-	18.4	5.70	6.47	5.30	17.9	35.9	53.8	12.2	47.5
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	<1,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.147	0.200	0.347	0.100	0.156
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	1.50	19.4	8.50	27.9	6.00	14.7
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.0620	0.141	0.324	0.304	0.577	0.881	0.203	0.753
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.58	4.61	24.9	7.59	32.5	2.78	25.6
Zinc (Zn)	mg/kg	123	315	<1	6.10	32.1	9.40	67.6	48.6	116	38.2	94.5

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 2021a).

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

Table D.20: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GAUT-5 on Upper Gardine Creek, September 2021

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	687	2,570	7,630	3,357	10,987	737	8,210
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	0.100	1.64	0.400	2.04	0.200	1.50
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.520	0.855	4.60	1.48	6.08	0.570	5.33
Barium (Ba)	mg/kg	-	-	57.7	38.3	66.5	32.7	122	195	317	105	253
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.330	<0.2	0.350	0.930	1.28	0.530	0.810
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	8.90
Cadmium (Cd)	mg/kg	0.600	3.50	0.194	0.194	0.452	0.0870	0.0780	0.927	1.00	0.646	0.850
Calcium (Ca)	mg/kg	-	-	6,650	2,970	3,030	1,260	293	13,910	14,203	6,000	11,500
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.610	4.59	10.4	10.7	21.1	5.61	12.3
Cobalt (Co)	mg/kg	-	-	0.330	1.06	6.14	2.21	2.72	9.74	12.5	7.20	10.7
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	9.77	12.6	11.3	23.9	1.00	17.4
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	4,320	3,750	10,500	8,170	18,670	4,370	16,000
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	2.28	2.51	7.78	5.79	13.6	2.78	11.9
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	6.50	20.0	26.5	10.0	12.9
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	2,800
Manganese (Mn)	mg/kg	460	1,100	61.5	162	292	32.0	38.6	548	586	454	492
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0823
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.950	2.00	2.95	1.00	1.03
Nickel (Ni)	mg/kg	16.0	75.0	0.860	2.70	17.2	13.5	10.9	34.3	45.2	19.9	37.7
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	129	-	-	229	229	179	1,020
Potassium (K)	mg/kg	-	-	150	-	-	-	-	150	150	-	1,720
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	0.210	1.66	0.470	2.27	2.74	0.410	1.65
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.310	0.400	0.710	0.200	0.300
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	59.0
Strontium (Sr)	mg/kg	-	-	23.9	6.50	7.34	5.48	17.7	43.2	60.9	13.8	53.4
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	<1,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.155	0.200	0.355	0.100	0.172
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	<1	19.2	8.00	27.2	6.00	17.9
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.0580	0.174	0.376	0.261	0.658	0.919	0.232	0.725
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	2.43	6.17	24.7	9.00	33.7	2.63	25.9
Zinc (Zn)	mg/kg	123	315	<1	7.40	34.0	13.5	59.7	55.9	116	41.4	94.8

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 2021).

[b] The 2 mg/kg alert concentration from BCMOECCS (2019) was applied; there is currently no BC WSQG for selenium.

Table D.21: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GANF-1 on Lower Gardine Creek, September 2021

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	404	1,570	7,190	2,074	9,264	454	5,270
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	1.05	0.400	1.45	0.200	1.03
Arsenic (As)	mg/kg	5.90	17.0	0.0530	0.0730	0.406	0.498	3.49	1.03	4.52	0.479	3.71
Barium (Ba)	mg/kg	-	-	28.7	57.7	50.7	21.6	118	159	277	108	228
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.270	<0.2	0.310	0.870	1.18	0.470	0.610
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	<5
Cadmium (Cd)	mg/kg	0.600	3.50	0.0540	0.244	0.358	0.0710	0.0700	0.727	0.797	0.602	0.757
Calcium (Ca)	mg/kg	-	-	4,530	46,900	37,500	2,620	547	91,550	92,097	84,400	85,700
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.570	3.30	9.80	9.37	19.2	5.57	8.46
Cobalt (Co)	mg/kg	-	-	0.270	0.910	2.51	1.34	2.33	5.03	7.36	3.42	6.32
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	6.65	9.87	8.15	18.0	1.00	13.7
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,480	2,630	9,010	5,210	14,220	2,530	10,900
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	2.99	0.950	5.40	4.94	10.3	3.49	8.40
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	6.20	20.0	26.2	10.0	8.20
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,950
Manganese (Mn)	mg/kg	460	1,100	85.8	148	132	11.9	34.5	378	412	280	365
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0721
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.620	2.00	2.62	1.00	0.810
Nickel (Ni)	mg/kg	16.0	75.0	0.560	2.80	8.73	8.58	8.90	20.7	29.6	11.5	25.5
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	63.0	-	-	163	163	113	894
Potassium (K)	mg/kg	-	-	170	-	-	-	-	170	170	-	1,090
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	0.400	2.10	0.540	2.90	3.44	0.600	2.56
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.250	0.400	0.650	0.200	0.270
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	70.0
Strontium (Sr)	mg/kg	-	-	9.72	26.8	21.7	5.84	16.2	64.1	80.3	48.5	76.5
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	2,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.153	0.200	0.353	0.100	0.147
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	23.1	15.5	30.1	45.6	6.00	9.00
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.188	0.209	0.226	0.243	0.673	0.916	0.397	0.852
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	1.84	4.04	22.2	6.28	28.5	2.04	16.8
Zinc (Zn)	mg/kg	123	315	<1	7.60	27.7	7.10	52.0	43.4	95.4	35.3	74.8

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 2021a).

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

Table D.22: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GANF-2 on Lower Gardine Creek, September 2021

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	425	1,410	6,510	1,935	8,445	475	5,590
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.930	0.400	1.33	0.200	0.840
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.0510	0.281	0.407	4.24	0.789	5.03	0.332	4.13
Barium (Ba)	mg/kg	-	-	23.0	55.3	40.4	21.0	114	140	254	95.7	200
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.260	<0.2	0.310	0.860	1.17	0.460	0.640
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	<5
Cadmium (Cd)	mg/kg	0.600	3.50	<0.05	0.233	0.287	0.0610	0.0800	0.631	0.711	0.520	0.651
Calcium (Ca)	mg/kg	-	-	3,680	48,500	24,600	2,060	703	78,840	79,543	73,100	76,300
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.660	2.95	8.80	9.11	17.9	5.66	8.78
Cobalt (Co)	mg/kg	-	-	0.230	0.780	2.91	1.06	2.59	4.98	7.57	3.69	6.90
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	4.80	10.7	6.30	17.0	1.00	12.7
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,640	2,060	10,400	4,800	15,200	2,690	12,600
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	2.97	0.760	5.87	4.73	10.6	3.47	9.00
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	6.20	20.0	26.2	10.0	9.10
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,760
Manganese (Mn)	mg/kg	460	1,100	86.9	134	169	12.2	38.3	402	440	303	409
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0696
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.660	2.00	2.66	1.00	0.830
Nickel (Ni)	mg/kg	16.0	75.0	<0.5	2.50	8.48	6.53	9.70	18.0	27.7	11.0	24.4
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	58.0	-	-	158	158	108	969
Potassium (K)	mg/kg	-	-	150	-	-	-	-	150	150	-	1,190
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	0.210	1.43	0.460	2.04	2.50	0.410	1.56
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.150	0.400	0.550	0.200	0.220
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	65.0
Strontium (Sr)	mg/kg	-	-	7.72	27.1	15.2	5.45	16.0	55.5	71.5	42.3	67.2
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,400
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.137	0.200	0.337	0.100	0.144
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	17.1	13.7	24.1	37.8	6.00	10.7
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.147	0.160	0.211	0.274	0.568	0.842	0.307	0.742
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	1.82	3.73	19.9	5.95	25.8	2.02	17.7
Zinc (Zn)	mg/kg	123	315	<1	6.50	25.3	5.70	54.8	38.5	93.3	31.8	78.1

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

Table D.23: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GANF-3 on Lower Gardine Creek, September 2021

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	392	1,700	5,380	2,192	7,572	442	6,280
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.890	0.400	1.29	0.200	0.910
Arsenic (As)	mg/kg	5.90	17.0	0.0550	0.104	0.421	0.556	2.91	1.14	4.05	0.525	3.85
Barium (Ba)	mg/kg	-	-	27.5	57.6	47.3	22.4	107	155	262	105	225
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.300	<0.2	0.260	0.900	1.16	0.500	0.650
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	6.50
Cadmium (Cd)	mg/kg	0.600	3.50	0.0610	0.218	0.325	0.0740	0.0570	0.678	0.735	0.543	0.635
Calcium (Ca)	mg/kg	-	-	4,870	50,000	33,100	2,730	463	90,700	91,163	83,100	92,300
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.540	4.11	7.40	10.2	17.6	5.54	9.58
Cobalt (Co)	mg/kg	-	-	0.280	0.900	2.17	1.31	1.94	4.66	6.60	3.07	6.30
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	7.36	8.55	8.86	17.4	1.00	12.7
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,320	2,860	7,180	5,280	12,460	2,370	11,900
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	2.77	1.16	4.72	4.93	9.65	3.27	8.62
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	20.0	25.0	10.0	9.60
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	4,090
Manganese (Mn)	mg/kg	460	1,100	112	135	98.1	10.9	26.3	356	382	233	371
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0809
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.580	2.00	2.58	1.00	0.890
Nickel (Ni)	mg/kg	16.0	75.0	0.510	2.30	7.46	9.11	7.50	19.4	26.9	9.76	23.2
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	52.0	-	-	152	152	102	974
Potassium (K)	mg/kg	-	-	160	-	-	-	-	160	160	-	1,420
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	0.360	2.35	0.490	3.11	3.60	0.560	2.05
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.260	0.400	0.660	0.200	0.230
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	75.0
Strontium (Sr)	mg/kg	-	-	10.5	28.2	20.1	6.07	15.7	64.9	80.6	48.3	79.4
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,700
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.132	0.200	0.332	0.100	0.181
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	27.0	11.4	34.0	45.4	6.00	13.2
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.0500	0.230	0.247	0.267	0.215	0.794	1.01	0.477	0.851
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	1.68	4.26	16.9	6.34	23.2	1.88	20.1
Zinc (Zn)	mg/kg	123	315	<1	7.10	24.4	7.50	43.6	40.0	83.6	31.5	74.7

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 2021a).

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

Table D.24: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GANF-4 on Lower Gardine Creek, September 2021

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	408	1,740	5,960	2,248	8,208	458	5,300
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.920	0.400	1.32	0.200	0.810
Arsenic (As)	mg/kg	5.90	17.0	0.0510	0.108	0.377	0.599	3.24	1.14	4.38	0.485	3.98
Barium (Ba)	mg/kg	-	-	29.5	55.0	45.0	22.6	113	152	265	100	223
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.340	<0.2	0.250	0.940	1.19	0.540	0.630
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	<5
Cadmium (Cd)	mg/kg	0.600	3.50	0.0550	0.216	0.327	0.0740	0.0610	0.672	0.733	0.543	0.710
Calcium (Ca)	mg/kg	-	-	5,080	47,100	29,900	2,640	436	84,720	85,156	77,000	91,500
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.630	4.22	8.10	10.4	18.4	5.63	8.67
Cobalt (Co)	mg/kg	-	-	0.230	0.790	2.43	1.41	2.06	4.86	6.92	3.22	6.49
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	7.30	8.93	8.80	17.7	1.00	12.9
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,380	2,900	7,670	5,380	13,050	2,430	11,900
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	2.65	1.38	5.21	5.03	10.2	3.15	8.95
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	5.20	20.0	25.2	10.0	9.10
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,860
Manganese (Mn)	mg/kg	460	1,100	106	129	111	12.3	28.6	358	387	240	389
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0660
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.620	2.00	2.62	1.00	0.810
Nickel (Ni)	mg/kg	16.0	75.0	0.510	2.30	7.86	9.67	7.80	20.3	28.1	10.2	23.7
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	83.0	-	-	183	183	133	963
Potassium (K)	mg/kg	-	-	150	-	-	-	-	150	150	-	1,090
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	0.370	2.52	0.510	3.29	3.80	0.570	1.96
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.250	0.400	0.650	0.200	0.250
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	72.0
Strontium (Sr)	mg/kg	-	-	10.9	27.7	18.1	6.05	15.1	62.8	77.8	45.8	78.6
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,800
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.143	0.200	0.343	0.100	0.159
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	25.4	13.2	32.4	45.6	6.00	11.9
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.0510	0.235	0.256	0.273	0.212	0.815	1.03	0.491	0.915
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	1.66	4.44	19.1	6.50	25.6	1.86	16.7
Zinc (Zn)	mg/kg	123	315	<1	6.50	25.3	7.50	46.0	40.3	86.3	31.8	75.3

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 2021a).

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

Table D.25: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GANF-5 on Lower Gardine Creek, September 2021

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	374	1,160	5,530	1,634	7,164	424	5,300
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.730	0.400	1.13	0.200	0.840
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.0600	0.417	0.323	3.23	0.850	4.08	0.477	3.29
Barium (Ba)	mg/kg	-	-	17.6	50.1	66.8	20.4	93.0	155	248	117	195
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.220	<0.2	0.230	0.820	1.05	0.420	0.480
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	5.60
Cadmium (Cd)	mg/kg	0.600	3.50	<0.05	0.179	0.313	0.0570	0.0570	0.599	0.656	0.492	0.566
Calcium (Ca)	mg/kg	-	-	3,150	50,400	71,700	2,470	589	127,720	128,309	122,100	104,000
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.620	2.31	7.60	8.43	16.0	5.62	7.98
Cobalt (Co)	mg/kg	-	-	0.190	0.670	2.77	0.900	2.11	4.53	6.64	3.44	5.29
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	4.75	8.77	6.25	15.0	1.00	11.7
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	2,230	1,800	8,740	4,130	12,870	2,280	9,710
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.36	<0.5	4.21	4.86	9.07	3.86	7.26
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	5.20	20.0	25.2	10.0	8.40
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	3,860
Manganese (Mn)	mg/kg	460	1,100	72.5	122	148	8.60	33.4	351	384	270	330
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0690
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.520	2.00	2.52	1.00	0.700
Nickel (Ni)	mg/kg	16.0	75.0	<0.5	2.30	7.89	5.70	8.00	16.4	24.4	10.2	20.4
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	66.0	-	-	166	166	116	749
Potassium (K)	mg/kg	-	-	150	-	-	-	-	150	150	-	1,210
Selenium (Se) [b]	mg/kg	2.00		<0.2	<0.2	0.260	1.00	0.340	1.66	2.00	0.460	1.35
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.140	0.400	0.540	0.200	0.220
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	73.0
Strontium (Sr)	mg/kg	-	-	7.53	28.5	39.9	5.07	13.8	81.0	94.8	68.4	81.7
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,900
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.106	0.200	0.306	0.100	0.127
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	17.6	11.0	24.6	35.6	6.00	14.0
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	<0.05	0.139	0.233	0.163	0.214	0.585	0.799	0.372	0.728
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	1.76	3.05	16.8	5.21	22.0	1.96	16.9
Zinc (Zn)	mg/kg	123	315	<1	5.60	22.5	4.50	45.0	33.6	78.6	28.1	59.0

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 2021a).

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

Table D.26: Differences in Concentrations of Sediment Quality Analytes Among Sampling Areas on Greenhills and Gardine Creeks, Based on Sequential Extraction Analyses, 2019 to 2021

ANOVA Model [a]							Area Magnitude of Difference											
							Area Effects [b]						Area Effects by Year [c]					
													2019					
Analyte	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	0.398	<0.001	nc	nc	nc	nc	nc	nc	-49	ns	-18	99	60	-20
	Fraction 4	mg/kg	lognormal	<0.001	0.131	0.011	nc	nc	nc	nc	nc	nc	-42	ns	ns	71	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.855	-19	17	-13	46	ns	-25	nc	nc	nc	nc	nc	nc
Antimony (Sb)	Fraction 5	mg/kg	lognormal	<0.001	0.278	<0.001	nc	nc	nc	nc	nc	nc	-41	-40	-47	ns	ns	ns
Arsenic (As)	Fraction 2	mg/kg	lognormal	0.015	0.001	0.003	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.114	0.155	-30	-21	-32	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	0.194	0.033	0.108	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	0.003	0.120	-34	ns	-22	67	ns	-30	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	0.003	0.007	0.037	nc	nc	nc	nc	nc	nc	-42	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	67	ns	175	43	-48
	Fraction 2	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-34	-36	ns	ns	43	46
	Fraction 3	mg/kg	lognormal	0.057	0.450	0.051	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	<0.001	0.035	<0.001	nc	nc	nc	nc	nc	nc	-32	-37	-41	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.359	0.585	-40	-31	-31	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.050	0.003	nc	nc	nc	nc	nc	nc	-20	ns	-16	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.658	<0.001	nc	nc	nc	nc	nc	nc	-29	-26	-23	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.055	0.058	-21	ns	ns	ns	21	ns	nc	nc	nc	nc	nc	nc
Beryllium (Be)	Fraction 3	mg/kg	lognormal	<0.001	0.147	<0.001	nc	nc	nc	nc	nc	nc	-38	-35	-33	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.139	-34	-11	-32	35	ns	-24	nc	nc	nc	nc	nc	nc
Cadmium (Cd)	Fraction 1	mg/kg	lognormal	<0.001	0.245	<0.001	nc	nc	nc	nc	nc	nc	-57	ns	-58	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.006	0.116	-40	-70	-60	-50	-32	35	nc	nc	nc	nc	nc	nc
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	-58	-57	-51	-49	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.269	<0.001	nc	nc	nc	nc	nc	nc	-41	-61	-55	-34	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.232	-28	ns	-30	23	ns	-21	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.351	0.034	nc	nc	nc	nc	nc	nc	-32	-62	-57	-44	-37	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.462	0.033	nc	nc	nc	nc	nc	nc	-30	-58	-55	-41	-36	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	-65	-57	-55	-46	ns
Calcium (Ca)	Fraction 1	mg/kg	lognormal	0.895	0.110	0.006	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.010	0.039	nc	nc	nc	nc	nc	nc	ns	-91	ns	-91	ns	1501
	Fraction 3	mg/kg	lognormal	<0.001	0.005	0.061	465	-64	142	-94	-57	576	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	37	-36	ns	-54	-26	59
	Fraction 5	mg/kg	lognormal	<0.001	0.516	<0.001	nc	nc	nc	nc	nc	nc	622	797	491	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.003	0.723	99	-78	61	-89	ns	640	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.003	0.685	101	-76	62	-88	ns	587	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.006	0.465	107	-88	68	-94	ns	1246	nc	nc	nc	nc	nc	nc
Chromium (Cr)	Fraction 3	mg/kg	lognormal	<0.001	0.005	<0.001	nc	nc	nc	nc	nc	nc	-41	-23	-28	31	ns	ns
	Fraction 4	mg/kg	lognormal	0.006	0.659	0.168	-28	-22	-22	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	0.010	0.534	-23	ns	-21	27	ns	-20	nc	nc	nc	nc	nc	nc
Cobalt (Co)	Fraction 1	mg/kg	lognormal	0.978	<0.001	0.009	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	0.145	0.032	0.001	nc	nc	nc	nc	nc	nc	-61	ns	-61	131	ns	-57
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-30	50	ns	114	ns	-42
	Fraction 4	mg/kg	lognormal	0.002	0.252	<0.001	nc	nc	nc	nc	nc	nc	44	ns	ns	ns	-35	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.468	-48	ns	-31	77	33	-25	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-100	30	-25	-	-	-42
	Sum of 1 to 5	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	15	-28	ns	ns	-37
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	-36	39	-21	116	23	-43
Copper (Cu)	Fraction 4	mg/kg	lognormal	<0.001	0.104	<0.001	nc	nc	nc	nc	nc	nc	-39	-73	-61	-56	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.131	-56	-33	-47	54	21	-22	nc	nc	nc	nc	nc	nc
Iron (Fe)	Fraction 3	mg/kg	lognormal	<0.001	0.296	<0.001	nc	nc	nc	nc	nc	nc	-49	ns	ns	113	64	-23
	Fraction 4	mg/kg	lognormal	0.081	0.611	0.094	ns	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.445	-27	30	ns	78	25	-30	nc	nc	nc	nc	nc	nc
Lead (Pb)	Fraction 3	mg/kg	lognormal	<0.001	0.004	0.014	nc	nc	nc	nc	nc	nc	-32	-27	-32	ns	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.089	<0.001	nc	nc	nc	nc	nc	nc	-61	-53	-39	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.078	-54	ns	-36	100	39	-30	nc	nc	nc	nc	nc	nc
Lithium (Li)	Fraction 5	mg/kg	lognormal	<0.001	0.315	<0.001	nc	nc	nc	nc	nc	nc	ns	65	29	61	26	-22

P-value <0.05.
Positive MOD (higher concentration of analyte at second biological monitoring area relative to the first).
Negative MOD (lower concentration of analyte at second biological monitoring area relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; mg/kg = milligrams per kilogram; < = less than; nc = no comparison; ns = not significant; HSD = Honestly Significant Difference; LRL = Laboratory Reporting Limit; > = greater than; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors 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 equal to the sum of the LRL values. Analytes that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1}*100$ for all years combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1}*100$ for each year when the *Area:Year* term was significant (α = 0.05).

Table D.26: Differences in Concentrations of Sediment Quality Analytes Among Sampling Areas on Greenhills and Gardine Creeks, Based on Sequential Extraction Analyses, 2019 to 2021

ANOVA Model [a]							Area Magnitude of Difference											
							Area Effects [b]						Area Effects by Year [c]					
													2019					
Analyte	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
Manganese (Mn)	Fraction 1	mg/kg	lognormal	0.370	<0.001	0.008	nc	nc	nc	nc	nc	nc	-76	-81	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	0.174	<0.001	0.096	28	ns	ns	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Fraction 3	mg/kg	lognormal	<0.001	0.041	0.002	nc	nc	nc	nc	nc	nc	85	130	108	ns	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.256	0.057	ns	97	ns	136	ns	-52	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.062	-33	ns	-23	71	ns	-33	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.160	0.527	ns	57	ns	ns	ns	-26	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.307	0.471	ns	51	ns	29	ns	-27	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.526	0.092	ns	69	ns	38	ns	-32	nc	nc	nc	nc	nc	nc
Molybdenum (Mo)	Fraction 5	mg/kg	lognormal	<0.001	0.200	0.055	-32	-22	-44	ns	ns	-28	nc	nc	nc	nc	nc	nc
Nickel (Ni)	Fraction 1	mg/kg	lognormal	<0.001	0.145	<0.001	nc	nc	nc	nc	nc	nc	ns	-36	-58	-50	-67	-34
	Fraction 2	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	46	-47	-66	-64	-76	-35
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	34	-21	-52	-41	-64	-39
	Fraction 4	mg/kg	lognormal	<0.001	0.081	<0.001	nc	nc	nc	nc	nc	nc	106	ns	ns	-62	-65	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.919	-44	-15	-37	52	ns	-27	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.006	<0.001	nc	nc	nc	nc	nc	nc	54	-26	-52	-52	-68	-34
	Sum of 1 to 5	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	28	-23	-47	-40	-59	-31
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	nc	nc	nc	37	-27	-55	-47	-67	-38
Phosphorus (P)	Fraction 3	mg/kg	lognormal	<0.001	0.079	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
Potassium (K)	Fraction 1	mg/kg	lognormal	0.991	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	0.991	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	0.991	<0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
Selenium (Se)	Fraction 1	mg/kg	lognormal	<0.001	0.616	0.003	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.349	<0.001	nc	nc	nc	nc	nc	nc	165	-79	ns	-92	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.530	<0.001	nc	nc	nc	nc	nc	nc	ns	-93	-90	-91	-89	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.010	<0.001	nc	nc	nc	nc	nc	nc	-60	-89	-88	-71	-71	ns
Silver (Ag)	Fraction 5	mg/kg	lognormal	<0.001	0.990	<0.001	nc	nc	nc	nc	nc	nc	-58	-69	-55	ns	ns	ns
Strontium (Sr)	Fraction 1	mg/kg	lognormal	<0.001	0.001	0.191	ns	194	49	162	33	-49	nc	nc	nc	nc	nc	nc
	Fraction 2	mg/kg	lognormal	<0.001	0.004	0.028	nc	nc	nc	nc	nc	nc	ns	-62	58	-58	79	321
	Fraction 3	mg/kg	lognormal	<0.001	0.002	0.104	181	ns	76	-73	-37	130	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	0.022	0.017	0.011	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.021	0.230	-25	-23	-32	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	<0.001	0.311	57	ns	60	-40	ns	71	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.003	0.030	nc	nc	nc	nc	nc	nc	ns	-22	ns	-33	ns	35
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.002	0.163	75	-50	73	-71	ns	243	nc	nc	nc	nc	nc	nc
Thallium (Tl)	Fraction 5	mg/kg	lognormal	0.017	0.609	0.116	ns	ns	-16	ns	ns	ns	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
	Fraction 5	mg/kg	lognormal	0.002	0.012	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
Uranium (U)	Fraction 1	mg/kg	lognormal	<0.001	0.046	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.494	<0.001	nc	nc	nc	nc	nc	nc	ns	-82	-45	-86	-56	211
	Fraction 3	mg/kg	lognormal	<0.001	0.502	<0.001	nc	nc	nc	nc	nc	nc	98	-50	-41	-75	-70	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.213	<0.001	nc	nc	nc	nc	nc	nc	ns	-46	-37	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.253	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	-28	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.100	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.095	<0.001	nc	nc	nc	nc	nc	nc	ns	ns	ns	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.933	<0.001	nc	nc	nc	nc	nc	nc	60	-71	-44	-82	-65	91
Vanadium (V)	Fraction 3	mg/kg	lognormal	<0.001	0.016	<0.001	nc	nc	nc	nc	nc	nc	-56	-26	-49	66	ns	-30
	Fraction 4	mg/kg	lognormal	<0.001	0.060	0.112	-39	-28	-35	ns	ns	ns	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.908	-36	-12	-32	36	ns	-22	nc	nc	nc	nc	nc	nc
Zinc (Zn)	Fraction 2	mg/kg	lognormal	<0.001	0.001	0.013	nc	nc	nc	nc	nc	nc	ns	-55	-61	-62	-67	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.005	<0.001	nc	nc	nc	nc	nc	nc	ns	-47	-55	-44	-53	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.039	<0.001	nc	nc	nc	nc	nc	nc	-38	-51	-49	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.974	-43	ns	-31	52	20	-21	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.001	<0.001	nc	nc	nc	nc	nc	nc	ns	-50	-57	-49	-56	ns

P-value <0.05.
Positive MOD (higher concentration of analyte at second biological monitoring area relative to the first).
Negative MOD (lower concentration of analyte at second biological monitoring area relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; mg/kg = milligrams per kilogram; < = less than; nc = no comparison; ns = not significant; HSD = Honestly Significant Difference; LRL = Laboratory Reporting Limit; > = greater than; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors 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 equal to the sum of the LRL values. Analytes that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1} * 100$ for all years combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1} * 100$ for each year when the *Area:Year* term was significant (α = 0.05).

Table D.26: Differences in Concentrations of Sediment Quality Analytes Among Sampling Areas on Greenhills and Gardine Creeks, Based on Sequential Extraction Analyses, 2019 to 2021

ANOVA Model[a]							Area Magnitude of Difference Area Effects by Year[c]											
							2020						2021					
Analyte	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	0.398	<0.001	-57	ns	-28	161	67	-36	-58	ns	-37	147	49	-40
	Fraction 4	mg/kg	lognormal	<0.001	0.131	0.011	ns	ns	ns	ns	ns	ns	-64	ns	ns	244	158	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.855	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Antimony (Sb)	Fraction 5	mg/kg	lognormal	<0.001	0.278	<0.001	-40	ns	-46	61	ns	-45	-57	ns	ns	186	118	-24
Arsenic (As)	Fraction 2	mg/kg	lognormal	0.015	0.001	0.003	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.114	0.155	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	0.194	0.033	0.108	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	0.003	0.120	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	0.003	0.007	0.037	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	-69	97	ns	528	148	-61	ns	179	38	122	ns	-51
	Fraction 2	mg/kg	lognormal	<0.001	<0.001	<0.001	-36	-18	ns	29	71	33	-14	-27	ns	-15	25	47
	Fraction 3	mg/kg	lognormal	0.057	0.450	0.051	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	<0.001	0.035	<0.001	ns	-28	-39	-30	-40	ns	-61	ns	ns	128	101	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.359	0.585	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.050	0.003	-30	ns	-19	48	ns	-22	-20	ns	ns	46	32	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.658	<0.001	-35	-16	-27	29	ns	-13	-30	ns	-13	40	25	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.055	0.058	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Beryllium (Be)	Fraction 3	mg/kg	lognormal	<0.001	0.147	<0.001	-48	-24	-43	46	ns	-25	ns	ns	-21	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.139	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Cadmium (Cd)	Fraction 1	mg/kg	lognormal	<0.001	0.245	<0.001	ns	ns	-81	ns	ns	-73	ns	ns	-71	ns	ns	-69
	Fraction 2	mg/kg	lognormal	<0.001	0.006	0.116	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	81	-51	-59	-73	-77	ns	347	ns	-32	-83	-85	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.269	<0.001	ns	-61	-56	-67	-63	ns	ns	ns	ns	-49	-51	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.232	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.351	0.034	-82	-58	-66	140	91	ns	-100	-42	-51	606659	512106	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.462	0.033	ns	-54	-64	ns	ns	ns	ns	-39	-49	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	ns	-60	-61	-66	-67	ns	154	-47	-46	-79	-79	ns
Calcium (Ca)	Fraction 1	mg/kg	lognormal	0.895	0.110	0.006	ns	ns	ns	ns	-30	ns	ns	ns	ns	44	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.010	0.039	59	-92	85	-95	ns	2074	ns	-94	ns	-94	ns	1759
	Fraction 3	mg/kg	lognormal	<0.001	0.005	0.061	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	<0.001	<0.001	<0.001	82	-34	ns	-64	-38	70	61	ns	87	-46	ns	117
	Fraction 5	mg/kg	lognormal	<0.001	0.516	<0.001	201	491	374	96	ns	ns	1077	341	430	-63	-55	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.003	0.723	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.003	0.685	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.006	0.465	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Chromium (Cr)	Fraction 3	mg/kg	lognormal	<0.001	0.005	<0.001	-52	ns	-32	75	43	-18	ns	-25	-39	-32	-45	-19
	Fraction 4	mg/kg	lognormal	0.006	0.659	0.168	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	0.010	0.534	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Cobalt (Co)	Fraction 1	mg/kg	lognormal	0.978	<0.001	0.009	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	0.145	0.032	0.001	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	-65	34	-41	284	71	-56	-75	ns	-50	377	100	-58
	Fraction 4	mg/kg	lognormal	0.002	0.252	<0.001	71	ns	ns	ns	-52	-35	ns	57	ns	95	46	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.468	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	<0.001	<0.001	-27	37	-30	88	ns	-49	-56	23	-33	181	53	-46
	Sum of 1 to 5	mg/kg	lognormal	<0.001	<0.001	<0.001	-33	24	-30	86	ns	-44	-56	ns	-33	152	51	-40
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	-52	29	-38	169	31	-52	-64	19	-43	231	59	-52
Copper (Cu)	Fraction 4	mg/kg	lognormal	<0.001	0.104	<0.001	ns	-61	-61	-58	-57	ns	-44	-39	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
Iron (Fe)	Fraction 3	mg/kg	lognormal	<0.001	0.296	<0.001	-53	28	-22	173	67	-39	-22	ns	-30	56	ns	-43
	Fraction 4	mg/kg	lognormal	0.081	0.611	0.094	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.445	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Lead (Pb)	Fraction 3	mg/kg	lognormal	<0.001	0.004	0.014	-21	-26	-26	ns	ns	ns	-15	-29	-19	-17	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.089	<0.001	ns	ns	-49	ns	ns	ns	ns	ns	-42	ns	ns	-46
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.078	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Lithium (Li)	Fraction 5	mg/kg	lognormal	<0.001	0.315	<0.001	ns	82	ns	93	ns	-41	47	48	ns	ns	-22	-23

P-value <0.05.

Positive MOD (higher concentration of analyte at second biological monitoring area relative to the first).

Negative MOD (lower concentration of analyte at second biological monitoring area relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; mg/kg = milligrams per kilogram; < = less than; nc = no comparison; ns = not significant; HSD = Honestly Significant Difference; LRL = Laboratory Reporting Limit; > = greater than; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors 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 equal to the sum of the LRL values. Analytes that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1} * 100$ for all years combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1} * 100$ for each year when the *Area:Year* term was significant (α = 0.05).

Table D.26: Differences in Concentrations of Sediment Quality Analytes Among Sampling Areas on Greenhills and Gardine Creeks, Based on Sequential Extraction Analyses, 2019 to 2021

ANOVA Model [a]							Area Magnitude of Difference												
							Area Effects by Year [c]												
							2020						2021					
Analyte	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
Manganese (Mn)	Fraction 1	mg/kg	lognormal	0.370	<0.001	0.008	359	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	0.174	<0.001	0.096	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 3	mg/kg	lognormal	<0.001	0.041	0.002	ns	127	ns	234	ns	-59	ns	ns	ns	ns	ns	-55
	Fraction 4	mg/kg	lognormal	<0.001	0.256	0.057	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.062	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.160	0.527	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.307	0.471	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.526	0.092	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Molybdenum (Mo)	Fraction 5	mg/kg	lognormal	<0.001	0.200	0.055	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Nickel (Ni)	Fraction 1	mg/kg	lognormal	<0.001	0.145	<0.001	166	ns	-62	-73	-86	-46	-46	-66	-78	-37	-59	-35
	Fraction 2	mg/kg	lognormal	<0.001	<0.001	<0.001	164	-53	-64	-82	-86	-23	-48	-75	-78	-52	-57	ns
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	67	-31	-64	-59	-79	-48	-68	-50	-74	54	-19	-47
	Fraction 4	mg/kg	lognormal	<0.001	0.081	<0.001	329	ns	-36	-82	-85	ns	-41	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.919	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.006	<0.001	144	-33	-60	-73	-84	-40	-58	-49	-67	ns	ns	-35
	Sum of 1 to 5	mg/kg	lognormal	<0.001	<0.001	<0.001	91	-28	-55	-62	-76	-37	-55	-41	-61	32	ns	-34
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	89	-36	-64	-66	-81	-44	-63	-57	-75	ns	-32	-42
Phosphorus (P)	Fraction 3	mg/kg	lognormal	<0.001	0.079	<0.001	ns	ns	-54	ns	-35	-56	-39	ns	-52	51	ns	-48
Potassium (K)	Fraction 1	mg/kg	lognormal	0.991	<0.001	<0.001	ns	ns	ns	ns	ns	ns	ns	49	55	49	55	ns
	Sum of 1 to 4	mg/kg	lognormal	0.991	<0.001	<0.001	ns	ns	ns	ns	ns	ns	ns	49	55	49	55	ns
	Sum of 1 to 5	mg/kg	lognormal	0.991	<0.001	<0.001	ns	ns	ns	ns	ns	ns	ns	49	55	49	55	ns
Selenium (Se)	Fraction 1	mg/kg	lognormal	<0.001	0.616	0.003	ns	ns	ns	ns	ns	ns	-81	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.349	<0.001	314	ns	-79	ns	-95	ns	ns	-84	-74	-75	-60	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.530	<0.001	96	-92	-89	-96	-94	ns	-74	-91	-85	-66	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.010	<0.001	ns	-85	-87	-84	-86	ns	-85	-87	-87	ns	ns	ns
Silver (Ag)	Fraction 5	mg/kg	lognormal	<0.001	0.990	<0.001	-48	-60	-56	ns	ns	ns	-70	ns	ns	123	143	ns
Strontium (Sr)	Fraction 1	mg/kg	lognormal	<0.001	0.001	0.191	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 2	mg/kg	lognormal	<0.001	0.004	0.028	ns	-52	102	-63	55	321	ns	-67	53	-75	ns	356
	Fraction 3	mg/kg	lognormal	<0.001	0.002	0.104	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	0.022	0.017	0.011	ns	ns	ns	ns	ns	ns	ns	ns	ns	41	57	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.021	0.230	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	<0.001	0.311	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.003	0.030	ns	ns	ns	-22	ns	33	54	ns	44	-38	ns	50
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.002	0.163	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Thallium (Tl)	Fraction 5	mg/kg	lognormal	0.017	0.609	0.116	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	ns	ns	ns	ns	ns	ns	-85	206	-89	137	1953
	Fraction 5	mg/kg	lognormal	0.002	0.012	<0.001	ns	98	ns	146	38	-44	109	44	ns	-31	-51	-29
Uranium (U)	Fraction 1	mg/kg	lognormal	<0.001	0.046	<0.001	ns	ns	ns	ns	ns	ns	ns	ns	-65	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.494	<0.001	211	ns	ns	ns	-74	ns	ns	-81	ns	-71	ns	232
	Fraction 3	mg/kg	lognormal	<0.001	0.502	<0.001	160	-54	-41	-82	-78	ns	ns	-37	ns	-45	ns	58
	Fraction 4	mg/kg	lognormal	<0.001	0.213	<0.001	ns	-43	-37	-42	-36	ns	-58	ns	ns	101	56	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.253	<0.001	-43	ns	-39	38	ns	ns	ns	ns	-33	-24	-40	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.100	<0.001	90	ns	ns	ns	ns	ns	ns	ns	-37	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.095	<0.001	47	ns	ns	ns	ns	ns	ns	ns	-36	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.933	<0.001	181	ns	ns	ns	-76	ns	ns	-63	ns	-57	ns	114
Vanadium (V)	Fraction 3	mg/kg	lognormal	<0.001	0.016	<0.001	-64	-24	-51	109	34	-36	-17	-27	-50	ns	-39	-32
	Fraction 4	mg/kg	lognormal	<0.001	0.060	0.112	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.908	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Zinc (Zn)	Fraction 2	mg/kg	lognormal	<0.001	0.001	0.013	84	-53	-61	-74	-79	ns	62	-62	-62	-77	-76	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.005	<0.001	83	-40	-54	-67	-75	-24	58	-36	-49	-60	-68	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.039	<0.001	ns	-47	-55	-57	-63	ns	ns	ns	-35	ns	ns	-34
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.974	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.001	<0.001	83	-44	-56	-69	-76	-22	59	-43	-52	-64	-70	ns

P-value <0.05.
Positive MOD (higher concentration of analyte at second biological monitoring area relative to the first).
Negative MOD (lower concentration of analyte at second biological monitoring area relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; mg/kg = milligrams per kilogram; < = less than; nc = no comparison; ns = not significant; HSD = Honestly Significant Difference; LRL = Laboratory Reporting Limit; > = greater than; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors 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 equal to the sum of the LRL values. Analytes that had >75% censored data were excluded from the analyses.

[b] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1} * 100$ for all years combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{area\ 2} - EMM_{area\ 1}]/EMM_{area\ 1} * 100$ for each year when the *Area:Year* term was significant (α = 0.05).

Table D.27: Differences in Concentrations of Sediment Quality Analytes Among Years on Lower Greenhills and Gardine Creeks Sampling Areas, Based on Sequential Extraction Analysis, 2019 to 2021

ANOVA Model [a]							Yearly Magnitude of Difference														
							Year Effects [b]			Year Effects by Area [c]											
										RG_GHP			RG_GHBP			RG_GAUT			RG_GANF		
Analyte	Fraction	Units	Assumed Distribution	Area	Year	Area:Year	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021
Aluminum (Al)	Fraction 3	mg/kg	lognormal	<0.001	0.398	<0.001	nc	nc	nc	ns	ns	ns	-15	ns	ns	ns	ns	ns	ns	-18	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.131	0.011	nc	nc	nc	ns	ns	ns	ns	ns	-57	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.855	ns	-12	-18	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Antimony (Sb)	Fraction 5	mg/kg	lognormal	<0.001	0.278	<0.001	nc	nc	nc	ns	ns	ns	ns	-35	-32	52	84	ns	ns	58	68
Arsenic (As)	Fraction 2	mg/kg	lognormal	0.015	0.001	0.003	nc	nc	nc	ns	ns	ns	193	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.114	0.155	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	0.194	0.033	0.108	ns	ns	-26	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	0.003	0.120	ns	-19	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	0.003	0.007	0.037	nc	nc	nc	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	ns	ns	ns	-39	87	206	40	51	ns	ns	44	35
	Fraction 2	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	-13	ns	ns	-16	24	48	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	0.057	0.450	0.051	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	<0.001	0.035	<0.001	nc	nc	nc	ns	ns	ns	53	-47	-65	ns	33	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.359	0.585	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	0.050	0.003	nc	nc	nc	ns	ns	ns	ns	ns	ns	22	31	ns	ns	22	24
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.658	<0.001	nc	nc	nc	ns	ns	ns	ns	-11	ns	12	21	ns	ns	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.055	0.058	ns	ns	12	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Beryllium (Be)	Fraction 3	mg/kg	lognormal	<0.001	0.147	<0.001	nc	nc	nc	ns	ns	ns	ns	ns	ns	18	29	ns	ns	17	35
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.139	ns	-14	-13	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Cadmium (Cd)	Fraction 1	mg/kg	lognormal	<0.001	0.245	<0.001	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.006	0.116	-18	ns	18	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	ns	ns	ns	101	312	104	ns	41	ns	ns	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.269	<0.001	nc	nc	nc	ns	ns	ns	84	75	ns	ns	ns	47	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.232	-14	-27	-15	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.351	0.034	nc	nc	nc	ns	ns	ns	-74	-100	-100	ns	34	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.462	0.033	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	26	ns	-21	ns	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	ns	ns	ns	40	180	100	ns	30	ns	ns	ns	ns
Calcium (Ca)	Fraction 1	mg/kg	lognormal	0.895	0.110	0.006	nc	nc	nc	ns	ns	ns	ns	ns	-27	ns	56	ns	ns	ns	37
	Fraction 2	mg/kg	lognormal	<0.001	0.010	0.039	nc	nc	nc	ns	ns	60	ns	52	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.005	0.061	ns	78	54	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	ns	ns	ns	39	ns	ns	ns	32	ns	ns	80	54
	Fraction 5	mg/kg	lognormal	<0.001	0.516	<0.001	nc	nc	nc	ns	ns	ns	-47	57	195	ns	-53	-44	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.003	0.723	ns	40	30	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.003	0.685	ns	38	29	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.006	0.465	ns	38	32	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Chromium (Cr)	Fraction 3	mg/kg	lognormal	<0.001	0.005	<0.001	nc	nc	nc	ns	ns	ns	-29	74	144	ns	ns	ns	ns	-20	ns
	Fraction 4	mg/kg	lognormal	0.006	0.659	0.168	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	0.010	0.534	ns	-11	-11	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

P-value <0.05.

Positive MOD (higher concentration of analyte in second year relative to the first).

Negative MOD (lower concentration of analyte in second year relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; % = percent; < = less than; nc = no comparison; ns = not significant; mm = millimetres; µm = micrometres; > = greater than; mg/kg = milligrams per kilogram dry weight; HSD = Honestly Significant Difference; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors *Area* , *Year* and *Area:Year* . Post-hoc contrasts were corrected using a Tukey's HSD Test. Analytes 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 areas combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{year\ 2} - EMM_{year\ 1}]/EMM_{year\ 1} * 100$ for each area when the *Area:Year* term was significant (α = 0.05).

Table D.27: Differences in Concentrations of Sediment Quality Analytes Among Years on Lower Greenhills and Gardine Creeks Sampling Areas, Based on Sequential Extraction Analysis, 2019 to 2021

ANOVA Model [a]							Yearly Magnitude of Difference														
							Year Effects [b]			Year Effects by Area [c]											
										RG_GHP			RG_GHBP			RG_GAUT			RG_GANF		
Analyte	Fraction	Units	Assumed Distribution	Area	Year	Area:Year	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021
Cobalt (Co)	Fraction 1	mg/kg	lognormal	0.978	<0.001	0.009	nc	nc	nc	ns	ns	ns	ns	ns	ns	183	186	ns	159	230	ns
	Fraction 2	mg/kg	lognormal	0.145	0.032	0.001	nc	nc	nc	ns	ns	ns	221	133	ns	ns	ns	ns	ns	124	ns
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	ns	ns	ns	-49	-66	-34	ns	-24	ns	-30	-45	-22
	Fraction 4	mg/kg	lognormal	0.002	0.252	<0.001	nc	nc	nc	ns	ns	ns	ns	-48	-57	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.468	ns	-26	-21	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	ns	ns	ns	-	-	-40	ns	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	ns	ns	ns	ns	ns	-37	ns	-12	-14	ns	-16	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	ns	ns	ns	-25	-48	-31	ns	-21	-16	-20	-33	-16
Copper (Cu)	Fraction 4	mg/kg	lognormal	<0.001	0.104	<0.001	nc	nc	nc	ns	ns	ns	58	ns	-53	ns	85	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.131	ns	-21	-20	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Iron (Fe)	Fraction 3	mg/kg	lognormal	<0.001	0.296	<0.001	nc	nc	nc	ns	ns	ns	ns	50	66	ns	ns	ns	ns	ns	ns
	Fraction 4	mg/kg	lognormal	0.081	0.611	0.094	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.445	ns	-26	-18	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Lead (Pb)	Fraction 3	mg/kg	lognormal	<0.001	0.004	0.014	nc	nc	nc	ns	-16	ns	ns	ns	ns	ns	-18	-16	ns	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.089	<0.001	nc	nc	nc	ns	ns	ns	76	ns	ns	ns	103	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.078	-15	-24	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Lithium (Li)	Fraction 5	mg/kg	lognormal	<0.001	0.315	<0.001	nc	nc	nc	ns	ns	ns	ns	28	39	ns	-20	-28	ns	-21	ns
Manganese (Mn)	Fraction 1	mg/kg	lognormal	0.370	<0.001	0.008	nc	nc	nc	ns	ns	ns	2004	1480	ns	782	787	ns	349	682	ns
	Fraction 2	mg/kg	lognormal	0.174	<0.001	0.096	45	59	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 3	mg/kg	lognormal	<0.001	0.041	0.002	nc	nc	nc	ns	ns	ns	-60	ns	101	ns	ns	ns	-51	-57	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.256	0.057	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.062	ns	-24	-16	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.160	0.527	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.307	0.471	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.526	0.092	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Molybdenum (Mo)	Fraction 5	mg/kg	lognormal	<0.001	0.200	0.055	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Nickel (Ni)	Fraction 1	mg/kg	lognormal	<0.001	0.145	<0.001	nc	nc	nc	ns	53	66	93	-35	-66	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	ns	27	43	61	-55	-72	ns	-41	-25	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	ns	23	26	22	-71	-76	ns	-23	ns	-28	-34	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.081	<0.001	nc	nc	nc	ns	ns	ns	103	-68	-84	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.919	ns	-26	-21	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.006	<0.001	nc	nc	nc	ns	ns	ns	53	-66	-78	ns	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	ns	ns	ns	43	-62	-73	ns	-16	ns	-17	-20	ns
	Sum of 2 and 3	mg/kg	lognormal	<0.001	<0.001	<0.001	nc	nc	nc	ns	24	29	33	-66	-75	ns	-26	ns	-24	-30	ns
Phosphorus (P)	Fraction 3	mg/kg	lognormal	<0.001	0.079	<0.001	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	-56	-50	ns
Potassium (K)	Fraction 1	mg/kg	lognormal	0.991	<0.001	<0.001	nc	nc	nc	30	ns	-16	ns	ns	-25	ns	67	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	0.991	<0.001	<0.001	nc	nc	nc	30	ns	-16	ns	ns	-25	ns	67	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	0.991	<0.001	<0.001	nc	nc	nc	30	ns	-16	ns	ns	-25	ns	67	ns	ns	ns	ns

P-value <0.05.

Positive MOD (higher concentration of analyte in second year relative to the first).

Negative MOD (lower concentration of analyte in second year relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; % = percent; < = less than; nc = no comparison; ns = not significant; mm = millimetres; µm = micrometres; > = greater than; mg/kg = milligrams per kilogram dry weight; HSD = Honestly Significant Difference; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors *Area*, *Year* and *Area:Year*. Post-hoc contrasts were corrected using a Tukey's HSD Test. Analytes 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 areas combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as $[EMM_{year\ 2} - EMM_{year\ 1}]/EMM_{year\ 1} * 100$ for each area when the *Area:Year* term was significant (α = 0.05).

Table D.27: Differences in Concentrations of Sediment Quality Analytes Among Years on Lower Greenhills and Gardine Creeks Sampling Areas, Based on Sequential Extraction Analysis, 2019 to 2021

ANOVA Model [a]							Yearly Magnitude of Difference														
							Year Effects [b]			Year Effects by Area [c]											
										RG_GHP			RG_GHBP			RG_GAUT			RG_GANF		
Analyte	Fraction	Units	Assumed Distribution	Area	Year	Area:Year	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021	2019 vs 2020	2019 vs 2021	2020 vs 2021
Selenium (Se)	Fraction 1	mg/kg	lognormal	<0.001	0.616	0.003	nc	nc	nc	ns	140	195	ns	ns	-59	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.349	<0.001	nc	nc	nc	ns	73	74	ns	-57	-73	ns	ns	ns	ns	ns	114
	Fraction 4	mg/kg	lognormal	<0.001	0.530	<0.001	nc	nc	nc	ns	ns	ns	79	-69	-83	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.010	<0.001	nc	nc	nc	ns	ns	ns	82	-68	-82	ns	ns	ns	ns	ns	ns
Silver (Ag)	Fraction 5	mg/kg	lognormal	<0.001	0.990	<0.001	nc	nc	nc	ns	ns	ns	ns	-45	-49	ns	71	ns	ns	ns	ns
Strontium (Sr)	Fraction 1	mg/kg	lognormal	<0.001	0.001	0.191	ns	29	21	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 2	mg/kg	lognormal	<0.001	0.004	0.028	nc	nc	nc	ns	ns	43	ns	73	45	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.002	0.104	ns	58	43	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 4	mg/kg	lognormal	0.022	0.017	0.011	nc	nc	nc	ns	ns	ns	26	ns	-29	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.021	0.230	ns	-14	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 4	mg/kg	lognormal	<0.001	<0.001	0.311	ns	33	26	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.003	0.030	nc	nc	nc	ns	ns	ns	ns	24	34	ns	ns	ns	ns	28	21
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.002	0.163	ns	35	31	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Thallium (Tl)	Fraction 5	mg/kg	lognormal	0.017	0.609	0.116	ns	ns	ns	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	ns	-69	-67	ns	ns	-55	ns	-93	-93	ns	ns	ns
	Fraction 5	mg/kg	lognormal	0.002	0.012	<0.001	nc	nc	nc	ns	ns	ns	ns	102.0	119	100	ns	-39	ns	ns	-23
Uranium (U)	Fraction 1	mg/kg	lognormal	<0.001	0.046	<0.001	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Fraction 2	mg/kg	lognormal	<0.001	0.494	<0.001	nc	nc	nc	ns	ns	70	91	ns	-64	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.502	<0.001	nc	nc	nc	ns	ns	ns	ns	-49	-60	ns	ns	ns	ns	48	53
	Fraction 4	mg/kg	lognormal	<0.001	0.213	<0.001	nc	nc	nc	ns	ns	ns	ns	-47	-60	ns	ns	ns	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	0.253	<0.001	nc	nc	nc	ns	ns	ns	-28	ns	65	ns	ns	ns	ns	ns	ns
	Sum of 1 to 4	mg/kg	lognormal	<0.001	0.100	<0.001	nc	nc	nc	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	Sum of 1 to 5	mg/kg	lognormal	<0.001	0.095	<0.001	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	0.933	<0.001	nc	nc	nc	ns	ns	ns	50	-43	-62	ns	ns	ns	ns	48	ns
Vanadium (V)	Fraction 3	mg/kg	lognormal	<0.001	0.016	<0.001	nc	nc	nc	ns	ns	ns	-15	83	116	ns	ns	ns	ns	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.060	0.112	ns	ns	ns	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.908	ns	-12	-15	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Zinc (Zn)	Fraction 2	mg/kg	lognormal	<0.001	0.001	0.013	nc	nc	nc	ns	ns	ns	57	68	ns	ns	ns	ns	ns	ns	ns
	Fraction 3	mg/kg	lognormal	<0.001	0.005	<0.001	nc	nc	nc	ns	ns	ns	80	64	ns	ns	ns	ns	ns	ns	ns
	Fraction 4	mg/kg	lognormal	<0.001	0.039	<0.001	nc	nc	nc	ns	ns	ns	110	ns	-42	ns	82	56	ns	ns	ns
	Fraction 5	mg/kg	lognormal	<0.001	<0.001	0.974	ns	-24	-19	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	Sum of 2 and 3	mg/kg	lognormal	<0.001	0.001	<0.001	nc	nc	nc	ns	ns	ns	74	66	ns	ns	ns	ns	ns	ns	ns

P-value <0.05.
Positive MOD (higher concentration of analyte in second year relative to the first).
Negative MOD (lower concentration of analyte in second year relative to the first).

Notes: ANOVA = Analysis of Variance; vs = versus; % = percent; < = less than; nc = no comparison; ns = not significant; mm = millimetres; µm = micrometres; > = greater than; mg/kg = milligrams per kilogram dry weight; HSD = Honestly Significant Difference; MOD = Magnitude of Difference; EMM = the estimated marginal mean from the censored regression model.

[a] Censored regression ANOVA with factors *Area*, *Year* and *Area:Year*. Post-hoc contrasts were corrected using a Tukey's HSD Test. Analytes 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 areas combined when the *Area:Year* term was insignificant (α = 0.05).

[c] The MOD was calculated as [$EMM_{year\ 2}$- $EMM_{year\ 1}$]/$EMM_{year\ 1}$*100 for each area when the *Area:Year* term was significant (α = 0.05).

Table D.28: Annual Differences in Sediment Quality in Lower Greenhills Creek (RG_GHBP) for Years Before (2017) and After (2018 to 2021) Initiation of Treatment with Antiscalant

ANOVA Model Testing for Difference Among Treatment and Year						Post-hoc Contrasts and MOD Relative to Pre-Treatment Year (2017)				
Analyte [a]		Units	% Censored	Treatment	Year (Treatment)	Treatment Effects [b]	Treatment Effects by Years [c]			
							2018	2019	2020	2021
Physical Tests	Moisture	%	0	<0.001	0.416	34	nc	nc	nc	nc
	% Sand (0.125 mm to 0.063 mm)	%	0	0.509	0.352	ns	nc	nc	nc	nc
	% Sand (0.25 mm to 0.125 mm)	%	0	0.181	0.722	ns	nc	nc	nc	nc
	% Sand (0.50 mm to 0.25 mm)	%	8.00	0.319	0.942	ns	nc	nc	nc	nc
	% Sand (1.00 mm to 0.50 mm)	%	8.00	0.684	0.975	ns	nc	nc	nc	nc
	% Sand (2.00 mm to 1.00 mm)	%	20.0	0.126	1.000	ns	nc	nc	nc	nc
	% Silt (0.0312 mm to 0.004 mm)	%	0	0.304	0.883	ns	nc	nc	nc	nc
	% Silt (0.063 mm to 0.0312 mm)	%	0	0.240	0.990	ns	nc	nc	nc	nc
	% Clay (<4 µm)	%	0	0.700	0.279	ns	nc	nc	nc	nc
	% Gravel (>2 mm)	%	48.0	0.246	0.986	ns	nc	nc	nc	nc
Organic Carbon	Total Organic Carbon	%	0	0.127	0.984	ns	nc	nc	nc	nc
Metals	Aluminum (Al)	mg/kg	0	0.417	0.607	ns	nc	nc	nc	nc
	Antimony (Sb)	mg/kg	0	0.397	0.671	ns	nc	nc	nc	nc
	Arsenic (As)	mg/kg	0	0.324	0.978	ns	nc	nc	nc	nc
	Barium (Ba)	mg/kg	0	0.862	0.118	ns	nc	nc	nc	nc
	Beryllium (Be)	mg/kg	0	0.308	0.978	ns	nc	nc	nc	nc
	Boron (B)	mg/kg	12.0	0.840	<0.001	nc	ns	ns	64	ns
	Cadmium (Cd)	mg/kg	0	0.705	0.113	ns	nc	nc	nc	nc
	Calcium (Ca)	mg/kg	0	0.824	0.997	ns	nc	nc	nc	nc
	Chromium (Cr)	mg/kg	0	0.102	0.975	ns	nc	nc	nc	nc
	Cobalt (Co)	mg/kg	0	0.718	0.071	ns	nc	nc	nc	nc
	Copper (Cu)	mg/kg	0	0.556	0.953	ns	nc	nc	nc	nc
	Iron (Fe)	mg/kg	0	0.426	1.000	ns	nc	nc	nc	nc
	Lead (Pb)	mg/kg	0	0.181	1.000	ns	nc	nc	nc	nc
	Lithium (Li)	mg/kg	0	0.162	0.999	ns	nc	nc	nc	nc
	Magnesium (Mg)	mg/kg	0	0.823	0.058	ns	nc	nc	nc	nc
	Manganese (Mn)	mg/kg	0	0.016	0.685	28	nc	nc	nc	nc
	Mercury (Hg)	mg/kg	0	0.395	0.108	ns	nc	nc	nc	nc
	Molybdenum (Mo)	mg/kg	0	0.162	0.967	ns	nc	nc	nc	nc
	Nickel (Ni)	mg/kg	0	0.300	0.417	ns	nc	nc	nc	nc
	Phosphorus (P)	mg/kg	0	0.488	0.961	ns	nc	nc	nc	nc
	Potassium (K)	mg/kg	0	0.384	0.351	ns	nc	nc	nc	nc
	Selenium (Se)	mg/kg	0	0.005	0.217	90	nc	nc	nc	nc
	Silver (Ag)	mg/kg	4.00	0.754	0.914	ns	nc	nc	nc	nc
	Sodium (Na)	mg/kg	0	0.290	0.017	nc	39	ns	ns	ns
	Strontium (Sr)	mg/kg	0	0.777	0.947	ns	nc	nc	nc	nc
	Sulfur (S)	mg/kg	20.0	0.169	0.936	ns	nc	nc	nc	nc
	Thallium (Tl)	mg/kg	0	0.124	0.082	ns	nc	nc	nc	nc
	Titanium (Ti)	mg/kg	0	0.021	<0.001	nc	128	ns	411	ns
	Uranium (U)	mg/kg	0	0.066	0.288	ns	nc	nc	nc	nc
	Vanadium (V)	mg/kg	0	0.333	0.862	ns	nc	nc	nc	nc
	Zinc (Zn)	mg/kg	0	0.209	<0.001	nc	ns	ns	43	14
	Zirconium (Zr)	mg/kg	48.0	0.678	0.302	ns	nc	nc	nc	nc
Polycyclic Aromatic Hydrocarbons	Acenaphthylene	mg/kg	56.0	0.561	0.207	ns	nc	nc	nc	nc
	Benz(a)anthracene	mg/kg	44.0	0.202	0.035	nc	ns	ns	146	ns
	Benzo(a)pyrene	mg/kg	4.00	0.017	0.179	141	nc	nc	nc	nc
	Benzo(b&j)fluoranthene	mg/kg	0	0.020	0.122	109	nc	nc	nc	nc
	Benzo(e)pyrene	mg/kg	0	0.009	0.122	136	nc	nc	nc	nc
	Benzo(g,h,i)perylene	mg/kg	0	0.004	0.099	182	nc	nc	nc	nc
	Benzo(k)fluoranthene	mg/kg	68.0	0.231	0.167	ns	nc	nc	nc	nc
	Chrysene	mg/kg	16.0	0.053	0.673	ns	nc	nc	nc	nc
	Dibenz(a,h)anthracene	mg/kg	36.0	0.155	0.012	nc	ns	ns	167	207
	Fluoranthene	mg/kg	0	0.020	0.160	114	nc	nc	nc	nc
	Fluorene	mg/kg	0	0.005	0.117	210	nc	nc	nc	nc
	Indeno(1,2,3-c,d)pyrene	mg/kg	32.0	0.022	0.740	155	nc	nc	nc	nc
	1-Methylnaphthalene	mg/kg	0	0.009	0.109	171	nc	nc	nc	nc
	2-Methylnaphthalene	mg/kg	0	0.013	0.132	165	nc	nc	nc	nc
	Naphthalene	mg/kg	0	0.009	0.115	201	nc	nc	nc	nc
	Phenanthrene	mg/kg	0	0.011	0.172	140	nc	nc	nc	nc
	Pyrene	mg/kg	0	0.001	0.193	193	nc	nc	nc	nc

Main effect p-value <0.05; interaction p-value <0.05.

Positive MOD (higher concentration of analyte after treatment relative to before treatment or in 2018, 2019, 2020, or 2021 relative to 2017).

Negative MOD (lower concentration of analyte after treatment relative to before treatment or in 2018, 2019, 2020, or 2021 relative to 2017).

Notes: ANOVA = Analysis of Variance; % = percent; MOD = Magnitude of Difference; < = less than; nc = no comparison; mm = millimetre; ns = not significant; > = greater than; mg/kg = milligrams per kilogram; LRL = Laboratory Reporting Limit; MCT = Measure of Central Tendency (i.e., the estimated marginal mean from the censored regression model).

[a] Analytes with >75% of reported values <LRL were excluded from the analysis. When year (treatment) was insignificant, the post-doc test was conducted as a Dunnett's test comparing all post-treatment years to the pre-treatment year (2017).

[b] MOD = $(MCT_{After\ Treatment} - MCT_{Before\ Treatment})/MCT_{Before\ Treatment}*100$. "After Treatment" combined all years (2018 to 2021) when Year (Treatment) was insignificant.

[c] MOD = $(MCT_{after\ year} - MCT_{2017})/MCT_{2017}*100$ when Year (Treatment) was significant.

Table D.29: Sediment Quality Indices (SQI) for Biological Monitoring Areas on Greenhills and Gardine Creeks, 2013 to 2021

Biological Monitoring Area	Year	SQI [a]	F1 (Scope) [b]	F2 (Area Frequency) [c]	F3 (Amplitude) [d]	Sample Size
RG_GHBP	2017	31.2	62.1	49.7	88.8	145
	2018	26.0	65.5	57.9	93.7	145
	2019	27.0	69.0	54.5	90.8	145
	2020	23.6	69.0	60.7	95.1	145
	2021	23.6	65.5	62.1	96.9	145
RG_GAUT	2019	32.3	69.0	49.7	80.8	145
	2020	34.2	55.2	51.0	85.6	145
	2021	24.9	72.4	53.1	94.1	145
RG_GANF	2019	32.4	58.6	51.7	87.2	145
	2020	34.6	51.7	46.9	89.2	145
	2021	30.6	55.2	50.3	94.2	145
RG_GHP	2013	20.5	79.3	57.1	96.9	210
	2017	24.5	69.0	58.6	94.4	174
	2019	20.3	75.9	64.4	95.8	174
	2020	21.3	69.0	66.2	97.2	145
	2021	23.6	65.5	61.4	97.2	145

Notes: Non-detect data were replaced with the LRL to support calculation of the SQI. Calculations were derived using a total of 29 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.

Table D.30: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHP-1 on the Greenhills Creek Sedimentation Pond, September 2021

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	631	1,670	6,100	2,401	8,501	681	7,930
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.880	0.400	1.28	0.200	1.03
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.100	0.816	0.480	3.86	1.45	5.31	0.916	5.70
Barium (Ba)	mg/kg	-	-	18.1	55.0	49.6	26.6	190	149	339	105	365
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.330	<0.2	0.340	0.930	1.27	0.530	0.840
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	<5
Cadmium (Cd)	mg/kg	0.600	3.50	0.109	0.559	0.626	0.108	0.0740	1.40	1.48	1.18	1.48
Calcium (Ca)	mg/kg	-	-	3,780	41,400	7,850	1,500	115	54,530	54,645	49,250	54,300
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.990	4.16	9.60	10.6	20.2	5.99	12.6
Cobalt (Co)	mg/kg	-	-	0.420	1.44	4.09	1.15	2.83	7.10	9.93	5.53	9.99
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.570	10.5	15.5	12.1	27.6	1.07	24.9
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,680	1,780	9,080	5,560	14,640	3,730	13,700
Lead (Pb)	mg/kg	35.0	91.3	<0.5	1.05	3.36	1.51	7.58	6.42	14.0	4.41	11.8
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	20.0	25.0	10.0	9.10
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	5,390
Manganese (Mn)	mg/kg	460	1,100	23.4	55.6	59.8	8.20	36.6	147	184	115	195
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.103
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	0.910	2.00	2.91	1.00	1.36
Nickel (Ni)	mg/kg	16.0	75.0	2.34	11.8	30.6	12.2	11.5	56.9	68.4	42.4	65.7
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	111	-	-	211	211	161	957
Potassium (K)	mg/kg	-	-	<100	-	-	-	-	100	100	-	1,780
Selenium (Se) [b]	mg/kg	2.00		2.62	0.820	2.81	34.4	10.2	40.6	50.9	3.63	46.4
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.320	0.400	0.720	0.200	0.370
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	73.0
Strontium (Sr)	mg/kg	-	-	5.04	18.9	8.34	5.33	19.3	37.6	56.9	27.2	59.0
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	2,400
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.154	0.200	0.354	0.100	0.139
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	14.6	13.2	21.6	34.8	6.00	5.00
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.271	0.516	0.320	0.426	0.325	1.53	1.86	0.836	1.76
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	3.59	5.66	25.3	9.65	35.0	3.79	30.5
Zinc (Zn)	mg/kg	123	315	<1	24.9	51.1	9.70	62.2	86.7	149	76.0	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 2021a).

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

Table D.31: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHP-3 on the Greenhills Creek Sedimentation Pond, September 2021

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	638	1,750	7,020	2,488	9,508	688	8,210
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	1.04	0.400	1.44	0.200	1.01
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.0560	0.487	0.453	5.28	1.05	6.33	0.543	5.93
Barium (Ba)	mg/kg	-	-	17.3	47.9	47.7	25.1	163	138	301	95.6	310
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.350	<0.2	0.380	0.950	1.33	0.550	0.740
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	<5
Cadmium (Cd)	mg/kg	0.600	3.50	0.266	0.501	0.441	0.100	0.109	1.31	1.42	0.942	1.39
Calcium (Ca)	mg/kg	-	-	3,420	32,000	6,440	1,400	109	43,260	43,369	38,440	43,200
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.980	4.07	11.2	10.6	21.8	5.98	12.8
Cobalt (Co)	mg/kg	-	-	0.110	0.360	6.55	1.20	3.49	8.22	11.7	6.91	11.1
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.570	9.76	19.2	11.3	30.5	1.07	25.6
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,400	1,660	11,600	5,160	16,760	3,450	14,500
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.47	1.59	9.30	6.06	15.4	3.97	12.2
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	5.30	20.0	25.3	10.0	8.90
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	5,020
Manganese (Mn)	mg/kg	460	1,100	69.8	126	410	26.6	48.0	632	680	536	673
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.130
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	1.29	2.00	3.29	1.00	1.63
Nickel (Ni)	mg/kg	16.0	75.0	1.88	9.40	31.1	11.9	14.6	54.3	68.9	40.5	64.5
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	159	-	-	259	259	209	967
Potassium (K)	mg/kg	-	-	<100	-	-	-	-	100	100	-	1,870
Selenium (Se) [b]	mg/kg	2.00		0.300	<0.2	0.830	7.14	2.05	8.47	10.5	1.03	8.38
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	0.150	<0.1	0.240	0.450	0.690	0.250	0.380
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	77.0
Strontium (Sr)	mg/kg	-	-	4.79	14.4	6.78	4.86	21.3	30.8	52.1	21.2	54.3
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,600
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.166	0.200	0.366	0.100	0.125
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	10.9	17.0	17.9	34.9	6.00	6.80
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.0740	0.203	0.228	0.379	0.366	0.884	1.25	0.431	1.13
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	3.27	5.68	29.6	9.35	39.0	3.47	31.1
Zinc (Zn)	mg/kg	123	315	<1	16.2	48.6	10.6	80.7	76.4	157	64.8	137

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 2021a).

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

Table D.32: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHP-4 on the Greenhills Creek Sedimentation Pond, September 2021

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	1,440	5,900	2,132	8,032	642	8,620
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.850	0.400	1.25	0.200	0.790
Arsenic (As)	mg/kg	5.90	17.0	<0.05	0.0960	0.622	0.379	4.20	1.15	5.35	0.718	5.01
Barium (Ba)	mg/kg	-	-	21.4	51.9	37.2	25.8	144	136	280	89.1	308
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.330	<0.2	0.350	0.930	1.28	0.530	0.750
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	6.00
Cadmium (Cd)	mg/kg	0.600	3.50	0.113	0.481	0.416	0.0940	0.0820	1.10	1.19	0.897	1.15
Calcium (Ca)	mg/kg	-	-	3,170	45,600	8,810	1,360	99.0	58,940	59,039	54,410	60,500
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	0.920	3.40	9.40	9.82	19.2	5.92	13.1
Cobalt (Co)	mg/kg	-	-	0.370	1.11	3.81	0.830	3.05	6.12	9.17	4.92	8.77
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	<0.5	8.21	17.2	9.71	26.9	1.00	22.4
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,160	1,380	9,620	4,640	14,260	3,210	12,200
Lead (Pb)	mg/kg	35.0	91.3	<0.5	0.850	3.49	1.33	7.31	6.17	13.5	4.34	10.8
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	20.0	25.0	10.0	8.30
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	4,730
Manganese (Mn)	mg/kg	460	1,100	81.8	91.5	88.1	9.10	41.6	270	312	180	308
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.0971
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	1.01	2.00	3.01	1.00	1.32
Nickel (Ni)	mg/kg	16.0	75.0	2.18	10.4	27.9	9.70	12.3	50.2	62.5	38.3	56.3
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	143	-	-	243	243	193	919
Potassium (K)	mg/kg	-	-	110	-	-	-	-	110	110	-	2,150
Selenium (Se) [b]	mg/kg	2.00		0.850	<0.2	0.990	10.6	3.65	12.6	16.3	1.19	13.8
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	<0.1	<0.1	0.280	0.400	0.680	0.200	0.340
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	82.0
Strontium (Sr)	mg/kg	-	-	4.63	18.6	8.56	4.37	20.2	36.2	56.4	27.2	62.1
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	2,000
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.109	0.200	0.309	0.100	0.111
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	13.9	13.1	20.9	34.0	6.00	6.90
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.107	0.327	0.192	0.285	0.310	0.911	1.22	0.519	1.14
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	3.19	5.30	25.4	8.89	34.3	3.39	32.3
Zinc (Zn)	mg/kg	123	315	<1	15.3	42.0	8.70	69.4	67.0	136	57.3	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 2021a).

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

Table D.33: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHP-5 on the Greenhills Creek Sedimentation Pond, September 2021

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	642	1,770	7,610	2,512	10,122	692	11,100
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	1.11	0.400	1.51	0.200	1.12
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.468	0.410	5.61	0.978	6.59	0.518	6.51
Barium (Ba)	mg/kg	-	-	17.2	50.0	48.3	29.8	166	145	311	98.3	361
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.370	<0.2	0.420	0.970	1.39	0.570	0.930
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	0.200
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	7.80
Cadmium (Cd)	mg/kg	0.600	3.50	0.235	0.588	0.471	0.102	0.103	1.40	1.50	1.06	1.54
Calcium (Ca)	mg/kg	-	-	3,710	39,900	5,990	1,410	110	51,010	51,120	45,890	53,200
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	1.01	3.96	12.0	10.5	22.5	6.01	16.8
Cobalt (Co)	mg/kg	-	-	0.190	0.560	6.04	1.15	3.72	7.94	11.7	6.60	12.1
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.710	10.6	22.0	12.3	34.3	1.21	30.5
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,520	1,540	12,000	5,160	17,160	3,570	16,400
Lead (Pb)	mg/kg	35.0	91.3	<0.5	0.510	3.90	1.63	9.79	6.54	16.3	4.41	14.1
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	5.30	20.0	25.3	10.0	10.6
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	5,150
Manganese (Mn)	mg/kg	460	1,100	103	153	351	26.3	51.2	633	684	504	688
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.135
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	1.51	2.00	3.51	1.00	1.75
Nickel (Ni)	mg/kg	16.0	75.0	2.40	11.4	33.8	11.5	15.8	59.1	74.9	45.2	72.8
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	134	-	-	234	234	184	1,020
Potassium (K)	mg/kg	-	-	120	-	-	-	-	120	120	-	2,790
Selenium (Se) [b]	mg/kg	2.00		0.690	<0.2	1.16	12.3	3.54	14.4	17.9	1.36	16.0
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	0.130	<0.1	0.310	0.430	0.740	0.230	0.470
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	83.0
Strontium (Sr)	mg/kg	-	-	5.48	19.1	6.67	4.71	23.4	36.0	59.4	25.8	67.7
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,700
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.144	0.200	0.344	0.100	0.122
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	<1	12.4	8.00	20.4	6.00	10.2
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.114	0.225	0.197	0.357	0.404	0.893	1.30	0.422	1.22
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	3.57	5.78	31.4	9.75	41.1	3.77	41.2
Zinc (Zn)	mg/kg	123	315	<1	16.4	53.5	11.4	85.2	82.3	168	69.9	156

Concentration exceeds the lower BC WSQG. (light blue shading)

Concentration exceeds the upper BC WSQG or alert concentration for selenium. (dark blue shading)

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 2021a).

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

Table D.34: Results of Sequential Extraction Analysis (SEA) for Sediment Collected from RG_GHP-6 on the Greenhills Creek Sedimentation Pond, September 2021

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	665	1,430	5,810	2,195	8,005	715	8,520
Antimony (Sb)	mg/kg	-	-	<0.1	<0.1	<0.1	<0.1	0.920	0.400	1.32	0.200	1.03
Arsenic (As)	mg/kg	5.90	17.0	<0.05	<0.05	0.473	0.382	4.53	0.955	5.48	0.523	5.77
Barium (Ba)	mg/kg	-	-	16.5	52.9	45.2	32.2	119	147	266	98.1	310
Beryllium (Be)	mg/kg	-	-	<0.2	<0.2	0.370	<0.2	0.360	0.970	1.33	0.570	0.780
Bismuth (Bi)	mg/kg	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	0.800	1.00	0.400	<0.2
Boron (B)	mg/kg	-	-	-	-	-	-	-	-	-	-	<5
Cadmium (Cd)	mg/kg	0.600	3.50	0.161	0.537	0.435	0.0880	0.0900	1.22	1.31	0.972	1.44
Calcium (Ca)	mg/kg	-	-	2,990	49,400	6,290	1,040	80.0	59,720	59,800	55,690	60,900
Chromium (Cr)	mg/kg	37.3	90.0	<0.5	<5	1.08	3.15	9.40	9.73	19.1	6.08	13.1
Cobalt (Co)	mg/kg	-	-	0.120	0.400	5.34	0.810	3.19	6.67	9.86	5.74	9.97
Copper (Cu)	mg/kg	35.7	197	<0.5	<0.5	0.600	7.78	19.6	9.38	29.0	1.10	26.1
Iron (Fe)	mg/kg	21,200	43,766	<50.0	<50.0	3,560	1,210	9,580	4,870	14,450	3,610	13,200
Lead (Pb)	mg/kg	35.0	91.3	<0.5	<0.5	3.97	1.52	7.96	6.49	14.4	4.47	12.3
Lithium (Li)	mg/kg	-	-	<5	<5	<5	<5	<5	20.0	25.0	10.0	8.00
Magnesium (Mg)	mg/kg	-	-	-	-	-	-	-	-	-	-	4,630
Manganese (Mn)	mg/kg	460	1,100	60.2	109	319	18.2	43.5	506	550	428	567
Mercury (Hg)	mg/kg	0.170	0.486	-	-	-	-	-	-	-	-	0.108
Molybdenum (Mo)	mg/kg	25.0	23,000	<0.5	<0.5	<0.5	<0.5	1.11	2.00	3.11	1.00	1.66
Nickel (Ni)	mg/kg	16.0	75.0	1.98	11.2	31.2	8.45	13.0	52.8	65.8	42.4	64.5
Phosphorus (P)	mg/kg	-	-	<50.0	<50.0	125	-	-	225	225	175	923
Potassium (K)	mg/kg	-	-	<100	-	-	-	-	100	100	-	2,070
Selenium (Se) [b]	mg/kg	2.00		0.520	0.210	0.860	6.91	1.84	8.50	10.3	1.07	8.70
Silver (Ag)	mg/kg	0.500	-	<0.1	<0.1	0.120	<0.1	0.230	0.420	0.650	0.220	0.360
Sodium (Na)	mg/kg	-	-	<100	-	-	-	-	100	100	-	71.0
Strontium (Sr)	mg/kg	-	-	4.24	20.2	7.29	3.64	20.7	35.4	56.1	27.5	62.3
Sulfur (S)	mg/kg	-	-	-	-	-	-	-	-	-	-	1,800
Thallium (Tl)	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	0.0990	0.200	0.299	0.100	0.0920
Tin (Sn)	mg/kg	-	-	<2	<2	<2	<2	<2	8.00	10.0	4.00	<2
Titanium (Ti)	mg/kg	-	-	<1	<5	<1	8.70	8.70	15.7	24.4	6.00	7.30
Tungsten (W)	mg/kg	-	-	-	-	-	-	-	-	-	-	<0.5
Uranium (U)	mg/kg	-	-	0.0870	0.261	0.179	0.270	0.325	0.797	1.12	0.440	1.09
Vanadium (V)	mg/kg	-	-	<0.2	<0.2	3.84	5.13	25.3	9.37	34.7	4.04	33.4
Zinc (Zn)	mg/kg	123	315	<1	15.6	49.3	8.60	71.0	74.5	146	64.9	135

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 2021a).

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

APPENDIX E
BENTHIC INVERTEBRATE COMMUNITY

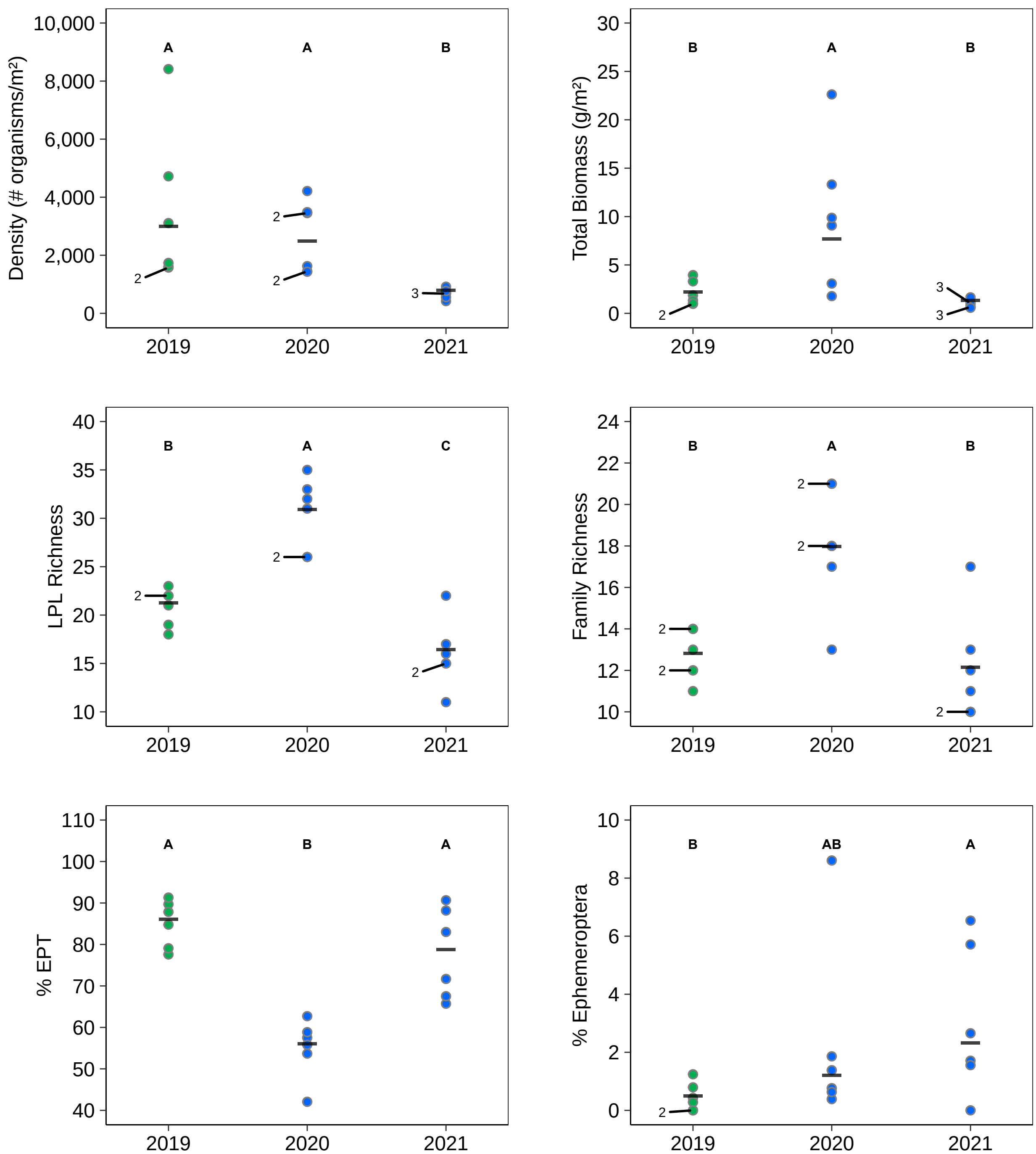


Figure E.1: Benthic Invertebrate Community Endpoint Comparisons for Upper Gardine Creek (RG_GAUT), September 2019 to 2021

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.

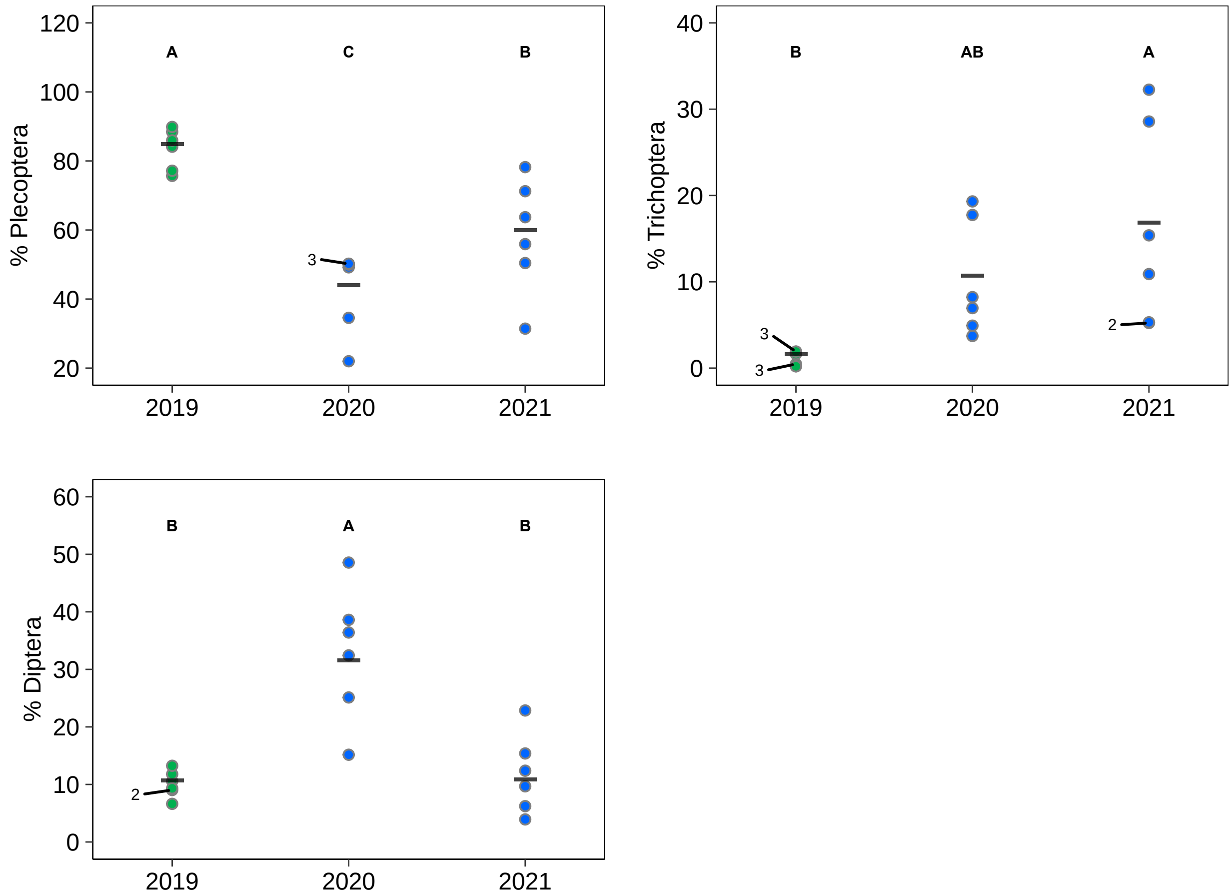


Figure E.1: Benthic Invertebrate Community Endpoint Comparisons for Upper Gardine Creek (RG_GAUT), September 2019 to 2021

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.

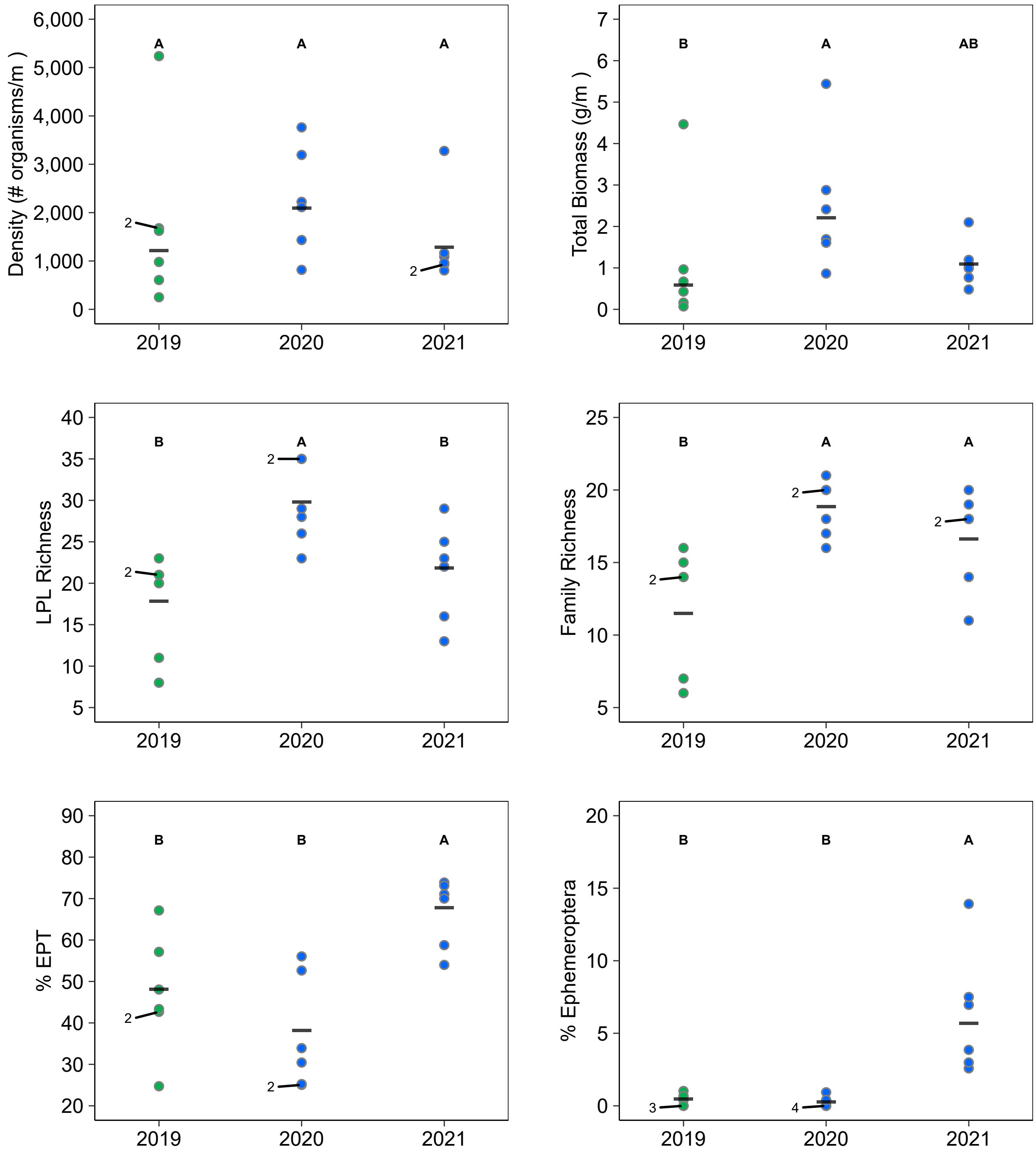


Figure E.2: Benthic Invertebrate Community Endpoint Comparisons for Lower Gardine Creek (RG_GANF), September 2019 to 2021

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.

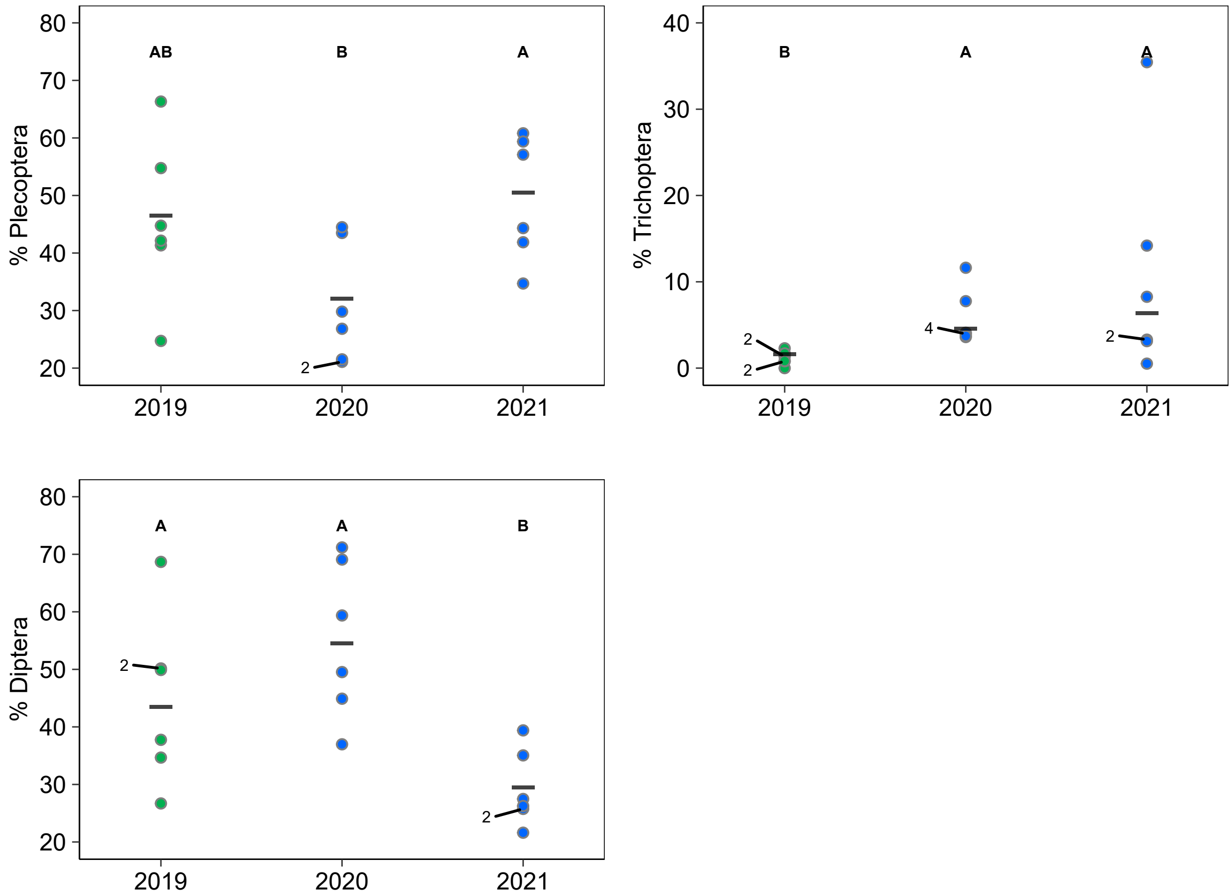


Figure E.2: Benthic Invertebrate Community Endpoint Comparisons for Lower Gardine Creek (RG_GANF), September 2019 to 2021

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.

Table E.1: Supporting Measures Associated with Area-based and Timed Kick and Sweep Benthic Invertebrate Community Sampling, September 2021

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		13-Sep-21	13-Sep-21	13-Sep-21	13-Sep-21	13-Sep-21	13-Sep-21
Weather		90% cloud cover, overnight precipitation					
Air Temperature (°C)		10					
UTMs (NAD83, Zone 11U)	Easting	654137	654138	654138	654130	654125	654135
	Northing	5550025	5550039	5550056	5550071	5550084	5540098
Habitat Characteristics							
Surrounding Land Use		Forest, logging, mining					
Length of Reach Assessed (m)		100					
Water Temperature (°C)		5.1	5.2	5.2	5.6	5.8	5.7
pH		7.39	7.58	7.64	7.65	7.66	7.63
Dissolved Oxygen	% sat	105.5	106.6	110.1	109.7	108.4	109.7
	mg/L	10.05	10.94	11.27	11.13	10.91	11.08
Conductance (µS/cm)		1,439	1,444	1,460	1,480	1,489	1,486
Specific Conductance (µS/cm)		2,323	2,325	2,349	2,352	2,353	2,356
Water Clarity		Clear					
Water Colour		Colourless					
Wetted width (m)		1.3					
Bankfull width (m)		1.4					
Average Water Depth (cm)		9.5	15.0	15.5	12.0	12.5	14.0
Average Water Velocity (m/s)		0.525	0.377	0.265	0.448	0.543	0.606
Substrate	% Bedrock	0					
	% Boulder	0					
	% Cobble	0					
	% Pebble	60					
	% Gravel	0					
	% Sand/Fines	40					
	% Organics	0					
Vegetation	Canopy Coverage (%)	1 to 25					
	Streamside Vegetation	Ferns/grass, shrubs, coniferous trees					
	Dominant Vegetation	Shrubs					
	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,b]							
Number of Jars		2	1	2	1	1	1
Macrophytes (in sampler)		N	N	N	N	N	N
Algae (in sampler)		A	A	A	C	C	C
Comments		Calcite covering entire streambed (acting as pavement).					

Notes: ID = identifier; % = percent; - = no data/not recorded; °C = degrees Celsius; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; m = metres; cm = centimetres; m/s = metres per second; mm = millimetres; < = less than; CABIN = Canadian Aquatic Biomonitoring Network; N = none; A = abundant; C = common; S = sparse; µm = micrometre; m^2 = square metres.

[a] Data are for area-based kicks unless otherwise indicated.

[b] 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 collected the timed CABIN samples from RG_GHNF (n = 3).

Table E.1: Supporting Measures Associated with Area-based and Timed Kick and Sweep Benthic Invertebrate Community Sampling, September 2021

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		10-Sep-21	10-Sep-21	10-Sep-21	10-Sep-21	11-Sep-21	11-Sep-21
Weather		Overcast (10-Sep-21); rainy (11-Sep-21)					
Air Temperature (°C)		15 (10-Sep-21); 8 (11-Sep-21)					
UTMs (NAD83, Zone 11U)	Easting	654372	654359	654343	654335	654338	654341
	Northing	5549052	5549088	5549094	5549122	5549130	5549160
Habitat Characteristics							
Surrounding Land Use		Forest, logging, mining					
Length of Reach Assessed (m)		100					
Water Temperature (°C)		5.5	6.5	7.2	7.9	6.0	6.0
pH		8.36	8.32	8.32	8.32	8.42	8.43
Dissolved Oxygen	% sat	98.5	105.0	104.6	99.5	118.1	113.4
	mg/L	10.08	10.46	10.25	9.60	11.98	11.52
Conductance (µS/cm)		1,386	1,427	1,453	1,480	1,400	1,394
Specific Conductance (µS/cm)		2,214	2,207	2,203	2,197	2,200	2,186
Water Clarity		Clear					
Water Colour		Colourless					
Wetted width (m)		2.9					
Bankfull width (m)		3.1					
Average Water Depth (cm)		7.0	15.5	14.0	26.0	30.0	8.0
Average Water Velocity (m/s)		0.255	0.446	0.167	0.852	0.352	0.439
Substrate	% Bedrock	0					
	% Boulder	0					
	% Cobble	0					
	% Pebble	0					
	% Gravel	0					
	% Sand/Fines	90					
	% Organics	10					
Vegetation	Canopy Coverage (%)	26 to 50					
	Streamside Vegetation	Ferns/grass, shrubs, coniferous trees					
	Dominant Vegetation	Shrubs					
	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,b]							
Number of Jars		1 each area-based and CABIN	2	2 each area-based and CABIN	2	1 each area-based and CABIN	1
Macrophytes (in sampler)		N	N	N	N	N	N
Algae (in sampler)		A	C	C	C	C	C
Comments		No riffle habitat due to barrage tufa blocking flow/forming cascades/calcite terraces. Kicks had to be completed among the cascades. Calcite covering all substrate (acting as pavement/concrete over stream bed).					

Notes: ID = identifier; % = percent; - = no data/not recorded; °C = degrees Celsius; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; m = metres; cm = centimetres; m/s = metres per second; mm = millimetres; < = less than; CABIN = Canadian Aquatic Biomonitoring Network; N = none; A = abundant; C = common; S = sparse; µm = micrometre; m^2 = square metres.

[a] Data are for area-based kicks unless otherwise indicated.

[b] 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 collected the timed CABIN samples from RG_GHNF (n = 3).

Table E.1: Supporting Measures Associated with Area-based and Timed Kick and Sweep Benthic Invertebrate Community Sampling, September 2021

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		09-Sep-21	09-Sep-21	09-Sep-21	09-Sep-21	10-Sep-21	10-Sep-21
Weather		0% cloud cover, sunny					
Air Temperature (°C)		-					
UTMs (NAD83, Zone 11U)	Easting	654130	654136	654138	654142	654141	654159
	Northing	5547161	5547187	5547184	5547184	5547189	5547188
Habitat Characteristics							
Surrounding Land Use		Forest, logging, mining					
Length of Reach Assessed (m)		100					
Water Temperature (°C)		6.7	7.8	8.4	8.9	6.3	6.3
pH		8.24	8.41	8.26	8.47	8.69	8.62
Dissolved Oxygen	% sat	104.8	105.7	94.4	95.6	101.9	102.1
	mg/L	10.51	10.36	9.12	9.07	10.36	10.44
Conductance (µS/cm)		1,164	1,205	1,211	1,236	1,159	1,158
Specific Conductance (µS/cm)		1,792	1,797	1,773	1,784	1,800	1,803
Water Clarity		Clear					
Water Colour		Colourless					
Wetted width (m)		2.7					
Bankfull width (m)		3.2					
Average Water Depth (cm)		11.7	14.0	24.5	13.0	13.0	20.5
Average Water Velocity (m/s)		0.283	0.409	0.534	0.275	0.275	0.305
Substrate	% Bedrock	0					
	% Boulder	0					
	% Cobble	70					
	% Pebble	20					
	% Gravel	10					
	% Sand/Fines	0					
	% Organics	0					
Vegetation	Canopy Coverage (%)	26 to 50					
	Streamside Vegetation	Ferns/grass, shrubs, coniferous trees					
	Dominant Vegetation	Coniferous 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,b]							
Number of Jars		1	1	1	1	1	1
Macrophytes (in sampler)		N	N	N	N	N	N
Algae (in sampler)		S	S	S	S	S	C
Comments		-					

Notes: ID = identifier; % = percent; - = no data/not recorded; °C = degrees Celsius; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; m = metres; cm = centimetres; m/s = metres per second; mm = millimetres; < = less than; CABIN = Canadian Aquatic Biomonitoring Network; N = none; A = abundant; C = common; S = sparse; µm = micrometre; m^2 = square metres.

[a] Data are for area-based kicks unless otherwise indicated.

[b] 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 collected the timed CABIN samples from RG_GHNF (n = 3).

Table E.1: Supporting Measures Associated with Area-based and Timed Kick and Sweep Benthic Invertebrate Community Sampling, September 2021

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		11-Sep-21	14-Sep-21	11-Sep-21	14-Sep-21	11-Sep-21	14-Sep-21
Weather		Sunny					
Air Temperature (°C)		12					
UTMs (NAD83, Zone 11U)	Easting	653507	653503	653522	653525	653523	653552
	Northing	554599	5545596	5545615	5545610	6545637	5545658
Habitat Characteristics							
Surrounding Land Use		Forest, mining					
Length of Reach Assessed (m)		100					
Water Temperature (°C)		13.7	11.2	11.4	13.2	13.6	14.6
pH		8.07	8.04	8.07	7.98	8.03	7.98
Dissolved Oxygen	% sat	114.9	118.1	115.7	115.9	115.7	117.6
	mg/L	9.93	10.83	10.57	10.17	10.07	10.05
Conductance (µS/cm)		1,225	1,154	1,164	1,215	1,192	1,256
Specific Conductance (µS/cm)		1,562	1,565	1,573	1,570	1,522	1,568
Water Clarity		Clear					
Water Colour		Colourless					
Wetted width (m)		1.9					
Bankfull width (m)		4.1					
Average Water Depth (cm)		15.0	13.5	14.0	11.5	9.0	9.0
Average Water Velocity (m/s)		0.332	0.617	0.560	0.342	0.361	0.308
Substrate	% Bedrock	0					
	% Boulder	0					
	% Cobble	60					
	% Pebble	10					
	% Gravel	20					
	% Sand/Fines	20					
	% Organics	0					
Vegetation	Canopy Coverage (%)	1 to 25					
	Streamside Vegetation	Ferns/grass, shrubs, coniferous trees					
	Dominant Vegetation	Coniferous 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,b]							
Number of Jars		1	1	1	1	1	1
Macrophytes (in sampler)		N	N	N	N	N	N
Algae (in sampler)		S	S	S	S	S	S
Comments		More calcite in depositional areas (large chunks of calcite present at banks in depositional areas and much less in faster-moving water).					

Notes: ID = identifier; % = percent; - = no data/not recorded; °C = degrees Celsius; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; m = metres; cm = centimetres; m/s = metres per second; mm = millimetres; < = less than; CABIN = Canadian Aquatic Biomonitoring Network; N = none; A = abundant; C = common; S = sparse; µm = micrometre; m^2 = square metres.

[a] Data are for area-based kicks unless otherwise indicated.

[b] 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 collected the timed CABIN samples from RG_GHNF (n = 3).

Table E.1: Supporting Measures Associated with Area-based and Timed Kick and Sweep Benthic Invertebrate Community Sampling, September 2021

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		16-Sep-21	16-Sep-21	16-Sep-21	16-Sep-21	16-Sep-21	16-Sep-21
Weather		10% cloud cover					
Air Temperature (°C)		9					
UTMs (NAD83, Zone 11U)	Easting	653459	653442	653434	653429	653424	653404
	Northing	5548928	5548923	5548937	5548960	5578968	5548973
Habitat Characteristics							
Surrounding Land Use		Forest, mining					
Length of Reach Assessed (m)		-					
Water Temperature (°C)		4.1	4.4	4.9	5.1	5.3	5.4
pH		7.93	7.91	7.88	7.85	7.86	7.87
Dissolved Oxygen	% sat	93.1	78.9	96.0	94.5	90.4	87.7
	mg/L	9.84	8.24	9.95	9.76	9.29	9.00
Conductance (µS/cm)		289	295	296	298	300	291
Specific Conductance (µS/cm)		482	485	479	481	480	466
Water Clarity		Clear					
Water Colour		Oh					
Wetted width (m)		0.55					
Bankfull width (m)		1.4					
Average Water Depth (cm)		4.5	6.0	5.5	5.0	3.0	4.5
Average Water Velocity (m/s)		0.215	0.059	0.082	0.098	0.101	0.134
Substrate	% Bedrock	0					
	% Boulder	0					
	% Cobble	0					
	% Pebble	5					
	% Gravel	45					
	% Sand/Fines	45					
	% Organics	5					
Vegetation	Canopy Coverage (%)	76 to 100					
	Streamside Vegetation	Ferns/grass, shrubs, coniferous trees					
	Dominant Vegetation	Coniferous 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,b]							
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	
Comments		-					

Notes: ID = identifier; % = percent; - = no data/not recorded; °C = degrees Celsius; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; m = metres; cm = centimetres; m/s = metres per second; mm = millimetres; < = less than; CABIN = Canadian Aquatic Biomonitoring Network; N = none; A = abundant; C = common; S = sparse; µm = micrometre; m^2 = square metres.

[a] Data are for area-based kicks unless otherwise indicated.

[b] 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 collected the timed CABIN samples from RG_GHNF (n = 3).

Table E.1: Supporting Measures Associated with Area-based and Timed Kick and Sweep Benthic Invertebrate Community Sampling, September 2021

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		15-Sep-21	15-Sep-21	15-Sep-21	16-Sep-21	16-Sep-21	16-Sep-21
Weather		Overcast					
Air Temperature (°C)		10					
UTMs (NAD83, Zone 11U)	Easting	654275	654275	654266	654255	654234	654203
	Northing	5547745	5547767	5547786	5547789	5547809	5577821
Habitat Characteristics							
Surrounding Land Use		Forest, mining					
Length of Reach Assessed (m)		100					
Water Temperature (°C)		6.7	6.8	6.8	3.0	2.9	3.2
pH		8.07	7.99	7.97	8.04	8.07	8.02
Dissolved Oxygen	% sat	104.6	104.1	102.3	113.2	109.7	110.2
	mg/L	10.43	10.33	10.17	12.48	12.15	12.07
Conductance (µS/cm)		765	772	771	843	847	864
Specific Conductance (µS/cm)		1,178	1,185	1,180	1,452	1,466	1,481
Water Clarity		Clear					
Water Colour		Colourless					
Wetted width (m)		1.3					
Bankfull width (m)		1.7					
Average Water Depth (cm)		9.5	14.5	15.0	8.0	6.5	8.5
Average Water Velocity (m/s)		0.132	0.175	0.256	0.317	0.151	0.045
Substrate	% Bedrock	0					
	% Boulder	5					
	% Cobble	30					
	% Pebble	40					
	% Gravel	10					
	% Sand/Fines	5					
	% Organics	0					
Vegetation	Canopy Coverage (%)	-					
	Streamside Vegetation	Shrubs, coniferous trees					
	Dominant Vegetation	-					
	Macrophyte Coverage (%)	-					
	Dominant Macrophyte	-					
	Periphyton Coverage (1 to 5)	1 - Rocks not slippery, no obvious colour (<0.5 mm thick)					
Benthic Invertebrate Sampling [a,b]							
Number of Jars		1	1	1	1	1	1
Macrophytes (in sampler)		N	N	N	N	N	N
Algae (in sampler)		C	C	N	N	-	N
Comments		Noticed more calcite at this station than previous.					

Notes: ID = identifier; % = percent; - = no data/not recorded; °C = degrees Celsius; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; m = metres; cm = centimetres; m/s = metres per second; mm = millimetres; < = less than; CABIN = Canadian Aquatic Biomonitoring Network; N = none; A = abundant; C = common; S = sparse; µm = micrometre; m^2 = square metres.

[a] Data are for area-based kicks unless otherwise indicated.

[b] 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 collected the timed CABIN samples from RG_GHNF (n = 3).

Table E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2016													
				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
Clitellata	-	Enchytraeidae	Enchytraeidae	347	254	92	57	137	79	80	60	93	33	76	174	12	13
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	57	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	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	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
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	32	0	46	0	20	0	0	20	27	6.7	12	44	24	17
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	13	0	36	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	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
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
Insecta	Coleoptera	Staphylinidae	Staphylinidae	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
Insecta	Diptera	Ceratopogonidae	Culicoides	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
Insecta	Diptera	Chironomidae	Brillia	159	0	23	0	0	86	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
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	22	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
Insecta	Diptera	Chironomidae	Diamesa	446	91	115	170	102	172	41	7.3	27	88	19	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	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	7.3	0	18	19	0	69	66
Insecta	Diptera	Chironomidae	Heleniella	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	7.3	40	7.3	86	131	6.3	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	13	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	43	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
Insecta	Diptera	Chironomidae	Orthocladius complex	1,814	432	115	625	407	452	232	239	667	131	1,095	958	1,004	607
Insecta	Diptera	Chironomidae	Pagastia	0	23	23	0	61	43	14	0	0	0	0	0	257	126
Insecta	Diptera	Chironomidae	Parametriocnemus	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
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	9.6	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	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	6.3	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	64	0	0	0	0	43	55	139	0	7.3	0	131	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	6.3	0
Insecta	Diptera	Chironomidae	Thienemanniella	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	7.3	106	218	44	17
Insecta	Diptera	Chironomidae	Zavrelimyia	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
Insecta	Diptera	Empididae	Chelifera/Metachela	0	22	0	0	0	0	80	6.7	27	34	67	87	96	77
Insecta	Diptera	Empididae	Clinocera	32	22	23	0	0	0	13	20	0	0	115	44	30	6.7
Insecta	Diptera	Empididae	Wiedemannia	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
Insecta	Diptera	Pelecorhynchidae	Glutops	0	22	0	0	0	0	13	37	13	0	48	0	36	10
Insecta	Diptera	Psychodidae	Pericoma	63	0	115	170	0	59	13	13	13	0	0	131	12	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	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	6.7	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	114	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
Insecta	Diptera	Tipulidae	Dicranota	284	216	183	398	235	99	293	290	360	20	154	392	36	3.3
Insecta	Diptera	Tipulidae	Limnophila	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	3.3
Insecta	Diptera	Tipulidae	Pedicia	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
Insecta	Ephemeroptera	Ameletidae	Ameletus	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
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	32	0	0	0	0	39	0	6.7	0	0	0	0	18	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	158	85	0	114	0	20	80	53	67	123	67	131	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2016													
				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
Insecta	Plecoptera	Capniidae	Eucapnopsis	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
Insecta	Plecoptera	Capniidae	Paracapnia	347	317	252	1,705	275	197	347	110	133	53	134	915	42	3.3
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	23	0	0	0	13	0	27	17	9.6	0	6.0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	57	0	0	0	0	0	6.7	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
Insecta	Plecoptera	Nemouridae	Zapada	63	21	23	398	353	414	80	13	13	0	9.6	305	42	13
Insecta	Plecoptera	Peltoperlidae	Yoraperla	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	6.7
Insecta	Plecoptera	Perlodidae	Megarcys	0	3.3	0	0	3.3	0	0	0	27	17	0	0	6.0	10
Insecta	Plecoptera	Perlodidae	Skwala	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	6.7	19	0	36	6.7
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	21	0	170	0	20	0	0	0	10	9.6	0	0	10
Insecta	Trichoptera	Brachycentridae	Micrasema	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
Insecta	Trichoptera	Glossosomatidae	Glossosoma	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
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	21	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
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	32	0	0	227	79	20	0	0	13	6.7	9.6	0	36	13
Insecta	Trichoptera	Limnephilidae	Homophylax	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
Insecta	Trichoptera	Limnephilidae	Philocasca	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
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	63	0	0	0	0	0	0	0	0	0	0	0	39	13
Malacostraca	Amphipoda	Gammaridae	Gammarus	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 E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2016				2017									
				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	-	Enchytraeidae	Enchytraeidae	61	195	48	8.3	160	280	97	303	90	80	0	10	57	37
Clitellata	Tubificida	Naididae	Nais communis	0	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	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	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
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	23	0	21	0	10	0	0	0	3.3	0	0	0	0	6.7
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	10	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	10	0	33	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0	0	3.3	10	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	3.3	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
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	10	0	0	0	3.3	0	0	0	6.7	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	20	0	35	0	21	3.6	0	7.0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	6.7	0	35	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	6.7	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	432	209	112	458	170	376	29	8.7	53	99
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	35	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	196	274	93	125	0	131	116	884	82	134	15	4.4	7.0	9.0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	34	37	11	70	24	21	0	127	42	9.0
Insecta	Diptera	Chironomidae	Limnophyes	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
Insecta	Diptera	Chironomidae	Micropsectra	0	0	0	0	0	0	3.5	35	20	63	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	1,339	1,299	1,486	602	1,720	798	576	3,427	514	1,423	7.2	39	182	0
Insecta	Diptera	Chironomidae	Pagastia	613	957	380	258	105	51	49	458	82	207	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	35	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	3.5	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
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	29	8.6	0	74	28	178	61	74	0	0	42	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	14	0	10	0	0	0	0	0	0	0	7.0	0
Insecta	Diptera	Chironomidae	Tanytarsus	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	7.0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	114	151	39	95	81	14	248	31	11	69	4.4	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	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
Insecta	Diptera	Empididae	Chelifera/Metachela	53	119	103	17	10	6.7	0	0	0	0	0	20	0	17
Insecta	Diptera	Empididae	Clinocera	7.6	43	28	8.3	10	6.7	3.3	0	10	20	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	10	13	10	0	3.3	0	3.4	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	40	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	7.6	0	0	0	0	0	0	33	0	0	0	6.7	6.7	6.7
Insecta	Diptera	Psychodidae	Pericoma	0	11	14	0	23	30	3.3	100	10	30	0	6.7	50	3.3
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	11	0	0	23	0	0	0	0	10	3.4	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	10	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	7.6	54	34	0	70	137	77	473	30	90	6.8	6.7	323	13
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	6.7	0	0	3.4	0	0	3.3	0	0	0	0	0	6.7	0
Insecta	Diptera	Tipulidae	Pedicia	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
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	7.6	0	0	0	0	13	0	0	0	0	3.3	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	11	0	0	0	0	0	0	3.3	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	3.3	0	6.7
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	33	20	3.3	203	20	40	40	17	373	17

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2016				2017									
				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
Insecta	Plecoptera	Capniidae	Eucapnopsis	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
Insecta	Plecoptera	Capniidae	Paracapnia	7.6	65	14	8.3	893	270	200	3,740	200	257	140	167	1,217	287
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	0	6.7	0	67	13	10	0	0	0	13
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	13	0	33	10	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	6.7	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
Insecta	Plecoptera	Nemouridae	Zapada	15	65	76	41	80	30	17	170	80	227	0	0	0	3.3
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	76	96	17	0	0	0	0	0	0	33	27	40	3.3
Insecta	Plecoptera	Perlodidae	Megarcys	0	14	0	4.1	0	0	0	67	3.3	20	0	3.3	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	107	141	21	58	10	0	10	33	3.3	0	17	0	0	0
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	6.9	12	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
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	23	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
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	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
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	7.6	11	41	4.1	0	6.7	10	0	40	60	0	0	17	0
Insecta	Trichoptera	Limnephilidae	Homophylax	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
Insecta	Trichoptera	Limnephilidae	Philocasca	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
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	69	0	14	17	23	0	3.3	33	0	0	0	0	0	3.3
Malacostraca	Amphipoda	Gammaridae	Gammarus	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 E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2017								2018					
				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	-	Enchytraeidae	Enchytraeidae	23	17	6.7	0	6.7	10	0	3.3	240	800	53	27	640	320
Clitellata	Tubificida	Naididae	Nais communis	0	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	80	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	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
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	3.3	0	3.3	3.3	10	0	6.7	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	3.3	0	3.3	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	3.3	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	3.3	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	53	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0	53
Insecta	Coleoptera	Staphylinidae	Staphylinidae	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
Insecta	Diptera	Ceratopogonidae	Culicoides	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
Insecta	Diptera	Chironomidae	Brillia	3.7	0	3.5	0	0	0	0	11	97	0	33	107	203	192
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	97	0	0	0	68	0
Insecta	Diptera	Chironomidae	Chironomus	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	64
Insecta	Diptera	Chironomidae	Diamesa	26	51	14	10	14	25	0	11	0	61	0	0	0	1,280
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	36	0	64
Insecta	Diptera	Chironomidae	Eukiefferiella	48	12	3.5	17	0	32	10	7.2	552	1,280	329	286	4,737	2,944
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	11	12	0	0	0	0	0	0	325	61	559	0	135	0
Insecta	Diptera	Chironomidae	Limnophyes	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
Insecta	Diptera	Chironomidae	Micropsectra	0	0	3.5	48	3.6	42	0	25	33	0	0	0	135	64
Insecta	Diptera	Chironomidae	Orthocladius complex	37	71	367	360	190	486	197	372	649	853	361	1,285	1,692	960
Insecta	Diptera	Chironomidae	Pagastia	0	0	232	367	176	342	92	207	65	61	33	143	0	128
Insecta	Diptera	Chironomidae	Parametriocnemus	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
Insecta	Diptera	Chironomidae	Pentaneura	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
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	6.9	0	3.5	17	0	292	0	230	0	880	576
Insecta	Diptera	Chironomidae	Psilometriocnemus	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
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	66	31	0	10	0	3.5	3.4	11	130	244	296	464	1,963	128
Insecta	Diptera	Chironomidae	Zavrelimyia	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
Insecta	Diptera	Empididae	Chelifera/Metachela	3.3	0	20	47	20	57	20	33	0	0	0	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	3.3	0	3.3	0	0	3.3	0	27	0	27	53	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	6.7	6.7	0	6.7	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	107	0
Insecta	Diptera	Pelecorhynchidae	Glutops	3.3	0	0	23	0	3.3	0	6.7	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	13	6.7	0	3.3	0	3.3	0	0	0	53	187	27	320	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	10	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
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	33	0	10	30	10	13	0	23	880	373	187	427	747	267
Insecta	Diptera	Tipulidae	Limnophila	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
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	10	0	3.3	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
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	3.3	0	3.3	0	3.3	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	3.3	13	17	6.7	6.7	3.3	27	27	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	103	127	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 E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2017								2018					
				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	Eucapnopsis	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	80	0	0	0	0	53
Insecta	Plecoptera	Capniidae	Paracapnia	663	773	23	147	23	33	0	43	1,520	427	773	427	2,027	533
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	3.3	0	10	0	3.3	0	0	53	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	10	3.3	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	3.3	0	0	3.3	0	0	3.3	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
Insecta	Plecoptera	Nemouridae	Zapada	27	37	13	90	43	60	3.3	50	53	107	27	0	320	480
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	13	20	0	0	3.3	6.7	0	0	27	0	80	27	53	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	3.3	20	17	13	33	0	23	0	0	0	0	53	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	53
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	6.7	17	60	23	3.3	60	13	133	0	0	0	0	0	53
Insecta	Trichoptera	Apataniidae	Pedomoecus	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
Insecta	Trichoptera	Glossosomatidae	Anagapetus	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
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	3.3	0	0	0	6.7	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	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
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	3.3	0	6.7	6.7	3.3	3.3	0	0	27	0	107	0
Insecta	Trichoptera	Limnephilidae	Homophylax	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
Insecta	Trichoptera	Limnephilidae	Philocasca	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
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	13	23	20	33	3.3	17	27	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	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 E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2018												2019	
				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
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	160	0	53	0	6.7	0	0	0	6.7	6.7	213	400
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	53	27	0	453	27	27	0	0	0	13	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	6.7	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	27	0	0	0	3.3	0	0	3.3	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	6.7	0	3.3	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	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
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0	0	0	0	0	6.7	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	3.3	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	27	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
Insecta	Diptera	Ceratopogonidae	Culicoides	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	27	0
Insecta	Diptera	Chironomidae	Brillia	139	759	53	170	383	270	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	135	0	0	0	21	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	28	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	28	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
Insecta	Diptera	Chironomidae	Eukiefferiella	388	197	107	0	118	135	64	98	72	21	49	23	975	993
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	225	0	28	0	0	0	0	0	0	0	0	271	827
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	57	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
Insecta	Diptera	Chironomidae	Micropsectra	0	28	0	0	0	0	14	0	3.5	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	166	84	133	57	88	135	797	922	538	524	480	317	1,300	1,048
Insecta	Diptera	Chironomidae	Pagastia	56	28	0	0	0	0	571	671	179	478	371	298	379	386
Insecta	Diptera	Chironomidae	Parametriocnemus	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
Insecta	Diptera	Chironomidae	Pentaneura	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
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	56	0	28	0	0	0	0	0	0	0	0	54	221
Insecta	Diptera	Chironomidae	Psilometriocnemus	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
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	1,997	1,715	267	1,047	531	757	7.1	56	6.9	25	56	23	433	552
Insecta	Diptera	Chironomidae	Zavrelimyia	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	3.3	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0	0	0	0	67	53	10	13	13	73	0	27
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	73	13	20	17	3.3	10	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	27	0	0	108	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	27	0	0	0	6.7	3.3	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	133	53	187	27	80	243	0	0	0	10	0	6.7	53	133
Insecta	Diptera	Sciomyzidae	Sciomyzidae	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
Insecta	Diptera	Stratiomyidae	Stratiomyidae	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
Insecta	Diptera	Tipulidae	Dicranota	293	213	427	187	107	162	73	13	17	17	10	47	267	187
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	3.3	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	27	27	0	0	6.7	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
Insecta	Diptera	Tipulidae	Rhabdomastix	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	3.3	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	6.7	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	27	0	0	0	13	6.7	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	20	0	13	10	10	6.7	0	0
Insecta	Plecoptera	Capniidae	Capnia	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 E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2018												2019	
				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
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	27	133	53	53	27	80	0	0	3.3	0	0	0	53	53
Insecta	Plecoptera	Capniidae	Paracapnia	693	1,307	613	507	320	587	233	93	47	23	47	33	507	347
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	0	0	0	13	3.3	0	17	10	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	6.7	0	0	0	0	3.3	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	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	0
Insecta	Plecoptera	Nemouridae	Zapada	133	27	80	27	187	133	627	840	477	310	187	153	53	53
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	107	107	187	53	133	80	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0	0	0	33	53	20	13	27	57	27	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	6.7	13	3.3	6.7	6.7	10	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	107	27	53	0	80	187	140	253	113	50	43	50	80	107
Insecta	Trichoptera	Apataniidae	Pedomoecus	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
Insecta	Trichoptera	Glossosomatidae	Anagapetus	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
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	13	0	0	10	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	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
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	3.3	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	27	27	0	0	0	0	0	13	3.3	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	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
Insecta	Trichoptera	Limnephilidae	Philocasca	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	27
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	13	53	17	3.3	27	13	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	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 E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2019													
				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	-	Enchytraeidae	Enchytraeidae	40	133	227	433	27	13	0	3.3	3.3	0	120	0	3.3	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	53	0	0	0	0	27	0	6.7	60	293	13	0	3.3	3.3
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	3.3	27	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	13	13	0	0	0	0	0	0	0	0	0	0	3.3	3.3
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	13	0	6.7	0	0	0	0	0	0	53	0	3.3	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	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
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	13	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
Insecta	Coleoptera	Staphylinidae	Staphylinidae	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
Insecta	Diptera	Ceratopogonidae	Culicoides	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
Insecta	Diptera	Chironomidae	Brillia	28	0	0	0	0	30	28	15	25	29	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	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
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	0	0	0	4.0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	28	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	28	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	266	557	675	2,013	141	105	444	7.3	25	200	1,544	128	165	270
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	883	70	55	28	141	15	444	11	8.3	114	76	0	254	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	29	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	28	0	14	0	0	0	28	0	0	0	45	0	16	0
Insecta	Diptera	Chironomidae	Orthocladius complex	308	1,059	1,019	340	226	179	222	11	4.1	57	363	8.2	40	76
Insecta	Diptera	Chironomidae	Pagastia	112	348	234	451	735	30	250	0	0	143	2,316	78	57	113
Insecta	Diptera	Chironomidae	Parametriocnemus	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
Insecta	Diptera	Chironomidae	Pentaneura	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
Insecta	Diptera	Chironomidae	Pseudodiamesa	210	14	41	28	28	0	166	7.3	0	57	30	0	40	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	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
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	98	125	69	87	9,580	986	7,991	152	58	5,664	666	12	16	8.1
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	15	28	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
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0	0	53	0	0	3.3	0	27	147	13	0	6.7
Insecta	Diptera	Empididae	Clinocera	40	0	0	0	27	13	0	10	0	0	0	6.7	3.3	17
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	13	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	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	160	53	27	27	400	108	133	40	20	480	80	0	3.3	6.7
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	13	0	23	17	80	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	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
Insecta	Diptera	Tipulidae	Dicranota	187	160	107	73	133	0	53	3.3	0	160	267	0	13	0
Insecta	Diptera	Tipulidae	Limnophila	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
Insecta	Diptera	Tipulidae	Pedicia	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
Insecta	Ephemeroptera	Ameletidae	Ameletus	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	3.3	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	13	13	0	0	13	0	0	0	0	27	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	3.3	0	0	0	3.3	0	6.7
Insecta	Plecoptera	Capniidae	Capnia	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 E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2019													
				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
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	13	0	53	6.7	133	160	213	90	33	320	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	227	240	107	113	427	160	827	230	57	693	133	3.3	33	10
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	0	13	0	0	0	0	13	0	0	3.3
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	3.3	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	13	0	47	0	0	0	0	6.7	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	67	160	80	113	133	387	853	167	30	613	1,773	143	87	103
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	133	67	80	23	10	107	13	3.3	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	3.3	0	0	0	0	0	0	3.3	0	3.3	6.7	0	10
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	13	13	13	27	67	53	33	13	53	40	17	3.3	10
Insecta	Trichoptera	Apataniidae	Pedomoecus	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	13	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	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
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	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	3.3	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	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
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	67	0	0	27	0	67	107	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
Insecta	Trichoptera	Limnephilidae	Limnephilidae	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
Insecta	Trichoptera	Limnephilidae	Psychoglypha	67	80	27	0	0	0	0	10	10	0	13	0	13	3.3
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	6.7	13	0	0	0	0	0	0	0	43	6.7	0	10
Malacostraca	Amphipoda	Gammaridae	Gammarus	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 E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2019		2020											
				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	-	Enchytraeidae	Enchytraeidae	100	10	347	293	267	293	240	1,707	107	67	53	0	80	27
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	3.3	0	40	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	13	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	6.7	0	27	0	53	0	0	0	0	0	0	13	0	13
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	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
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	27	107	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	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
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	27	0	0	0	0	0	0	0	0	0	14	0
Insecta	Diptera	Ceratopogonidae	Culicoides	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
Insecta	Diptera	Chironomidae	Brillia	0	0	0	108	55	30	61	0	0	14	0	0	14	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	15	0	0	0	0	0	0	0	0	14	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	56	92	274	60	91	113	126	69	0	0	130	64
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	91	0	113	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	920	404	790	62	766	634	1,067	5,649	126	14	34	15	0	32
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	315	14	51	0	58	0
Insecta	Diptera	Chironomidae	Hydrobaenus	56	31	113	523	985	694	1,554	1,243	441	263	0	15	115	0
Insecta	Diptera	Chironomidae	Limnophyes	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
Insecta	Diptera	Chironomidae	Micropsectra	16	12	113	77	274	754	1,737	904	63	0	0	0	14	0
Insecta	Diptera	Chironomidae	Orthocladius complex	120	31	1,523	431	547	121	1,310	3,954	63	0	17	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	1,767	602	705	15	164	211	427	3,276	126	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	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	17	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	15	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	3.9	28	62	492	272	274	339	189	152	0	0	43	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	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
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	208	66	113	92	657	573	305	1,582	1,324	166	0	194	29	64
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	28	0	0	14	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	14	0
Insecta	Diptera	Empididae	Chelifera/Metachela	80	27	40	27	0	0	0	0	160	53	133	56	27	13
Insecta	Diptera	Empididae	Clinocera	67	3.3	40	0	0	0	0	0	0	0	13	28	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	27	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	53	0	0	0	107	53	13	0	54	0
Insecta	Diptera	Psychodidae	Pericoma	13	20	53	200	1,120	613	933	2,133	267	80	133	98	54	13
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	6.7	27	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
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	147	17	400	163	1,227	350	880	1,387	2,027	280	347	140	338	253
Insecta	Diptera	Tipulidae	Limnophila	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
Insecta	Diptera	Tipulidae	Pedicia	6.7	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
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	27	0	0	0	0	0	53	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	13	0	27	0	0	0	27	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	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	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2019		2020											
				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	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	0	80	0	98	0	409	1,542	175	201	91	46	124
Insecta	Plecoptera	Capniidae	Paracapnia	213	10	213	53	907	782	907	2,044	1,285	491	345	136	728	249
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	6.7	0	0	13	0	27	0	0	0	0	27	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	53	0	0	0	0	27	13	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	6.7	0	0	373	0	0	0	293	0	0	120	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	1,307	310	80	27	0	347	240	640	293	53	53	120	0	173
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	40	3.3	0	13	160	80	0	0	320	67	93	120	40	40
Insecta	Plecoptera	Perlodidae	Megarcys	6.7	0	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	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	13	13	0	0	0	0	0	0	0	0	0	13	0	13
Insecta	Trichoptera	Apataniidae	Pedomoecus	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	53	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	107	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	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
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	3.3	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
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	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
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	13	803	693	1,413	853	53	53	27	13	53	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	6.7	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	6.7	3.3	0	0	0	0	0	3.3	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	27	0	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2020						2021							
				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	-	Enchytraeidae	Enchytraeidae	80	0	6.7	67	6.7	67	432	132	216	120	24	144	120	96
Clitellata	Tubificida	Naididae	Nais communis	0	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	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	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
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	13	40	6.7	0	13	27	24	0	48	0	0	24	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	6.7	0	0	0	0	0	0	24	0	24	24	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	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	24	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	13	0	0	0	6.7	40	24	120	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	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
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	13	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
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	116	0	29	0	0	80	0	52
Insecta	Diptera	Chironomidae	Chaetocladius	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
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	58	0	58	54	0	0	26	104
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0	0	0	26	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	123	115	142	29	97	111	6,325	2,478	2,324	4,129	3,459	3,107	79	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	53	208
Insecta	Diptera	Chironomidae	Hydrobaenus	165	115	0	462	14	111	0	0	29	0	0	0	0	260
Insecta	Diptera	Chironomidae	Limnophyes	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
Insecta	Diptera	Chironomidae	Micropsectra	178	29	14	0	14	28	58	0	0	0	0	0	26	208
Insecta	Diptera	Chironomidae	Orthocladius complex	370	288	654	881	839	319	347	507	581	751	195	186	315	52
Insecta	Diptera	Chironomidae	Pagastia	1,001	620	1,180	823	562	2,306	1,126	718	581	885	335	372	2,073	520
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	14	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
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	41	14	0	0	14	28	0	70	349	80	28	0	53	312
Insecta	Diptera	Chironomidae	Psilometriocnemus	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
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	55	58	36	58	0	97	347	42	58	54	112	0	3,805	5,099
Insecta	Diptera	Chironomidae	Zavrelimyia	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
Insecta	Diptera	Empididae	Chelifera/Metachela	293	262	206	320	92	253	0	60	0	0	0	0	360	144
Insecta	Diptera	Empididae	Clinocera	13	18	14	0	8.3	0	72	0	48	48	0	96	72	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	120	0	0	24	0	24	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	80	0	0	27	6.7	0	0	0	0	0	0	3.0	0	48
Insecta	Diptera	Psychodidae	Pericoma	173	0	0	160	27	40	312	192	360	96	312	336	120	864
Insecta	Diptera	Sciomyzidae	Sciomyzidae	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
Insecta	Diptera	Stratiomyidae	Stratiomyidae	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
Insecta	Diptera	Tipulidae	Dicranota	80	80	13	200	40	133	192	156	192	144	168	144	336	144
Insecta	Diptera	Tipulidae	Limnophila	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	24	0	0
Insecta	Diptera	Tipulidae	Pedicia	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
Insecta	Ephemeroptera	Ameletidae	Ameletus	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
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	67	107	27	93	40	53	0	0	0	0	0	24	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	13	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	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2020						2021							
				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
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	41	0	0	0	0	34	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	122	0	17	0	29	450	84	336	126	48	343	293	246
Insecta	Plecoptera	Capniidae	Paracapnia	173	305	6.7	117	20	345	613	24	168	42	48	103	763	2,538
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	13	0	0	0	6.7	0	0	0	24	0	0	0	24	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	13	0	0	6.7	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	31	165	0	0	14	39	96	0	24	0	72	0	56	88
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	96	0	24	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	1,009	2,035	380	800	193	2,161	768	48	48	168	0	336	1,792	1,592
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	6.7	0	0	0	24	12	0	0	24	48	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	13	20	0	20	0	16	144	72	240	24	144	312	408	624
Insecta	Plecoptera	Perlodidae	Megarcys	27	60	20	20	0	64	24	0	0	24	0	0	3.0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	13	0	53	6.7	40	48	0	0	0	48	72	96	96
Insecta	Trichoptera	Apataniidae	Pedomoecus	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
Insecta	Trichoptera	Glossosomatidae	Anagapetus	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
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	27	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	13	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	36	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	80	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	24	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	107	0	53	13	0	80	48	84	264	384	456	360	144	384
Insecta	Trichoptera	Limnephilidae	Philocasca	0	13	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
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	27	120	13	13	0	53	48	0	0	24	0	48	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	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 E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density									
Higher Level Classification		Family	Lowest Practical Level Identification	2021									
				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	-	Enchytraeidae	Enchytraeidae	0	0	48	48	0	6.0	6.0	6.0	24	96
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	48	12	24	0	3.0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	12	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	24	0	0	36	6.0	24	12	24	36
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	206	29	0	27	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	185	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	51	29	26	185	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	51	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	29	0	0	1,259	873	373	917	1,513	1,521
Insecta	Diptera	Chironomidae	Heleniella	51	0	0	79	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	132	0	15	0	0	0	95
Insecta	Diptera	Chironomidae	Limnophyes	0	29	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	51	0	0	371	0	177	6.8	0	42	109
Insecta	Diptera	Chironomidae	Orthocladius complex	154	29	40	212	364	30	41	119	113	652
Insecta	Diptera	Chironomidae	Pagastia	1,543	57	675	715	1,161	265	210	476	551	1,712
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	206	0	13	79	0	0	0	0	0	27
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	7,766	713	410	6,247	0	15	0	0	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	3.0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	72	24	132	96	228	24	126	84	156	432
Insecta	Diptera	Empididae	Clinocera	72	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	6.0	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	432	144	48	528	0	54	18	18	84	144
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	3.0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	6.0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	576	48	132	648	0	3.0	6.0	0	12	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	6.0	0	0	12
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.2: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

Taxon				Density									
Higher Level Classification		Family	Lowest Practical Level Identification	2021									
				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	Eucapnopsis	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	80	40	167	1,606	0	0	12	0	0	36
Insecta	Plecoptera	Capniidae	Paracapnia	2,225	80	229	1,874	0	6.0	0	0	12	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	24	0	0	0	0	6.0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	172	0	41	0	0	9.0	0	18	0	81
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	1,460	528	367	768	240	45	228	97	300	423
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	48	120	13	288	12	0	6.0	0	12	36
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	203	24	0	6.0	0	6.0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	240	48	72	168	48	24	12	72	48	120
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	48	216	60	0	0	18	18	0	48	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	12	3.0	30	6.0	12	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Three-minute Kick Samples											
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	RG_GHNF-3
Clitellata	-	Enchytraeidae	Enchytraeidae	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
Clitellata	Tubificida	Naididae	Nais	0	0	1.13	0	0.289	0	0	0.254	0.338	0	0.496	0.605
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	0.847	0	0.403
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0.289	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	Hygrobatidae	Hygrobates	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
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0.156	0	0.287	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	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
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Liodessus	0	0	0	0	0	0	0	0	0.338	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0.156	0	0	0	0	0	0	0	0
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	0.254	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	0.157	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	0	0	0	0.333	0	0.379	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0.482	0.306	0	0	0	0	0.726	1.12	0.226
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0.306	0	0	0	0	0	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	0.726	0.279	0
Insecta	Diptera	Chironomidae	Diamesa	89	11	5.27	52	20	0.985	0.667	2.69	5.69	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	37	14	4.02	0	1.64	3.00	1.61	7.20	0	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0.363	3.91	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	2.05	0	0.306	1.97	3.33	1.61	0.379	0	1.95	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0.538	0	1.09	0.279	0.226
Insecta	Diptera	Chironomidae	Metriocnemus	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	1.35
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	54	49	47	25	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	23	11	13	39	0	0	0	0	2.91	4.47	2.26
Insecta	Diptera	Chironomidae	Pagastia	0	1.68	0	0	0.612	1.64	2.33	0.807	0	4.72	8.10	28
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0.333	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0.673	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
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	0.293	0.321	0.612	0.985	2.00	0.538	1.14	0.363	1.67	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	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
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0.293	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
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0.657	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	0.306	0	0	1.34	0	0	0	0
Insecta	Diptera	Chironomidae	hienemannimyia compl	0	0	0	0	0	0	0	0	0	0	0.558	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
Insecta	Diptera	Chironomidae	Zavrelimyia	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	0.282	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
Insecta	Diptera	Empididae	Clinocera	0	0	0	0.392	0	0	0	0	5.02	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0.637	0	0	0	0	0	0	0	0	0.748	1.41
Insecta	Diptera	Empididae	Wiedemannia	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
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	0	0	0	0.339	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Three-minute Kick Samples											
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	RG_GHNF-3
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopu	1.57	1.91	1.70	1.10	1.73	3.72	0.317	3.55	2.38	10	8.97	2.82
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0.157	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	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
Insecta	Diptera	Simuliidae	Prosimulium	0	0	0	0.188	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	Simuliidae	Simulium	0.313	4.46	1.13	2.45	0	0.860	0.317	0	6.45	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	0.940	0.319	2.27	1.10	0.867	2.58	1.27	0.254	11	4.52	3.74	4.44
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	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
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0.338	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	Baetidae	Baetis rhodani group	1.88	0.317	1.13	0.939	0	0	0.315	0	1.01	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0.338	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0.254	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
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0.315	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
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0.287	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	1.01	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0.627	5.71	18	12	10	1.43	2.84	17	19	50	20	12
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	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	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
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	0.874	0.753	0.639
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	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	4.85	13	0.469	5.06	8.02	4.73	14	2.36	7.86	19	0
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	1.39	8.61	0.469	3.03	1.43	0	0	0	0	0.379	16
Insecta	Plecoptera	Nemouridae	apada oregonensis gro	0	1.39	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
Insecta	Plecoptera	Peltoperlidae	Yoraperla	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	1.10	0.867	0	0	1.27	0	0	0	6.61
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.635	2.83	0	0	2.87	1.89	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	4.95	4.27	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	1.59	13	2.19	3.47	8.60	12	0	1.01	2.33	0.502	8.95
Insecta	Trichoptera	Apataniidae	Pedomoecus	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
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	Glossosomatidae	Glossosomatidae	0	0	0	0	0	0.573	0.868	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	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
Insecta	Trichoptera	Hydropsychidae	Parapsyche	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
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	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
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0.627	0.317	0	0.939	0	0	1.74	0.254	0	0	1.49	0.403
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	Rhyacophila	0.313	0	0	1.10	0	0.287	0.434	0	0.338	0	0	0
Insecta	Trichoptera	Rhyacophilidae	cophila brunnea/vemna	0.313	0.317	0	0.156	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples													
				2016													
Higher Level Classification		Family	Lowest Practical Level Identification	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
Clitellata	-	Enchytraeidae	Enchytraeidae	7.59	13	6.90	1.10	6.01	3.20	4.51	4.01	4.70	5.32	3.19	3.77	0.634	1.30
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	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	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	1.10	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	0
Euchelicerata	Sarcoptiformes	-	Oribatida	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
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.690	0	3.45	0	0.858	0	0	1.34	1.34	1.06	0.498	0.943	1.27	1.63
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	0.671	0	1.49	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	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	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0.800	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Liodessus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0.690	0	3.45	0	0	0.800	0.752	0	0	0	0	0	0.317	0
Insecta	Coleoptera	Elmidae	Narpus	0	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	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	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	0.671	0	0.419	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	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
Insecta	Diptera	Chironomidae	Apedilum	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
Insecta	Diptera	Chironomidae	Brillia	3.49	0	1.72	0	0	3.50	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	0	0.665	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0.875	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
Insecta	Diptera	Chironomidae	Diamesa	9.76	4.77	8.62	3.30	4.45	7.00	2.31	0.490	1.34	14	0.801	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	4.88	5.96	10	5.49	22	16	2.31	0.490	0	2.91	0.801	0	3.66	6.48
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	2.38	0	0	0	0	0	0.490	2.01	1.16	3.60	2.83	0.332	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0.671	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	1.75	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	1.39	0	0	6.59	0	0	0.770	11	0	0	0	12	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	40	23	8.62	12	18	18	13	16	34	21	46	21	53	59
Insecta	Diptera	Chironomidae	Pagastia	0	1.19	1.72	0	2.67	1.75	0.770	0	0	0	0	0	14	12
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	1.54	3.19	0	0	0.801	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	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	0.401	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0.697	0	1.72	4.40	0	1.75	0	0	0	0	0	0	0.332	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	1.39	0	0	0	0	1.75	3.08	9.32	0	1.16	0	2.83	0	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	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	0
Insecta	Diptera	Chironomidae	Stempellina	0	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	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0	0	0	0.332	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	hienemannimyia compl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	2.79	7.15	3.45	0	1.78	3.50	7.70	3.19	2.68	1.16	4.41	4.72	2.33	1.71
Insecta	Diptera	Chironomidae	Zavrelimyia	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
Insecta	Diptera	Empididae	Chelifera/Metachela	0	1.13	0	0	0	0	4.51	0.445	1.34	5.43	2.80	1.89	5.07	7.49
Insecta	Diptera	Empididae	Clinocera	0.690	1.13	1.72	0	0	0	0.752	1.34	0	0	4.81	0.943	1.58	0.651
Insecta	Diptera	Empididae	Neoplasta	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
Insecta	Diptera	Muscidae	Muscidae	0	0	1.72	0	1.15	2.40	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	1.13	0	0	0	0	0.752	2.45	0.671	0	2.00	0	1.90	0.977
Insecta	Diptera	Psychodidae	Pericoma	1.38	0	8.62	3.30	0	2.40	0.752	0.891	0.671	0	0	2.83	0.634	0

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples													
				2016													
Higher Level Classification		Family	Lowest Practical Level Identification	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
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopu	0	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	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	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	0
Insecta	Diptera	Simuliidae	Prosimulium	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	0.445	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	2.20	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
Insecta	Diptera	Tipulidae	Dicranota	6.21	11	14	7.69	10	4.00	17	19	18	3.26	6.41	8.49	1.90	0.326
Insecta	Diptera	Tipulidae	Limnophila	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	0.891	0	0	0	0	0	0.326
Insecta	Diptera	Tipulidae	Pedicia	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
Insecta	Ephemeroptera	Ameletidae	Ameletidae	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
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	1.60	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	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	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	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0.690	0	0	0	0	1.60	0	0.445	0	0	0	0	0.951	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	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	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	3.45	4.44	0	2.20	0	0.800	4.51	3.56	3.36	20	2.79	2.83	0	0
Insecta	Plecoptera	Capniidae	Capniidae	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
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	7.59	17	19	33	12	8.00	20	7.35	6.71	8.51	5.58	20	2.22	0.326
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	1.72	0	0	0	0.752	0	1.34	2.66	0.398	0	0.317	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	1.10	0	0	0	0	0	1.06	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0	0	0	0	0	0	0	0.317	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	1.38	1.11	1.72	7.69	15	17	4.51	0.891	0.671	0	0.398	6.60	2.22	1.30
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	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	0
Insecta	Plecoptera	Nemouridae	apada oregonensis gro	0	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	0
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	2.22	1.72	0	0	0	11	11	17	5.32	11	8.49	0	0.651
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.175	0	0	0.146	0	0	0	1.34	2.66	0	0	0.317	0.977
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	3.45	1.11	0	1.10	1.72	0	0	2.00	0	1.06	0.797	0	1.90	0.651
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	1.11	0	3.30	0	0.800	0	0	0	1.60	0.398	0	0	0.977
Insecta	Trichoptera	Brachycentridae	Micrasema	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
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	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	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	1.11	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	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	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
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0.690	0	0	4.40	3.43	0.800	0	0	0.671	1.06	0.398	0	1.90	1.30
Insecta	Trichoptera	Limnephilidae	Homophylax	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
Insecta	Trichoptera	Limnephilidae	Philocasca	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
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	1.38	0	0	0	0	0	0	0	0	0	0	0	2.08	1.30
Insecta	Trichoptera	Rhyacophilidae	cophila brunnea/vemna	0	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	0

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples													
Higher Level Classification		Family	Lowest Practical Level Identification	2016				2017									
				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	-	Enchytraeidae	Enchytraeidae	2.39	5.64	1.80	0.672	4.24	12	7.14	2.71	5.96	2.48	0	2.22	2.32	6.83
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	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	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	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	0
Euchelicerata	Sarcoptiformes	-	Oribatida	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
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.896	0	0.771	0	0.265	0	0	0	0.221	0	0	0	0	1.24
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0.440	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0.440	0	0.298	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	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	0.621
Insecta	Coleoptera	Dytiscidae	Liodessus	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	0.221	0.310	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0.246	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	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
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0.265	0	0	0	0.221	0	0	0	0.273	0
Insecta	Diptera	Ceratopogonidae	Probezzia	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
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0.888	0	0.312	0	0.654	0.978	0	0.287	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0.296	0	0.312	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0.296	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	11	9.18	8.31	4.09	11	12	7.82	1.94	2.15	18
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0.312	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	7.68	7.91	3.50	10	0	5.77	8.57	7.90	5.41	4.14	3.91	0.970	0.287	1.67
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0.901	1.63	0.779	0.625	1.58	0.654	0	28	1.72	1.67
Insecta	Diptera	Chironomidae	Limnophyes	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
Insecta	Diptera	Chironomidae	Micropsectra	0	0	0	0	0	0	0.260	0.312	1.35	1.96	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	53	38	56	49	46	35	43	31	34	44	1.96	8.73	7.45	0
Insecta	Diptera	Chironomidae	Pagastia	24	28	14	21	2.79	2.22	3.63	4.09	5.41	6.43	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0.312	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	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	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0.260	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
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	1.08	0.699	0	3.26	2.08	1.59	4.06	2.29	0	0	1.72	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0.538	0	0.270	0	0	0	0	0	0	0	0.287	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	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	0
Insecta	Diptera	Chironomidae	Stempellina	0	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	0
Insecta	Diptera	Chironomidae	Tanytarsus	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	0.287	0
Insecta	Diptera	Chironomidae	hienemannimyia compl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	3.29	5.65	3.15	2.52	3.55	1.04	2.22	2.03	0.327	19	0.970	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	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
Insecta	Diptera	Empididae	Chelifera/Metachela	2.09	3.44	3.87	1.35	0.265	0.293	0	0	0	0	0	4.44	0	3.11
Insecta	Diptera	Empididae	Clinocera	0.299	1.25	1.03	0.677	0.265	0.293	0.246	0	0.662	0.620	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0.265	0.587	0.739	0	0.221	0	0.923	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	1.24	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0.299	0	0	0	0	0	0	0.298	0	0	0	1.48	0.273	1.24
Insecta	Diptera	Psychodidae	Pericoma	0	0.313	0.516	0	0.618	1.32	0.246	0.894	0.662	0.931	0	1.48	2.05	0.621

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples													
Higher Level Classification		Family	Lowest Practical Level Identification	2016				2017									
				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
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopu	0	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	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	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	0
Insecta	Diptera	Simuliidae	Prosimulium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0.313	0	0	0.618	0	0	0	0	0.310	0.923	0	0	0
Insecta	Diptera	Simuliidae	Simulium	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
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0.265	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0.299	1.57	1.29	0	1.86	6.01	5.67	4.23	1.99	2.79	1.85	1.48	13	2.48
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0.261	0	0	0.273	0	0	0.246	0	0	0	0	0	0.273	0
Insecta	Diptera	Tipulidae	Pedicia	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
Insecta	Ephemeroptera	Ameletidae	Ameletidae	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
Insecta	Ephemeroptera	Baetidae	Baetis	0.299	0	0	0	0	0.587	0	0	0	0	0.901	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	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	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0.313	0	0	0	0	0	0	0.221	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	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	0.741	0	1.24
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0.883	0.880	0.246	1.82	1.32	1.24	11	3.70	15	3.11
Insecta	Plecoptera	Capniidae	Capniidae	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
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0.299	1.88	0.514	0.672	24	12	15	33	13	7.96	38	37	50	53
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	0	0.293	0	0.596	0.883	0.310	0	0	0	2.48
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0.587	0	0.298	0.662	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0.293	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
Insecta	Plecoptera	Nemouridae	Zapada	0.597	1.88	2.83	3.36	2.12	1.32	1.23	1.52	5.30	7.03	0	0	0	0.621
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	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	0
Insecta	Plecoptera	Nemouridae	apada oregonensis gro	0	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	0
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	2.19	3.60	1.34	0	0	0	0	0	0	9.01	5.93	1.64	0.621
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.410	0	0.336	0	0	0	0.596	0.221	0.620	0	0.741	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	4.18	4.07	0.771	4.70	0.265	0	0.739	0.298	0.221	0	4.50	0	0	0
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0.257	1.01	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
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0.896	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	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	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
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	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
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0.299	0.313	1.54	0.336	0	0.293	0.739	0	2.65	1.86	0	0	0.682	0
Insecta	Trichoptera	Limnephilidae	Homophylax	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
Insecta	Trichoptera	Limnephilidae	Philocasca	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
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	2.69	0	0.514	1.34	0.618	0	0.246	0.298	0	0	0	0	0	0.621
Insecta	Trichoptera	Rhyacophilidae	cophila brunnea/vemna	0	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	0

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples													
Higher Level Classification		Family	Lowest Practical Level Identification	2017								2018					
				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	-	Enchytraeidae	Enchytraeidae	2.13	1.39	0.820	0	1.22	0.777	0	0.326	4.64	19	1.63	0.806	4.49	3.90
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	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	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	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	2.44	0	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	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
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0.279	0	0.257	0.610	0.777	0	0.651	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0.279	0	0.257	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0.279	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	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0.304	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Liodessus	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	0.375	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0	0.649
Insecta	Coleoptera	Elmidae	Optioservus	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
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	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
Insecta	Diptera	Ceratopogonidae	Probezzia	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
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0.333	0	0.426	0	0	0	0	1.05	1.88	0	1.00	3.24	1.43	2.34
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	1.88	0	0	0	0.475	0
Insecta	Diptera	Chironomidae	Chironomus	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	0.779
Insecta	Diptera	Chironomidae	Diamesa	2.33	4.26	1.70	0.794	2.62	1.92	0	1.05	0	1.41	0	0	0	16
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	1.08	0	0.779
Insecta	Diptera	Chironomidae	Eukiefferiella	4.33	0.984	0.426	1.32	0	2.46	2.74	0.699	11	30	10	8.64	33	36
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	1.00	0.984	0	0	0	0	0	0	6.28	1.41	17	0	0.951	0
Insecta	Diptera	Chironomidae	Limnophyes	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
Insecta	Diptera	Chironomidae	Micropsectra	0	0	0.426	3.70	0.655	3.28	0	2.44	0.628	0	0	0	0.951	0.779
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	3.33	5.91	45	28	35	38	53	36	13	20	11	39	12	12
Insecta	Diptera	Chironomidae	Pagastia	0	0	29	28	32	27	25	20	1.26	1.41	1.00	4.32	0	1.56
Insecta	Diptera	Chironomidae	Parametriocnemus	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
Insecta	Diptera	Chironomidae	Parorthocladius	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
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0.529	0	0.274	4.56	0	5.65	0	7.01	0	6.18	7.01
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	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	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	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	0
Insecta	Diptera	Chironomidae	Stempellinella	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
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	hienemannimyia compl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	6.00	2.62	0	0.794	0	0.274	0.912	1.05	2.51	5.64	9.02	14	14	1.56
Insecta	Diptera	Chironomidae	Zavrelimyia	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
Insecta	Diptera	Empididae	Chelifera/Metachela	0.304	0	2.46	3.60	3.66	4.40	5.36	3.26	0	0	0	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	0.279	0	0.257	0	0	0.893	0	0.515	0	0.813	1.61	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0.820	0.514	0	0.518	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	0.749	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0.304	0	0	1.80	0	0.259	0	0.651	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	1.22	0.557	0	0.257	0	0.259	0	0	0	1.23	5.69	0.806	2.25	0

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples													
Higher Level Classification		Family	Lowest Practical Level Identification	2017								2018					
				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	Diptera	Psychodidae	Pericoma/Telmatoscopu	0	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	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	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	0
Insecta	Diptera	Simuliidae	Prosimulium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0.912	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	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	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
Insecta	Diptera	Tipulidae	Dicranota	3.04	0	1.23	2.31	1.83	1.04	0	2.28	17	8.64	5.69	13	5.24	3.25
Insecta	Diptera	Tipulidae	Limnophila	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
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0.771	0	0.259	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	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	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
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	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	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0.257	0	0.259	0	0.326	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0.279	1.64	1.29	1.22	0.518	0.893	2.61	0.515	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	9.42	11	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	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	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	1.55	0	0	0	0	0.649
Insecta	Plecoptera	Capniidae	Paracapnia	61	65	2.87	11	4.27	2.59	0	4.23	29	9.88	24	13	14	6.49
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0.279	0	0.771	0	0.259	0	0	1.03	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0.771	0.610	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0.304	0	0	0.257	0	0	0.893	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
Insecta	Plecoptera	Nemouridae	Zapada	2.43	3.06	1.64	6.94	7.93	4.66	0.893	4.89	1.03	2.47	0.813	0	2.25	5.84
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	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	0
Insecta	Plecoptera	Nemouridae	apada oregonensis gro	0	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	0
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	1.22	1.67	0	0	0.610	0.518	0	0	0.515	0	2.44	0.806	0.375	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.279	2.46	1.29	2.44	2.59	0	2.28	0	0	0	0	0.375	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0.649
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0.608	1.39	7.38	1.80	0.610	4.66	3.57	13	0	0	0	0	0	0.649
Insecta	Trichoptera	Apataniidae	Pedomoecus	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
Insecta	Trichoptera	Glossosomatidae	Anagapetus	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
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	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
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0.257	0	0	0	0.651	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	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
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0.410	0	1.22	0.518	0.893	0.326	0	0	0.813	0	0.749	0
Insecta	Trichoptera	Limnephilidae	Homophylax	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
Insecta	Trichoptera	Limnephilidae	Philocasca	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
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	1.64	1.80	3.66	2.59	0.893	1.63	0.515	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	cophila brunnea/vemna	0	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	0

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples													
Higher Level Classification		Family	Lowest Practical Level Identification	2018												2019	
				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
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	6.74	0	2.44	0	0.239	0	0	0	0.480	0.576	4.55	7.46
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	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	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	1.23	0.529	0	17	1.22	0.870	0	0	0	0.855	0	0	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	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	0.423	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	1.22	0	0	0	0.211	0	0	0.288	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0.239	0	0.211	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	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	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Liodessus	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	0.576	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0.211	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0.870	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
Insecta	Diptera	Ceratopogonidae	Culicoides	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
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0	0	0	0.577	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	3.19	15	2.25	6.24	18	8.82	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	4.41	0	0	0	1.36	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0.558	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0.638	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
Insecta	Diptera	Chironomidae	Eukiefferiella	8.93	3.90	4.49	0	5.39	4.41	2.27	3.08	4.59	1.36	3.53	1.96	21	19
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	4.46	0	1.04	0	0	0	0	0	0	0	0	5.77	15
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	2.08	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
Insecta	Diptera	Chironomidae	Micropsectra	0	0.558	0	0	0	0	0.505	0	0.219	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	3.83	1.67	5.62	2.08	4.04	4.41	29	29	34	34	35	27	28	20
Insecta	Diptera	Chironomidae	Pagastia	1.28	0.558	0	0	0	0	21	21	11	31	27	26	8.08	7.20
Insecta	Diptera	Chironomidae	Parametriocnemus	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
Insecta	Diptera	Chironomidae	Parorthocladius	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
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	1.12	0	1.04	0	0	0	0	0	0	0	0	1.15	4.12
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	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	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	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	0
Insecta	Diptera	Chironomidae	Stempellinella	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
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	hienemannimyia compl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	46	34	11	39	24	25	0.253	1.76	0.437	1.59	4.03	1.96	9.23	10
Insecta	Diptera	Chironomidae	Zavrelimyia	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	0.240	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0	0	0	0	2.39	1.68	0.634	0.855	0.959	6.34	0	0.498
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	2.63	0.420	1.27	1.07	0.240	0.865	0	0
Insecta	Diptera	Empididae	Neoplasta	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
Insecta	Diptera	Muscidae	Muscidae	0	0	1.12	0	0	3.53	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	1.22	0	0	0	0.423	0.214	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	3.07	1.06	7.87	0.980	3.66	7.93	0	0	0	0.641	0	0.576	1.14	2.49

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples													
Higher Level Classification		Family	Lowest Practical Level Identification	2018												2019	
				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
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopu	0	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	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	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	0
Insecta	Diptera	Simuliidae	Prosimulium	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
Insecta	Diptera	Simuliidae	Simulium	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
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	6.75	4.23	18	6.86	4.88	5.29	2.63	0.420	1.06	1.07	0.719	4.03	5.68	3.48
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0	0.240	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	1.12	0.980	0	0	0.239	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
Insecta	Diptera	Tipulidae	Rhabdomastix	0	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	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0.211	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0	0	0	0.480	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	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	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	0.955	0	0	0	0.959	0.576	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0.716	0	0.846	0.641	0.719	0.576	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	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	0
Insecta	Plecoptera	Capniidae	Capniidae	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
Insecta	Plecoptera	Capniidae	Mesocapnia	0.613	2.65	2.25	1.96	1.22	2.61	0	0	0.211	0	0	0	1.14	0.995
Insecta	Plecoptera	Capniidae	Paracapnia	16	26	26	19	15	19	8.35	2.94	2.96	1.50	3.36	2.88	11	6.47
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	0	0	0	0.420	0.211	0	1.20	0.865	0	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0.239	0	0	0	0	0.288	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	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	0
Insecta	Plecoptera	Nemouridae	Zapada	3.07	0.529	3.37	0.980	8.54	4.35	22	27	30	20	13	13	1.14	0.995
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	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	0
Insecta	Plecoptera	Nemouridae	apada oregonensis gro	0	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	0
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	2.45	2.12	7.87	1.96	6.10	2.61	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0	0	0	1.19	1.68	1.27	0.855	1.92	4.90	0.568	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0.239	0.420	0.211	0.427	0.480	0.865	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	2.45	0.529	2.25	0	3.66	6.09	5.01	7.98	7.19	3.21	3.12	4.32	1.70	1.99
Insecta	Trichoptera	Apataniidae	Pedomoecus	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
Insecta	Trichoptera	Glossosomatidae	Anagapetus	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
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	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	0.420	0	0	0.719	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	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	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	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	0.211	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0.613	0.529	0	0	0	0	0	0.420	0.211	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	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
Insecta	Trichoptera	Limnephilidae	Philocasca	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	0.498
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0	0	0.477	1.68	1.06	0.214	1.92	1.15	0	0
Insecta	Trichoptera	Rhyacophilidae	cophila brunnea/vemna	0	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	0

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples													
				2019													
Higher Level Classification		Family	Lowest Practical Level Identification	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	-	Enchytraeidae	Enchytraeidae	1.40	4.33	8.13	11	0.216	0.541	0	0.391	0.862	0	1.54	0	0.435	0
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	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	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	1.86	0	0	0	0	1.08	0	0.781	16	3.21	0.171	0	0.435	0.505
Euchelicerata	Sarcoptiformes	-	Oribatida	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	0.862	0.292	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.465	0.433	0	0	0	0	0	0	0	0	0	0	0.435	0.505
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0.433	0	0.173	0	0	0	0	0	0	0.684	0	0.435	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	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	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Liodessus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0.478	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
Insecta	Coleoptera	Elmidae	Optioservus	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
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	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
Insecta	Diptera	Ceratopogonidae	Probezzia	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
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0.977	0	0	0	0	1.21	0.233	1.70	6.42	0.313	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	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
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	0	0	0	0.526	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0.228	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0.721	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	9.29	18	24	52	1.14	4.24	3.72	0.851	6.42	2.19	20	30	22	41
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	31	2.26	1.98	0.721	1.14	0.605	3.72	1.28	2.14	1.25	0.971	0	33	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0	0.313	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0.977	0	0.494	0	0	0	0.233	0	0	0	0.583	0	2.11	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	11	34	37	8.83	1.83	7.26	1.86	1.28	1.07	0.625	4.66	1.90	5.26	12
Insecta	Diptera	Chironomidae	Pagastia	3.91	11	8.40	12	5.94	1.21	2.09	0	0	1.56	30	18	7.37	17
Insecta	Diptera	Chironomidae	Parametriocnemus	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
Insecta	Diptera	Chironomidae	Parorthocladius	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
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	7.33	0.453	1.48	0.721	0.228	0	1.40	0.851	0	0.625	0.388	0	5.26	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	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	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	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	0
Insecta	Diptera	Chironomidae	Stempellinella	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
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	hienemannimyia compl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	3.42	4.08	2.47	2.25	77	40	67	18	15	62	8.55	2.85	2.11	1.22
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0.605	0.233	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
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0	0	0.431	0	0	0.391	0	0.292	1.88	3.08	0	1.01
Insecta	Diptera	Empididae	Clinocera	1.40	0	0	0	0.216	0.545	0	1.17	0	0	0	1.54	0.435	2.53
Insecta	Diptera	Empididae	Neoplasta	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
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0.347	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	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	5.58	1.73	0.957	0.693	3.23	4.36	1.12	4.69	5.17	5.25	1.03	0	0.435	1.01

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples													
				2019													
Higher Level Classification		Family	Lowest Practical Level Identification	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
Insecta	Diptera	Psychodidae	ericoma/Telmatoscopu	0	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	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	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	0
Insecta	Diptera	Simuliidae	Prosimulium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0.545	0	2.73	4.31	0.875	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	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
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	6.51	5.20	3.83	1.91	1.08	0	0.447	0.391	0	1.75	3.42	0	1.74	0
Insecta	Diptera	Tipulidae	Limnophila	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
Insecta	Diptera	Tipulidae	Pedicia	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
Insecta	Ephemeroptera	Ameletidae	Ameletidae	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
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0	0	0.391	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	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	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	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0.433	0.478	0	0	0.541	0	0	0	0	0.342	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0.391	0	0	0	0.769	0	1.01
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	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	0
Insecta	Plecoptera	Capniidae	Capniidae	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
Insecta	Plecoptera	Capniidae	Mesocapnia	0.465	0	1.91	0.173	1.08	6.49	1.79	11	8.62	3.50	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	7.91	7.80	3.83	2.95	3.45	6.49	6.94	27	15	7.58	1.71	0.769	4.35	1.52
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	0	0.541	0	0	0	0	0.171	0	0	0.505
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	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	0.769	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0.433	0	1.21	0	0	0	0	1.72	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	2.33	5.20	2.87	2.95	1.08	16	7.16	20	7.76	6.71	23	33	11	16
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	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	0
Insecta	Plecoptera	Nemouridae	apada oregonensis gro	0	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	0
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	1.08	2.70	0.671	2.73	2.59	1.17	0.171	0.769	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.108	0	0	0	0	0	0	0.862	0	0.0428	1.54	0	1.52
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0.433	0.478	0.347	0.216	2.70	0.447	3.91	3.45	0.583	0.513	3.85	0.435	1.52
Insecta	Trichoptera	Apataniidae	Pedomoecus	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	0.171	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	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
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	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
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0.435	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	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
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	2.33	0	0	0.693	0	2.70	0.895	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
Insecta	Trichoptera	Limnephilidae	Limnephilidae	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
Insecta	Trichoptera	Limnephilidae	Psychoglypha	2.33	2.60	0.957	0	0	0	0	1.17	2.59	0	0.171	0	1.74	0.505
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0.217	0.478	0	0	0	0	0	0	0	0.556	1.54	0	1.52
Insecta	Trichoptera	Rhyacophilidae	cophila brunnea/vemna	0	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	0

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples													
Higher Level Classification		Family	Lowest Practical Level Identification	2019		2020											
				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	-	Enchytraeidae	Enchytraeidae	1.96	0.629	7.22	12	2.89	4.36	2.09	6.42	1.14	3.14	3.36	0	4.26	2.47
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	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	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0.210	0	1.66	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	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0.840	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.130	0	0.555	0	0.578	0	0	0	0	0	0	1.14	0	1.23
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	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
Insecta	Coleoptera	Curculionidae	Curculionidae	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
Insecta	Coleoptera	Dytiscidae	Liodessus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0.232	0.402	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	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	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0.555	0	0	0	0	0	0	0	0	0	0.719	0
Insecta	Diptera	Ceratopogonidae	Culicoides	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
Insecta	Diptera	Chironomidae	Apedilum	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
Insecta	Diptera	Chironomidae	Brillia	0	0	0	4.46	0.593	0.449	0.530	0	0	0.653	0	0	0.767	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0.637	0	0	0	0	0	0	0	0	0.767	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	1.17	3.82	2.96	0.898	0.795	0.425	1.35	3.27	0	0	6.91	5.93
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	1.35	0	0.425	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	18	25	16	2.55	8.30	9.43	9.28	21	1.35	0.653	2.16	1.27	0	2.96
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	3.38	0.653	3.24	0	3.07	0
Insecta	Diptera	Chironomidae	Hydrobaenus	1.09	1.95	2.35	22	11	10	14	4.68	4.73	12	0	1.27	6.14	0
Insecta	Diptera	Chironomidae	Limnophyes	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
Insecta	Diptera	Chironomidae	Micropsectra	0.313	0.733	2.35	3.19	2.96	11	15	3.40	0.675	0	0	0	0.767	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	2.35	1.95	32	18	5.93	1.80	11	15	0.675	0	1.08	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	35	38	15	0.637	1.78	3.14	3.71	12	1.35	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	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	1.08	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	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
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0.637	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0.244	0.587	2.55	5.34	4.04	2.39	1.28	2.03	7.18	0	0	2.30	0
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	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	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	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	0
Insecta	Diptera	Chironomidae	Stempellinella	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
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	hienemannimyia compl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	4.07	4.15	2.35	3.82	7.11	8.53	2.65	5.95	14	7.84	0	17	1.53	5.93
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	1.31	0	0	0.767	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0.719	0
Insecta	Diptera	Empididae	Chelifera/Metachela	1.56	1.68	0.833	1.10	0	0	0	0	1.71	2.52	8.40	4.78	1.44	1.23
Insecta	Diptera	Empididae	Clinocera	1.30	0.210	0.833	0	0	0	0	0	0	0	0.840	2.39	0	0
Insecta	Diptera	Empididae	Neoplasta	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
Insecta	Diptera	Muscidae	Muscidae	0	0	0.555	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0.578	0	0	0	1.14	2.52	0.840	0	2.88	0
Insecta	Diptera	Psychodidae	Pericoma	0.261	1.26	1.11	8.28	12	9.12	8.12	8.03	2.86	3.77	8.40	8.36	2.88	1.23

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples													
Higher Level Classification		Family	Lowest Practical Level Identification	2019		2020											
				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	Diptera	Psychodidae	Pericoma/Telmatoscopu	0	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	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	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	0
Insecta	Diptera	Simuliidae	Prosimulium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0.419	0.555	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	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	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
Insecta	Diptera	Tipulidae	Dicranota	2.87	1.05	8.33	6.76	13	5.21	7.66	5.22	22	13	22	12	18	24
Insecta	Diptera	Tipulidae	Limnophila	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
Insecta	Diptera	Tipulidae	Pedicia	0.130	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
Insecta	Ephemeroptera	Ameletidae	Ameletidae	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
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0.555	0	0	0	0	0	0.571	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	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	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0.261	0	0.555	0	0	0	0.232	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	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	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	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	0
Insecta	Plecoptera	Capniidae	Capniidae	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
Insecta	Plecoptera	Capniidae	Mesocapnia	0	0	0	3.31	0	1.45	0	1.54	17	8.28	13	7.73	2.42	12
Insecta	Plecoptera	Capniidae	Paracapnia	4.17	0.629	4.44	2.21	9.82	12	7.89	7.70	14	23	22	12	39	23
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0.130	0	0	0.552	0	0.397	0	0	0	0	1.68	0	0	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0.578	0	0	0	0	1.26	0.840	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0.419	0	0	4.04	0	0	0	3.14	0	0	10	0	0
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	26	20	1.67	1.10	0	5.16	2.09	2.41	3.14	2.52	3.36	10	0	16
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	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	0
Insecta	Plecoptera	Nemouridae	apada oregonensis gro	0	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	0
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0.782	0.210	0	0.552	1.73	1.19	0	0	3.43	3.14	5.88	10	2.13	3.70
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0.130	0	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	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0.261	0.839	0	0	0	0	0	0	0	0	0	1.14	0	1.23
Insecta	Trichoptera	Apataniidae	Pedomoecus	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	0.571	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0.402	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	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	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0.0694	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	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	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
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	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
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0.552	8.70	10	12	3.21	0.571	2.52	1.68	1.14	2.84	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0.419	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0.130	0.210	0	0	0	0	0	0.0125	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	cophila brunnea/vemna	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0.555	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.3: **Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021**

Taxon				Area-based Kick Samples													
Higher Level Classification		Family	Lowest Practical Level Identification	2020						2021							
				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	-	Enchytraeidae	Enchytraeidae	1.92	0	0.239	1.59	0.329	1.03	3.61	2.73	3.57	1.67	0.439	2.31	1.08	0.702
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	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	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	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	0
Euchelicerata	Sarcoptiformes	-	Oribatida	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
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.319	0.852	0.239	0	0.658	0.412	0.201	0	0.794	0	0	0.384	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0.239	0	0	0	0	0	0	0.333	0	0.384	0.217	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	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	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0.397	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Liodessus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0.319	0	0	0	0.329	0.619	0.201	2.48	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	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
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0.319	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
Insecta	Diptera	Ceratopogonidae	Probezzia	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
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	0.967	0	0.480	0	0	1.28	0	0.380
Insecta	Diptera	Chironomidae	Chaetocladius	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
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0.483	0	0.960	0.745	0	0	0.237	0.761
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0	0	0	0.237	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	2.96	2.46	5.10	0.687	4.79	1.72	53	51	38	57	63	50	0.711	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	0.474	1.52
Insecta	Diptera	Chironomidae	Hydrobaenus	3.94	2.46	0	11	0.685	1.72	0	0	0.480	0	0	0	0	1.90
Insecta	Diptera	Chironomidae	Limnophyes	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
Insecta	Diptera	Chironomidae	Micropsectra	4.27	0.614	0.510	0	0.685	0.430	0.483	0	0	0	0	0	0.237	1.52
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	8.87	6.14	24	21	41	4.94	2.90	11	9.60	10	3.57	2.98	2.85	0.380
Insecta	Diptera	Chironomidae	Pagastia	24	13	42	20	28	36	9.42	15	9.60	12	6.12	5.95	19	3.80
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0.344	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	0
Insecta	Diptera	Chironomidae	Pentaneura	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
Insecta	Diptera	Chironomidae	Pseudodiamesa	0.986	0.307	0	0	0.685	0.430	0	1.46	5.76	1.12	0.510	0	0.474	2.28
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	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	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	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	0
Insecta	Diptera	Chironomidae	Stempellinella	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
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	hienemannimyia compl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	1.31	1.23	1.28	1.37	0	1.50	2.90	0.874	0.960	0.745	2.04	0	34	37
Insecta	Diptera	Chironomidae	Zavrelimyia	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
Insecta	Diptera	Empididae	Chelifera/Metachela	7.03	5.59	7.40	7.62	4.52	3.92	0	1.24	0	0	0	0	3.25	1.05
Insecta	Diptera	Empididae	Clinocera	0.319	0.373	0.493	0	0.411	0	0.602	0	0.794	0.667	0	1.54	0.651	0
Insecta	Diptera	Empididae	Neoplasta	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
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	1.00	0	0	0.333	0	0.384	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	1.92	0	0	0.635	0.329	0	0	0	0	0	0	0.0481	0	0.351
Insecta	Diptera	Psychodidae	Pericoma	4.15	0	0	3.81	1.32	0.619	2.61	3.97	5.95	1.33	5.70	5.38	1.08	6.32

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples													
Higher Level Classification		Family	Lowest Practical Level Identification	2020						2021							
				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
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopu	0	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	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	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	0
Insecta	Diptera	Simuliidae	Prosimulium	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
Insecta	Diptera	Simuliidae	Simulium	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
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	1.92	1.70	0.478	4.76	1.97	2.06	1.61	3.23	3.17	2.00	3.07	2.31	3.04	1.05
Insecta	Diptera	Tipulidae	Limnophila	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	0.384	0	0
Insecta	Diptera	Tipulidae	Pedicia	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
Insecta	Ephemeroptera	Ameletidae	Ameletidae	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
Insecta	Ephemeroptera	Baetidae	Baetis	0	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	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	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	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	1.60	2.27	0.957	2.22	1.97	0.825	0	0	0	0	0	0.384	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0.319	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	0
Insecta	Plecoptera	Capniidae	Capnia	0	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	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0.342	0	0	0	0	0.549	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0	2.60	0	0.397	0	0.444	3.76	1.74	5.56	1.75	0.877	5.49	2.65	1.80
Insecta	Plecoptera	Capniidae	Paracapnia	4.15	6.49	0.239	2.78	0.987	5.33	5.13	0.496	2.78	0.583	0.877	1.65	6.89	19
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0.319	0	0	0	0.329	0	0	0	0.397	0	0	0	0.217	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0.284	0	0	0.329	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0.733	3.52	0	0	0.680	0.608	0.803	0	0.397	0	1.32	0	0.506	0.646
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0.803	0	0.397	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	24	43	14	19	9.52	33	6.43	0.993	0.794	2.33	0	5.38	16	12
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	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	0
Insecta	Plecoptera	Nemouridae	apada oregonensis gro	0	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	0
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0.239	0	0	0	0.201	0.248	0	0	0.439	0.769	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0.319	0.426	0	0.476	0	0.247	1.20	1.49	3.97	0.333	2.63	5.00	3.69	4.56
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0.639	1.28	0.718	0.476	0	0.990	0.201	0	0	0.333	0	0	0.0271	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0.284	0	1.27	0.329	0.619	0.402	0	0	0	0.877	1.15	0.867	0.702
Insecta	Trichoptera	Apataniidae	Pedomoecus	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
Insecta	Trichoptera	Glossosomatidae	Anagapetus	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
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	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
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0.412	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	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0.317	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0.744	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	1.70	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0.397	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	2.56	0	1.91	0.317	0	1.24	0.402	1.74	4.37	5.33	8.33	5.77	1.30	2.81
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0.284	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
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0.639	2.56	0.478	0.317	0	0.825	0.402	0	0	0.333	0	0.769	0	0
Insecta	Trichoptera	Rhyacophilidae	cophila brunnea/vemna	0	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	0

Note: - = not applicable.

Table E.3: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples									
Higher Level Classification		Family	Lowest Practical Level Identification	2021									
				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	-	Enchytraeidae	Enchytraeidae	0	0	1.79	0.336	0	0.377	0.532	0.327	0.810	1.74
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais	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
Collembola	Collembola	-	Collembola	0	2.13	0.446	0.168	0	0.188	0	0	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0	0.405	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	1.06	0	0	1.07	0.377	2.13	0.654	0.810	0.651
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Liodessus	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Culicoides	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Apedilum	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	1.33	1.26	0	0.185	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	1.30	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0.332	1.26	0.984	1.30	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0.332	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	1.26	0	0	38	55	33	50	51	28
Insecta	Diptera	Chironomidae	Heleniella	0.332	0	0	0.555	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0.925	0	0.925	0	0	0	1.72
Insecta	Diptera	Chironomidae	Limnophyes	0	1.26	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0.332	0	0	2.59	0	11	0.601	0	1.43	1.96
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0.995	1.26	1.48	1.48	11	1.85	3.60	6.48	3.82	12
Insecta	Diptera	Chironomidae	Pagastia	9.95	2.53	25	5.00	35	17	19	26	19	31
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	1.33	0	0.492	0.555	0	0	0	0	0	0.491
Insecta	Diptera	Chironomidae	Psilometriocnemus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	hienemannimyia compl	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	50	32	15	44	0	0.925	0	0	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0.188	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0.464	1.06	4.91	0.671	6.79	1.51	11	4.58	5.26	7.81
Insecta	Diptera	Empididae	Clinocera	0.464	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	0.377	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	2.79	6.38	1.79	3.69	0	3.39	1.60	0.980	2.83	2.60

Note: - = not applicable.

Table E.3: **Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2012 to 2021**

Taxon				Area-based Kick Samples									
				2021									
Higher Level Classification		Family	Lowest Practical Level Identification	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	Diptera	Psychodidae	Pericoma/Telmatoscopu	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	Sciomyzidae	0	0	0	0	0	0.188	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0.327	0	0
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	3.72	2.13	4.91	4.53	0	0.188	0.532	0	0.405	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Molophilus	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pedicia	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	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
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	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
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	0.532	0	0	0.217
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Mesocapnia	0.512	1.77	6.20	11	0	0	1.06	0	0	0.651
Insecta	Plecoptera	Capniidae	Paracapnia	14	3.55	8.53	13	0	0.377	0	0	0.405	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	1.06	0	0	0	0	0.532	0	0	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	1.11	0	1.52	0	0	0.565	0	0.955	0	1.47
Insecta	Plecoptera	Nemouridae	Visoka	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	9.42	23	14	5.37	7.14	2.82	20	5.25	10	7.64
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	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
Insecta	Plecoptera	Nemouridae	apada oregonensis gro	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0.310	5.32	0.473	2.01	0.357	0	0.532	0	0.405	0.651
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	7.56	0.168	0	0.377	0	0.327	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	1.55	2.13	2.68	1.17	1.43	1.51	1.06	3.92	1.62	2.17
Insecta	Trichoptera	Apataniidae	Pedomoecus	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Homophylax	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0.310	9.57	2.23	0	0	1.13	1.60	0	1.62	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	0	0	0.357	0.188	2.66	0.327	0.405	0
Insecta	Trichoptera	Rhyacophilidae	cophila brunnea/vemna	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.4: 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 2021

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	RG_GHNF-3
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	7.5	18	1.0	0	0	0
Clitellata	Tubificida	Naididae	Nais	0	0	50	0	20	0	0	5.9	1.0	0	40	15
Collembola	Collembola	-	Collembola	0	0	0	0	0	0	0	0	0	20	0	10
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	20	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	1.0	20	2.2	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	1.0	0	2.2	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	11	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Liodessus	0	0	0	0	0	0	0	0	1.0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	1.0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	5.9	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	1.0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Boreoheptagyia	0	0	0	0	0	0	2.6	0	1.1	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	3.1	21	0	0	0	0	17	90	5.6
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	21	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0	0	0	0	17	23	0
Insecta	Diptera	Chironomidae	Diamesa	3,156	339	233	331	1,397	7.6	5.3	62	17	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	1,155	608	26	0	13	24	37	21	0	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	8.6	315	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	91	0	21	15	26	37	1.1	0	157	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	13	0	26	23	5.6
Insecta	Diptera	Chironomidae	Micropsectra	0	11	13	5.1	317	10	16	0	1.1	17	900	34
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	418	391	1,091	75	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	731	491	83	2,666	0	0	0	0	69	360	56
Insecta	Diptera	Chironomidae	Pagastia	0	53	0	0	42	13	19	19	0	111	652	689
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	2.6	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	21	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	2.6	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	13	2.1	42	7.6	16	13	3.4	8.6	135	0
Insecta	Diptera	Chironomidae	Rheocricotopus	0	0	0	0	0	0	0	6.2	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	13	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	21	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	5.1	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	21	0	0	31	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemannimyia complex	0	0	0	0	0	0	0	0	0	0	45	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	39	6.2	169	18	5.3	50	15	146	495	330
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	6.7	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	11	0	25	2.5	0	13	18	0	4.2	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	2.5	0	0	0	0	15	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	20	0	0	0	0	0	0	0	0	60	35
Insecta	Diptera	Muscidae	Muscidae	0	10	0	0	220	0	0	77	0	13	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	0	0	0	1.0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	56	60	75	7.0	120	29	2.5	82	7.0	240	723	70
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	1.0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Gymnopais	0	0	0	1.2	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Prosimulium	0	0	0	1.2	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simulium	11	141	50	16	0	6.7	2.5	0	19	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	33	10	100	7.0	60	20	10	5.9	32	107	301	110
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	1.0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	67	10	50	6.0	0	0	2.5	0	3.0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	1.0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella grandis group	0	0	0	0	0	0	0	5.9	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	20	0	0	40	8.9	7.5	0	2.0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Epeorus	0	0	0	0	0	0	2.5	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	122	60	25	12	80	4.4	18	5.9	1.0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Rhithrogena	0	0	0	0	0	2.2	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capnia	0	0	0	0	0	0	0	0	3.0	0	0	0

Notes: No./3-min kick = number of organisms per three minute kick; - = not applicable.

Table E.4: 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 2021

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	RG_GHNF-3
Insecta	Plecoptera	Capniidae	Capniidae	22	180	775	78	700	11	23	382	57	1,168	1,598	307
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	3.0	0	0	13	5.9	1.0	6.9	20	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	0	0	0	21	61	16
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	153	570	3.0	350	62	38	329	7.0	186	1,527	0
Insecta	Plecoptera	Nemouridae	Zapada columbiana	0	44	380	3.0	210	11	0	0	0	0	31	402
Insecta	Plecoptera	Nemouridae	Zapada oregonensis group	0	44	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	1.0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	7.0	60	0	0	29	0	0	0	164
Insecta	Plecoptera	Perlodidae	Megarcys	0	20	125	0	0	22	15	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	117	344	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	50	562	14	240	67	98	0	3.0	55	41	222
Insecta	Trichoptera	Brachycentridae	Micrasema	0	0	13	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosomatidae	0	0	0	0	0	4.4	6.9	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	11	0	112	0	40	0	3.4	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	22	10	0	6.0	0	0	14	5.9	0	0	120	10
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	11	0	0	7.0	0	2.2	3.4	0	1.0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	11	10	0	1.0	0	0	0	0	0	0	0	0

Notes: No./3-min kick = number of organisms per three minute kick; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density							
Higher Level Classification		Family	2016							
			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	-	Enchytraeidae	347	254	92	57	137	79	80	60
Collembola	Collembola	Collembola	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	20	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	23	0	26	59	0	0
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	114	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	0	23	0	0	0	13	0
Insecta	Plecoptera	Leuctridae	0	0	0	57	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	158	21	0	57	39	0	0	30
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density							
Higher Level Classification		Family	2016							
			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	-	Enchytraeidae	93	33	76	174	12	13	61	195
Collembola	Collembola	Collembola	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	13	0	10	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	27	17	10	0	6	0	0	0
Insecta	Plecoptera	Leuctridae	0	7	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	7	19	0	36	7	107	141
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density							
Higher Level Classification		Family	2016		2017					
			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	-	Enchytraeidae	48	8	160	280	97	303	90	80
Collembola	Collembola	Collembola	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	10	0	33	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	10	0	0	0	3	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	40
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	0	0	7	0	67	13	10
Insecta	Plecoptera	Leuctridae	0	0	0	13	0	33	10	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	21	58	10	0	10	33	3	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density							
Higher Level Classification		Family	2017							
			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	-	Enchytraeidae	0	10	57	37	23	17	7	0
Collembola	Collembola	Collembola	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	3	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	3	3	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	7	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	0	0	13	0	3	0	10
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	10
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	17	0	0	0	7	17	60	23
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density							
Higher Level Classification		Family	2017				2018			
			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	-	Enchytraeidae	7	10	0	3	240	800	53	27
Collembola	Collembola	Collembola	0	0	0	0	0	0	80	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	3	0	0	53	0	0	0
Insecta	Plecoptera	Leuctridae	3	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	3	60	13	133	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density							
Higher Level Classification		Family	2018							
			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	-	Enchytraeidae	640	320	0	0	160	0	53	0
Collembola	Collembola	Collembola	0	0	53	27	0	453	27	27
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	27
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	107	0	0	0	27	0	0	108
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	53	107	27	53	0	80	187
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density							
Higher Level Classification		Family	2018						2019	
			RG_GHFF-1	RG_GHFF-2	RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6	RG_GHUT-1	RG_GHUT-2
Clitellata	-	Enchytraeidae	7	0	0	0	7	7	213	400
Collembola	Collembola	Collembola	0	0	0	13	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	3	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	13	3	0	17	10	0	0
Insecta	Plecoptera	Leuctridae	7	0	0	0	0	3	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	140	253	113	50	43	50	80	107
Insecta	Trichoptera	Lepidostomatidae	0	0	3	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density							
Higher Level Classification		Family	2019							
			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	-	Enchytraeidae	40	133	227	433	27	13	0	3
Collembola	Collembola	Collembola	53	0	0	0	0	27	0	7
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	0	13	0	0	0	0
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	0	0	0	0	13	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	13	13	13	27	67	53	33
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density							
Higher Level Classification		Family	2019							
			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	-	Enchytraeidae	3	0	120	0	3	0	100	10
Collembola	Collembola	Collembola	60	293	13	0	3	3	0	3
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	0	13	0	0	3	7	0
Insecta	Plecoptera	Leuctridae	0	0	0	3	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	13	53	40	17	3	10	13	13
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density							
Higher Level Classification		Family	2020							
			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	-	Enchytraeidae	347	293	267	293	240	1,707	107	67
Collembola	Collembola	Collembola	0	40	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	27	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	27	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	13	0	27	0	0	0	0
Insecta	Plecoptera	Leuctridae	0	0	53	0	0	0	0	27
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density							
Higher Level Classification		Family	2020							
			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	-	Enchytraeidae	53	0	80	27	80	0	7	67
Collembola	Collembola	Collembola	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	14	0	13	0	0	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	27	0	0	0	13	0	0	0
Insecta	Plecoptera	Leuctridae	13	0	0	0	0	13	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	7	0
Insecta	Plecoptera	Taeniopterygidae	0	13	0	13	0	13	0	53
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density							
Higher Level Classification		Family	2020		2021					
			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	-	Enchytraeidae	7	67	432	132	216	120	24	144
Collembola	Collembola	Collembola	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	24	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	120	0	0	24	0	24
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	7	0	0	0	24	0	0	0
Insecta	Plecoptera	Leuctridae	7	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	24	12	0	0	24	48
Insecta	Plecoptera	Taeniopterygidae	7	40	48	0	0	0	48	72
Insecta	Trichoptera	Lepidostomatidae	0	0	0	36	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density							
Higher Level Classification		Family	2021							
			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	-	Enchytraeidae	120	96	0	0	48	48	0	6
Collembola	Collembola	Collembola	0	0	0	48	12	24	0	3
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	0	0	0	0	0	0	0	3
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	24	0	0	24	0	0	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	96	96	240	48	72	168	48	24
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.5: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density			
Higher Level Classification		Family	2021			
			RG_GHFF-3	RG_GHFF-4	RG_GHFF-5	RG_GHFF-6
Clitellata	-	Enchytraeidae	6	6	24	96
Collembola	Collembola	Collembola	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0
Insecta	Diptera	Muscidae	0	0	0	0
Insecta	Diptera	Sciomyzidae	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	6	0	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	12	72	48	120
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.6: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Three-minute Kick Samples												Area-based Kick Samples			
Higher Level Classification		Family	2012	2014				2015				2021			2016			
			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_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-4
Clitellata	-	Enchytraeidae	0	0	0	0	0	0	0.946	0.761	0.338	0	0	0	7.59	13	6.90	1.10
Collembola	Collembola	Collembola	0	0	0	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
Insecta	Coleoptera	Curculionidae	0.313	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	0.338	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
Insecta	Diptera	Ceratopogonidae	0	0	0	0.157	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0.319	0	0	3.18	0	0	3.30	0	0.565	0	0	0	0	1.72	0
Insecta	Diptera	Sciomyzidae	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	2.20
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0.338	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	0	0	0.469	0	0	1.58	0.254	0.338	0.291	0.251	0	0	0	1.72	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0	0	0.874	0.753	0.639	0	0	0	1.10
Insecta	Plecoptera	Peltoperlidae	0	0	0	0.156	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	1.59	13	2.19	3.47	8.60	12	0	1.01	2.33	0.502	8.95	3.45	1.11	0	1.10
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.6: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Area-based Kick Samples															
Higher Level Classification		Family	2016														2017	
			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	RG_GHUT-1	RG_GHUT-2
Clitellata	-	Enchytraeidae	6.01	3.20	4.51	4.01	4.70	5.32	3.19	3.77	0.634	1.30	2.39	5.64	1.80	0.672	4.24	12
Collembola	Collembola	Collembola	0	0	0	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	0.440
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0.800	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	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0.671	0	0.419	0	0	0	0	0	0	0	0.265	0
Insecta	Diptera	Muscidae	1.15	2.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	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	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	0	0.752	0	1.34	2.66	0.398	0	0.317	0	0	0	0	0	0	0.293
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	1.06	0	0	0	0	0	0	0	0	0	0.587
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	1.72	0	0	2.00	0	1.06	0.797	0	1.90	0.651	4.18	4.07	0.771	4.70	0.265	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.6: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Area-based Kick Samples															
Higher Level Classification		Family	2017															
			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	RG_GHFF-6
Clitellata	-	Enchytraeidae	7.14	2.71	5.96	2.48	0	2.22	2.32	6.83	2.13	1.39	0.820	0	1.22	0.777	0	0.326
Collembola	Collembola	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0.298	0	0	0	0	0	0	0	0.279	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	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	0.621	0.304	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
Insecta	Diptera	Ceratopogonidae	0	0	0.221	0	0	0	0.273	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	0	1.24	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	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	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	0.596	0.883	0.310	0	0	0	2.48	0	0.279	0	0.771	0	0.259	0	0
Insecta	Plecoptera	Leuctridae	0	0.298	0.662	0	0	0	0	0	0	0	0	0.771	0.610	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0.739	0.298	0.221	0	4.50	0	0	0	0.608	1.39	7.38	1.80	0.610	4.66	3.57	13
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.6: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Area-based Kick Samples															
Higher Level Classification		Family	2018															
			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	-	Enchytraeidae	4.64	19	1.63	0.806	4.49	3.90	0	0	6.74	0	2.44	0	0.239	0	0	0
Collembola	Collembola	Collembola	0	0	2.44	0	0	0	1.23	0.529	0	17	1.22	0.870	0	0	0	0.855
Euchelicerata	Trombidiformes	Torrenticolidae	0	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	0
Insecta	Coleoptera	Dytiscidae	0	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	0.870	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	Muscidae	0	0	0	0	0.749	0	0	0	1.12	0	0	3.53	0	0	0	0
Insecta	Diptera	Sciomyzidae	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	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.211	0
Insecta	Plecoptera	Chloroperlidae	1.03	0	0	0	0	0	0	0	0	0	0	0	0	0.420	0.211	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0	0.239	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0.649	2.45	0.529	2.25	0	3.66	6.09	5.01	7.98	7.19	3.21
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.211	0

Note: - = not applicable.

Table E.6: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Area-based Kick Samples															
Higher Level Classification		Family	2018		2019													
			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	RG_GHFF-2
Clitellata	-	Enchytraeidae	0.480	0.576	4.55	7.46	1.40	4.33	8.13	11	0.216	0.541	0	0.391	0.862	0	1.54	0
Collembola	Collembola	Collembola	0	0	0	0	1.86	0	0	0	0	1.08	0	0.781	16	3.21	0.171	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	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	0
Insecta	Coleoptera	Dytiscidae	0	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	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0.347	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	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	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	1.20	0.865	0	0	0	0	0	0	0	0.541	0	0	0	0	0.171	0
Insecta	Plecoptera	Leuctridae	0	0.288	0	0	0	0	0	0	0	0	0	0	0	0	0	0.769
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	3.12	4.32	1.70	1.99	0	0.433	0.478	0.347	0.216	2.70	0.447	3.91	3.45	0.583	0.513	3.85
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.6: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Area-based Kick Samples															
Higher Level Classification		Family	2019				2020											
			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	RG_GHNF-6
Clitellata	-	Enchytraeidae	0.435	0	1.96	0.629	7.22	12	2.89	4.36	2.09	6.42	1.14	3.14	3.36	0	4.26	2.47
Collembola	Collembola	Collembola	0.435	0.505	0	0.210	0	1.66	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
Insecta	Coleoptera	Curculionidae	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	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0.555	0	0	0	0	0	0	0	0	0	0.719	0
Insecta	Diptera	Muscidae	0	0	0	0	0.555	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	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	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	0.505	0.130	0	0	0.552	0	0.397	0	0	0	0	1.68	0	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0.578	0	0	0	0	1.26	0.840	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0.435	1.52	0.261	0.839	0	0	0	0	0	0	0	0	0	1.14	0	1.23
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.6: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Area-based Kick Samples															
Higher Level Classification		Family	2020						2021									
			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	-	Enchytraeidae	1.92	0	0.239	1.59	0.329	1.03	3.61	2.73	3.57	1.67	0.439	2.31	1.08	0.702	0	0
Collembola	Collembola	Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.13
Euchelicerata	Trombidiformes	Torrenticolidae	0	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	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0.397	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
Insecta	Diptera	Ceratopogonidae	0.319	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	1.00	0	0	0.333	0	0.384	0	0	0	0
Insecta	Diptera	Sciomyzidae	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	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0.319	0	0	0	0.329	0	0	0	0.397	0	0	0	0.217	0	0	1.06
Insecta	Plecoptera	Leuctridae	0	0.284	0	0	0.329	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0.239	0	0	0	0.201	0.248	0	0	0.439	0.769	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	0.284	0	1.27	0.329	0.619	0.402	0	0	0	0.877	1.15	0.867	0.702	1.55	2.13
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0.744	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.6: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Area-based Kick Samples							
Higher Level Classification		Family	2021							
			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	-	Enchytraeidae	1.79	0.336	0	0.377	0.532	0.327	0.810	1.74
Collembola	Collembola	Collembola	0.446	0.168	0	0.188	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Sciomyzidae	0	0	0	0.188	0	0	0	0
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	0	0	0	0.532	0	0	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	2.68	1.17	1.43	1.51	1.06	3.92	1.62	2.17
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.7: Abundance (No./3-min Kick) of Benthic Invertebrate Taxa in Samples from Upper Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Abundance											
Higher Level Classification		Family	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	RG_GHNF-3
Clitellata	-	Enchytraeidae	0	0	0	0	0	0	8	18	1	0	0	0
Insecta	Coleoptera	Curculionidae	11	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
Insecta	Diptera	Ceratopogonidae	0	0	0	1	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	0	10	0	0	220	0	0	77	0	13	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	1	0	0	0
Insecta	Plecoptera	Chloroperlidae	0	0	0	3	0	0	13	6	1	7	20	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0	0	21	61	16
Insecta	Plecoptera	Peltoperlidae	0	0	0	1	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	50	562	14	240	67	98	0	3	55	41	222

Notes: No./3-min kick = number of organisms per three minute kick; - = not applicable.

Table E.8: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

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	-	Enchytraeidae	Enchytraeidae	28	699	1,039	1,152	2,682	4,507	27	313	443	23	200	697
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
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	6.7
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	6.7	0	0	0	13
Insecta	Coleoptera	Elmidae	Heterlimnius	140	117	152	192	0	0	0	10	10	20	6.7	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	13	0	0	0	0	6.7
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	32	32	0	0	0	80	25	45	13	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	5.6	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0	0	0	30	0	0	0	0	0	17
Insecta	Diptera	Chironomidae	Heleniella	0	32	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	4.4	0	0
Insecta	Diptera	Chironomidae	Micropsectra	221	95	712	576	579	628	23	303	101	257	230	144
Insecta	Diptera	Chironomidae	Nanocladius	0	32	97	58	0	0	0	0	0	4.4	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	37	0	32	0	0	0	11	10	11	0	7.7	17
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	11	5.1	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	5.6	44	38	25
Insecta	Diptera	Chironomidae	Psectrocladius	0	0	0	0	0	0	0	0	5.6	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	8.3
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0	131	31	33
Insecta	Diptera	Chironomidae	Tvetenia	0	32	0	0	0	0	0	5.1	5.6	0	0	0
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	3.3	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	38	74	154	60	267	0	6.7	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	3.3	23	6.7	10	47	6.7
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	3.3	0	0	0	33	90
Insecta	Diptera	Tipulidae	Dicranota	14	57	50	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	3.3	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	3.3	20	63
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	43	67	6.7	10	6.7	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	14	0	0	0	0	0	23	10	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	0	0	0	0	0	0	0	0	6.7	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	112	19	223	77	119	27	10	3.3	6.7	43	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	28	0	0	0	60	0	0	0	0	3.3	0	6.7
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	6.7	0	0	6.7	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.8: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

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	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	6.7	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	3.3	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	3.3	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	Rhyacophila	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 E.8: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

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	-	Enchytraeidae	Enchytraeidae	0	0	13	67	37	23	13	40	23	6.7	93	6.7
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
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	3.3	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	27	213	40	320	73	70	13	20	43	13	80	6.7
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	6.7	6.7
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	13	0	0	6.7	3.3	3.3	13	0	0	0	6.7	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	20	0	3.3	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	6.7	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	7.9	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	3.8	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	7.0
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	4.4	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	0	0	0	0	0	0	0	0	0	0	7.0
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	7.4	3.3	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	7.9	14	7.4	3.3	12	14
Insecta	Diptera	Chironomidae	Psectrocladius	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	6.7	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	40	40	20	17	3.3	6.7	13	3.3	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	3.3	6.7	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	6.7	3.3	27	480	1,147	267	43	587	160
Insecta	Diptera	Tipulidae	Antocha	0	0	0	13	3.3	17	0	0	3.3	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	40	53	40	13	6.7	3.3	6.7	40	13	3.3	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	Heptageniidae	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	3.3	13	13	6.7	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	3.3	0	0	0	0	0	0	6.7	0	13	6.7

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.8: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

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	Plecoptera	Perlodidae	Skwala	13	13	0	0	0	3.3	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	3.3	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	3.3	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	0	0	0	0	10	33	6.7	0	10	0	0	6.7
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	80	267	53	40	110	37	67	93	37	3.3	0	67
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	6.7	0	0	0	0	6.7
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	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	6.7
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 E.8: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

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	RG_GHBP-5	RG_GHBP-6
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	3,804	3,588
Clitellata	-	Enchytraeidae	Enchytraeidae	800	160	40	10	53	27	53	17	12	54	12	36	339	84
Clitellata	Tubificida	Naididae	Chaetogaster	0	0	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	0	0
Clitellata	Tubificida	Naididae	Nais communis	187	0	0	0	0	13	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
Collembola	Collembola	-	Collembola	0	0	13	0	0	0	0	0	0	6.0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	53	107	53	20	93	53	40	3.3	60	12	24	24	72	36
Euchelicerata	Trombidiformes	Neoacaridae	Neoacaridae	0	0	0	0	0	13	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	373	907	0	0	0	0	0	6.7	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	24	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	53	13	27	13	13	3.3	60	24	12	12	24	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	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	12	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0	0	0	0	0	12	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0	0	18	0	12	12	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	18	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	22	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	41	32	65	19	55	4.3	0	27	0	0	19	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	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	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0	0	0	0	0	19	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	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	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	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	457	90
Insecta	Diptera	Chironomidae	Nanocladius	0	0	0	0	0	19	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	98	60	0	21	0	19	18	0	0	96	0	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	11	0	0	0	0	0	0	0	0	0	18
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	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	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	4.3	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	327	60	20	11	65	37	92	13	24	41	0	0	57	0
Insecta	Diptera	Chironomidae	Psectrocladius	0	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	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	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	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	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	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	27	160	0	0	0	0	0	0	0	0	0	0	24	12
Insecta	Diptera	Empididae	Clinocera	0	0	0	6.7	0	0	0	6.7	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	27	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	27	27	27	3.3	48	84	3.0	3.0	72	12
Insecta	Diptera	Psychodidae	Pericoma	133	53	880	517	1,560	2,053	840	517	864	1,560	288	924	6,168	912
Insecta	Diptera	Simuliidae	Simuliidae	880	853	53	67	53	27	93	13	0	48	96	72	108	24
Insecta	Diptera	Tipulidae	Antocha	0	53	0	0	13	0	0	10	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	240	320	0	13	27	13	0	0	0	0	0	0	12	0
Insecta	Diptera	Tipulidae	Hexatoma	3.7	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
Insecta	Diptera	Tipulidae	Tipula	0	0	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	6.0	24	24	72	12
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	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	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0	13	0	0	0	13	0	12	0	0	12	0	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	13	23	27	53	27	0	12	6.0	36	0	120	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0	13	3.3	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	17	10	33	14	15	4.9	396	282	591	511	1,130	192
Insecta	Plecoptera	Nemouridae	Zapada	240	107	530	977	341	466	452	88	240	1,137	693	1,457	1,925	588
Insecta	Plecoptera	Perlodidae	Isoperla	27	0	0	3.3	0	0	0	10	0	6.0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	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 E.8: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek, Based on the Lowest Practical Level of Taxonomy, 2016 to 2021

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	RG_GHBP-5	RG_GHBP-6
Insecta	Plecoptera	Perlodidae	Skwala	0	0	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	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	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	360	516
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	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	3.3	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	0	0	0	0	0	0	13	6.7	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	53	267	160	37	187	240	320	27	12	24	72	12	180	60
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	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	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	0	107	230	347	213	533	27	144	312	267	651	1,035	240
Malacostraca	Amphipoda	Gammaridae	Gammarus	987	1,013	6.7	0	27	17	27	27	132	15	36	72	210	78
Malacostraca	Amphipoda	Hyalellidae	Hyalella	160	427	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 E.9: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Three-minute Kick Samples										Area-based Kick Samples		
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014	2015		2018	2019	2020	2021			2016		
				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_GHBP-1	RG_GHBP-2	RG_GHBP-3
Bivalvia	Veneroida	Pisidiidae	Pisidiidae	0.0483	0	5.11	2.67	18	16	7.31	16	19	23	0	0	0
Bivalvia	Veneroida	Pisidiidae	Pisidium	0	0	0	0	0	0	0	0	0	0	8.58	5.49	2.98
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0.636	11	11
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	3.41	2.13	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	2.44
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	5.15
Clitellata	Tubificida	Naididae	Tubificinae	0	0	12	3.47	0	0	0	0.771	0.935	0.587	1.59	0.305	1.63
Collembola	Collembola	-	Collembola	0	0	0	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
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0.189	0	0	0	0	0.257	0.312	0.293	0	0	0
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
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	1.78	3.36	3.53
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	0.445	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	0.275	0	0.257	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	0.877	0.257	0	0	3.18	1.89	1.66
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	1.07	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	0.318	0	0.308
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	0.838	0.509	0.355
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	0.509	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	0	0	0	0	0	0.355
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	0
Insecta	Diptera	Chironomidae	Micropsectra	13	0.321	17	2.31	6.41	9.32	0	0.720	2.08	1.23	5.03	1.53	7.80
Insecta	Diptera	Chironomidae	Nanocladius	0	0	0	0	0	0	0	0	0	0	0	0.509	1.06
Insecta	Diptera	Chironomidae	Orthocladius	0	0	1.20	0.329	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	0.838	0	0.355
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	0.329	0	0	0	0	0	0	1.68	0	1.42
Insecta	Diptera	Chironomidae	Procladius	0	0	0.401	1.32	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Psectrocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	12	0	0	0	0	0	0	0	0	0.838	1.02	2.48
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	1.32	0	0	0	2.16	2.77	1.64	0	0	0
Insecta	Diptera	Chironomidae	Thienemannimyia complex	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	0.509	0

Note: - = not applicable.

Table E.9: **Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2021**

Taxon				Three-minute Kick Samples										Area-based Kick Samples		
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014	2015		2018	2019	2020	2021			2016		
				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_GHBP-1	RG_GHBP-2	RG_GHBP-3
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	0.611	0.814
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0.533	0	0	0	0	0.312	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	0.189	0.533	0	1.10	0	0	0	0	0.954	3.93	1.88
Insecta	Diptera	Psychodidae	Pericoma	0	0	0	0	0	0	0	0	0	0	26	24	25
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	3.04	24	8.33	44	27	19	15	8.23	19	32	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0	0	0	3.81	9.16	2.71
Insecta	Diptera	Simuliidae	Simulium	77	13	8.71	2.40	0.602	3.31	13	3.60	2.49	0.293	0	0	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	0.267	0	0	0	0	0	0	0.318	0.305	0.271
Insecta	Diptera	Tipulidae	Dicranota	0.290	2.17	0.568	0.533	0.452	0	0	0	0	0	0.318	0.916	0.543
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	1.91	0.611	0.814
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0.310	5.30	5.33	2.71	28	7.31	0.771	0.623	0.293	0	0	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
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	0.267	0	0	0	0	0	0	0.318	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	2.54	0.305	2.44
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0.0483	1.24	2.65	0.800	0.602	0.826	0.585	0.257	0.623	0.587	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0.189	0	0	0	0	0	0	0	0.636	0	0
Insecta	Plecoptera	Nemouridae	Amphinemura	0	0	1.23	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	11	1.23	2.49	24	12	8.76	12	14	8.75
Insecta	Plecoptera	Nemouridae	Zapada	0	0	0	0	0	0	0	0	0	0	15	11	3.53
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0.725	6.50	1.23	20	8.49	4.00	31	20	26	12	0	0	0
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	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0	0	0	0	0	0	0	0.303	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	0.267	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	0	0	0.271
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	0.800	1.45	0	1.49	2.35	1.56	3.38	0.318	2.44	0.814
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	0.267	0	0	0.893	0.293	0	0	0	0	0
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	1.27	0.611	4.61
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	2.86	0.305	2.17
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	4.27	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	2.40	1.45	1.21	3.57	4.98	4.67	3.99	5.30	4.58	2.71
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna grou	0.870	15	1.99	2.67	2.53	2.43	7.14	7.92	3.12	3.69	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	1.06	0	0.631	0	0	0	0.877	2.57	1.56	0.880	0	0	0
Malacostraca	Amphipoda	Hyalellidae	Hyalella	0	0.310	0.316	0	0	0	0	0.257	0	0	0	0	0

Note: - = not applicable.

Table E.9: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2016			2017						2018			
				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	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	0
Bivalvia	Veneroida	Pisidiidae	Pisidium	4.58	12	2.88	2.96	1.95	1.82	8.16	21	4.37	1.94	1.65	6.52	3.93
Clitellata	-	Enchytraeidae	Enchytraeidae	11	22	35	1.25	12	17	1.36	7.67	22	0	0	0.272	1.36
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Lumbriculida	Lumbriculidae	Lumbriculidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Chaetogaster	0	0	0	0	0	0	0.583	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	12	11	12	0	0	0	1.17	2.56	0	0	0	0	0.407
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	4.53	0	0	0	0.583	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	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	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	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	0
Euchelicerata	Trombidiformes	Feltriidae	Feltria	0	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	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	4.20	2.40	2.38	2.65	2.46	0.649	5.05	1.02	2.45	0.554	2.40	0.815	6.50
Euchelicerata	Trombidiformes	Neoacaridae	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0.297	0	0	0	0	0	0.213	0.277	0	0	0.407
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0.259	0	0	0	0.426	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	1.91	0	0	0	0.389	0.390	1.17	0.256	0	0.277	0	0	0.136
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0.623	0	0	0	0	0.213	0	0	0	0.407
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	Bezzia/ Palpomyia	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	Mallochohelea	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	Brillia	0	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	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	3.72	0.982	1.75	0.762	0	0	0.353	0.589	0.720	0.784
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0.219	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0.231	0	0	0	0	0	0.527	0	0	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0.584	0.231	0	0	0	0	0	0	0.706	0	2.88	0.261
Insecta	Diptera	Chironomidae	Hydrobaenus	0	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	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	0.254	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	5.73	4.67	4.84	1.06	12	3.94	15	8.82	4.61	5.65	3.24	7.20	0.523
Insecta	Diptera	Chironomidae	Nanocladius	0.573	0	0	0	0	0	0.254	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	0	0.531	0.393	0.438	0	0.294	0.527	0	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0.531	0.196	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	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	0.353	0	0.720	0.523
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	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	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0.573	0.584	0.231	1.33	0.589	0.219	2.54	1.47	0.791	7.06	4.12	2.88	1.57
Insecta	Diptera	Chironomidae	Procladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Psectrocladius	0	0	0	0	0	0.219	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	1.15	2.34	2.08	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0.264	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	7.62	1.18	1.05	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemannimyia complex	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	0	0	0.196	0.219	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.9: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification	2016			2017						2018			
				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	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4
Insecta	Diptera	Dixidae	Dixa	0	0	0	0.156	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	1.53	0.481	2.06	0	0.259	0.519	0.583	0	1.06	0	0.450	0.815	0.407
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	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	0.763	1.52	0.206	0.156	0.908	0.260	0.583	1.79	0.213	0	0.300	0.543	2.17
Insecta	Diptera	Psychodidae	Pericoma	19	14	3.91	27	17	21	16	16	14	28	44	26	40
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	3.05	0	4.73	5.45	12	11	3.11	6.78	11	2.49	2.55	6.79	0.136
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	3.44	1.44	1.03	0.156	0	0	0	1.28	2.88	0	0	0	0.271
Insecta	Diptera	Tipulidae	Dicranota	0.382	0	0.206	3.27	2.33	3.38	1.17	1.79	1.60	0.831	0.600	0.815	0.271
Insecta	Diptera	Tipulidae	Hexatoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0.156	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	Baetidae	Baetis	1.15	1.44	0.412	2.80	0.908	0.519	0.194	0.767	2.02	3.60	4.80	4.62	5.96
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	Ephemerellidae	0	0	0	2.02	2.59	0.260	0.583	0.256	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	Heptageniidae	0	0	0	1.09	0.389	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	Paracapnia	0	0	0	0	0	0	0	0.256	0	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0.763	0.962	0.206	0.467	0.130	0.260	2.52	0	0	0.277	0.0375	0.272	0.271
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0.481	0	0	0	0	0.194	0	0.213	0	0	0	0
Insecta	Plecoptera	Nemouridae	Amphinemura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	4.20	5.77	2.26	3.12	3.24	1.56	5.63	3.96	2.02	1.39	1.65	0.543	6.37
Insecta	Plecoptera	Nemouridae	Zapada	7.25	4.81	0.823	32	24	25	22	14	11	36	25	27	22
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	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
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	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0.206	0.623	0.259	0	0	0.256	0	0	0.0375	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0	0.277	0.150	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	0.206	0.312	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0.156	0	0	0	3.45	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	2.67	5.29	11	0.935	0.778	1.17	1.75	0	8.20	0.277	0.300	0.272	0.678
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0	0.554	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 elsis	0	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	0
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	7.25	4.81	6.79	0	0	0	0.194	1.53	3.51	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0.382	0	0	2.02	1.17	0	0.583	1.28	0.426	1.66	3.00	1.09	0.813
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0.382	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	Phryganeidae	Phryganeidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	5.73	3.77	1.23	3.58	2.72	8.44	0	2.94	3.73	8.03	4.65	8.97	3.12
Insecta	Trichoptera	Rhyacophilidae	hyacophila brunnea/vemna gro	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
Malacostraca	Amphipoda	Hyalellidae	Hyalella	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.9: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification			2019						2020				
				RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	GH_GH1_AS-1	GH_GH1_AS	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3
Bivalvia	Veneroida	Pisidiidae	Pisidiidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Pisidiidae	Pisidium	14	7.30	1.61	1.95	19	14	8.11	14	32	20	33	14	35
Clitellata	-	Enchytraeidae	Enchytraeidae	1.73	1.38	0.459	0.533	0.563	1.06	1.96	0.286	6.99	1.52	1.09	0.369	0.957
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Lumbriculida	Lumbriculidae	Lumbriculidae	0	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	0
Clitellata	Tubificida	Naididae	Nais	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	5.36	6.60	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0	0	0	0	0	0	0	0	1.63	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0	0.178	0	0	0	0	0	0	0.364	0	0
Collembola	Collembola	Hypogastruridae	Hypogastruridae	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	Aturidae	Aturidae	0	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	0
Euchelicerata	Trombidiformes	Hydryphantidae	Protzia	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0.532	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	3.46	4.14	0.459	0.266	1.05	2.13	1.68	0.286	0.466	1.02	1.46	0.738	1.67
Euchelicerata	Trombidiformes	Neoacaridae	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0.592	0.459	0.266	0	0	0.140	0.286	3.26	8.63	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	Elmidae	Heterlimnius	0.157	0.197	0.459	0	0	0	0.140	0	0	0	1.46	0.492	0.478
Insecta	Coleoptera	Elmidae	Narpus	0	0.197	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	Bezzia/ Palpomyia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0.229	0	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	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	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0	0	0	0	0	0	0	0.389
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0.271	0.750	0	1.60	0	0	0	0	1.11	1.17	1.17
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0.222	0	0.187	0	0	0.252	0	0.286	0	0.557	0	0
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	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	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0.301	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	1.86	5.10	2.44	2.25	6.16	7.98	0.755	4.51	4.00	3.43	7.24	1.95	3.50
Insecta	Diptera	Chironomidae	Nanocladius	0.206	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	0	0	0	0	0	0.301	0.857	0.571	0	0.779	0
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	0	0	0	0	0	0.390	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0.179	0.532	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	Paratanytarsus	0	0	0	0	0	0	0	0	0	4.57	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	1.24	1.78	0.271	0.187	0.179	0.532	0.252	0.602	2.86	0.571	0.557	0.390	1.17
Insecta	Diptera	Chironomidae	Procladius	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Psectrocladius	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	0.857	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemannimyia complex	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

Note: - = not applicable.

Table E.9: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples												
Higher Level Classification		Family	Lowest Practical Level Identification			2019								2020		
				RG_GHBP-5	RG_GHBP-6	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-4	RG_GHBP-5	RG_GHBP-6	GH_GH1_AS-1	GH_GH1_AS	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3
Insecta	Diptera	Dixidae	Dixa	0	0	0.229	0	0	0	0	0	0	0	0	0	0.478
Insecta	Diptera	Empididae	Chelifera/Metachela	0.786	0.197	0.229	0.178	0.0805	0	0	0.571	0.233	1.52	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	0	0	0	0	0.246	0
Insecta	Diptera	Empididae	Neoplasta	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	0.233	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0.157	0.394	0	0.355	0.885	0	0	0	0	0	0	0	0.478
Insecta	Diptera	Psychodidae	Pericoma	35	18	2.98	5.68	18	9.57	19	3.71	1.17	0.508	24	19	28
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0.157	1.58	17	15	6.44	6.91	12	6.86	7.69	8.12	1.46	2.46	0.957
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	0.157	0.986	0	0	0.0805	0	0	0	0	0.508	0	0	0.239
Insecta	Diptera	Tipulidae	Dicranota	0.314	0.197	0.229	0.533	0.322	0.532	0.979	1.43	2.09	3.05	0	0.492	0.478
Insecta	Diptera	Tipulidae	Hexatoma	0	0	0	0	0	0	0	0	0.0327	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	0.688	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	Baetidae	Baetis	3.30	5.52	25	35	33	35	25	44	0.699	0.508	3.64	8.49	5.26
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	Ephemerellidae	0	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
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	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	Paracapnia	0	0	0	0	0	0	0	0	0	0	0.364	0	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0.314	0.592	2.52	0.533	1.29	2.66	1.82	0.857	0	0	0.364	0.861	0.478
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	Amphinemura	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	5.66	7.50	3.44	3.55	0.885	4.26	1.54	1.14	0	0	0.467	0.373	0.582
Insecta	Plecoptera	Nemouridae	Zapada	20	23	29	19	7.08	6.38	20	6.86	2.10	1.02	15	36	6.12
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	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
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0	0	0	0.233	0	0	0.123	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	0.161	0	0.280	0.286	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0.197	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	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	1.42	11	0.917	0.533	0.402	0.532	1.54	6.57	0.466	0.508	1.09	1.97	2.63
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	0.0805	0	0	0	16	21	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche elsis	0	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	0
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	0.472	1.97	0.229	0	0.241	0	0	0.286	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	5.19	2.17	2.29	1.24	0.885	0.532	0	2.86	0.466	2.54	4.37	1.35	3.35
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0.229	0	0	0	0	0.286	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	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	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	4.25	6.31	8.72	12	3.94	5.32	3.92	2.86	0	0	2.91	8.49	6.22
Insecta	Trichoptera	Rhyacophilidae	acophila brunnea/vemna g	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0	0	0	0	0	0.286	8.62	9.64	0.182	0	0.478
Malacostraca	Amphipoda	Hyalellidae	Hyalella	0	0	0	0	0	0	0	0	1.40	4.06	0	0	0

Note: - = not applicable.

Table E.9: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples								
Higher Level Classification		Family	Lowest Practical Level Identification	2020			2021					
				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
Bivalvia	Veneroida	Pisidiidae	Pisidium	35	45	24	60	14	50	26	23	56
Clitellata	-	Enchytraeidae	Enchytraeidae	0.402	0.810	0.800	0.226	1.20	0.248	0.646	2.09	1.30
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	0	0	0	0	0	0	0
Clitellata	Lumbriculida	Lumbriculidae	Lumbriculidae	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Chaetogaster	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais bretscheri	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Nais communis	0.201	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0	0	0.133	0	0	0	0
Collembola	Collembola	Hypogastruridae	Hypogastruridae	0	0	0	0	0	0	0	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Aturidae	Aturidae	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	Feltria	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Protzia	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.804	0.607	0.160	1.13	0.267	0.496	0.431	0.444	0.557
Euchelicerata	Trombidiformes	Neoacaridae	Neoacaridae	0.201	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0.320	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	Torrenticolidae	0	0	0	0	0	0	0.431	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0.201	0.202	0.160	1.13	0.533	0.248	0.215	0.148	0
Insecta	Coleoptera	Elmidae	Narpus	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0.201	0	0	0	0	0	0	0.0739	0
Insecta	Diptera	Ceratopogonidae	Bezzia/ Palpomyia	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Ceratopogonidae	0	0	0	0	0	0.248	0	0	0
Insecta	Diptera	Ceratopogonidae	Mallochohelea	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0.400	0	0.215	0.0739	0
Insecta	Diptera	Chironomidae	Brillia	0	0.280	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0.280	0.839	0.208	0	0.610	0	0	0.117	0
Insecta	Diptera	Chironomidae	Diamesa	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0	0	0.305	2.23	0	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0	0	0.117	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Labrundinia	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	6.44	8.95	3.12	0	0.305	0.743	1.94	2.81	1.39
Insecta	Diptera	Chironomidae	Nanocladius	0.280	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0.280	0.280	0	0	2.13	0	0	0	0
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	0	0	0.279
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parorthocladius	0	0	0.208	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0.560	1.40	0.624	0.452	0.914	0	0	0.352	0
Insecta	Diptera	Chironomidae	Procladius	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Psectrocladius	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellina	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemannimyia complex	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.9: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Lowest Practical Level of Taxonomy, 2012 to 2021

Taxon				Area-based Kick Samples								
Higher Level Classification		Family	Lowest Practical Level Identification	2020			2021					
				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	Dixidae	Dixa	0	0	0	0	0.133	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0	0	0	0	0	0.148	0.186
Insecta	Diptera	Empididae	Clinocera	0	0	0.320	0	0	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Muscidae	Muscidae	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0.402	0.405	0.160	0.905	1.87	0.0620	0.0538	0.444	0.186
Insecta	Diptera	Psychodidae	Pericoma	31	13	25	16	35	5.95	17	38	14
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0.402	1.42	0.640	0	1.07	1.98	1.29	0.665	0.371
Insecta	Diptera	Simuliidae	Simulium	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Antocha	0	0	0.480	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0.201	0	0	0	0	0	0	0.0739	0
Insecta	Diptera	Tipulidae	Hexatoma	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	4.63	3.04	13	0	0.133	0.496	0.431	0.444	0.186
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	0	0.202	0	0.226	0	0	0.215	0	0
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0.804	0.405	0	0.226	0.133	0.743	0	0.739	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0.202	0.160	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Amphinemura	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0.213	0.229	0.236	7.47	6.27	12	9.16	6.96	2.97
Insecta	Plecoptera	Nemouridae	Zapada	7.03	6.86	4.24	4.52	25	14	26	12	9.10
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0.480	0	0.133	0	0	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Pteronarcyidae	Pteronarcella	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Brachycentrus	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	3.62	2.63	22	1.58	1.87	1.73	3.23	2.22	7.99
Insecta	Trichoptera	Hydropsychidae	Arctopsyche	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	0	0	0.160	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche elsis	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptila	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptilidae	0	0.202	0.320	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	3.62	4.86	1.28	0.226	0.533	1.49	0.215	1.11	0.929
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0.202	0	0	0	0.248	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	3.22	8.10	1.28	2.71	6.93	5.51	12	6.38	3.71
Insecta	Trichoptera	Rhyacophilidae	yacophila brunnea/vemna gr	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0.251	0.405	1.28	2.49	0.333	0.743	1.29	1.29	1.21
Malacostraca	Amphipoda	Hyalellidae	Hyalella	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.10: 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 2021

Taxon				Abundance									
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014	2015		2018	2019	2020	2021		
				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
Bivalvia	Veneroida	Pisidiidae	Pisidiidae	20	0	540	167	1,180	590	357	886	1,220	1,580
Clitellata	-	Enchytraeidae	Enchytraeus	0	0	360	133	0	0	0	0	0	0
Clitellata	Lumbriculida	Lumbriculidae	Lumbriculidae	0	0	0	0	0	30	0	0	0	0
Clitellata	Tubificida	Naididae	Nais	220	180	20	0	80	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	1,300	217	0	0	0	42.9	60	40
Collembola	Collembola	Hypogastruridae	Hypogastruridae	0	0	0	0	0	0	0	14	0	0
Euchelicerata	Sarcoptiformes	-	Oribatida	0	0	20	0	0	0	0	14	20	20
Euchelicerata	Trombidiformes	Aturidae	Aturidae	0	0	108	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	Feltria	0	80	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Protzia	0	0	0	0	0	0	14	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	30	20	152	0	100	37.5	14	14	20	180
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	30	0	0	0	0	13	0	0	0	0
Insecta	Coleoptera	Curculionidae	Curculionidae	0	0	0	0	0	10	0	14	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0	42.9	14	0	0
Insecta	Coleoptera	Elmidae	Optioservus	0	0	40	66.7	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	20	0	0	0	20	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia/ Palpomyia	0	0	20	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Mallochohelea	20	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0	129	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	22.4	20.5	0	0	0	0
Insecta	Diptera	Chironomidae	Diamesa	0	62.3	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	220	62.3	21.2	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	42.4	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Labrundinia	0	62.3	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	5,500	20.8	1,823	144	426	338	0	40	133	84
Insecta	Diptera	Chironomidae	Orthocladius	0	0	127	20.6	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	41.5	0	0	0	20.5	0	0	44.4	28
Insecta	Diptera	Chironomidae	Pagastia	0	20.8	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	112	0	0	0	0	0
Insecta	Diptera	Chironomidae	Parametriocnemus	40	0	0	0	0	20.5	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	41.5	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	212	20.6	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Procladius	0	0	42.4	82.3	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	0	768	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stempellinella	0	0	657	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Thienemanniella	0	0	21.2	82.3	0	0	0	120	178	112
Insecta	Diptera	Chironomidae	Thienemannimyia complex	40	20.8	572	0	0	10	0	0	44.4	56
Insecta	Diptera	Chironomidae	Tvetenia	0	0	21.2	0	0	0	0	40	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	80	260	180	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Neoplasta	0	0	0	33.3	0	0	0	0	20	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	20	33.3	0	40	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma/Telmatoscopus	1,260	1,520	880	2,750	1,780	700	714	457	1,240	2,200
Insecta	Diptera	Simuliidae	Simulium	31,900	840	920	150	40	120	614	200	160	20
Insecta	Diptera	Stratiomyidae	Stratiomyidae	0	0	0	0	0	0	0	0	0	20
Insecta	Diptera	Tipulidae	Antocha	200	40	0	17	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	120	140	60	33.3	30	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	20	60	0	30	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletidae	0	0	40	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis rhodani group	0	20	560	333	180	1,030	357	42.9	40	20
Insecta	Ephemeroptera	Ephemerellidae	Drunella doddsii	0	0	40	0	0	0	0	14	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	57.1	14	0	0
Insecta	Ephemeroptera	Heptageniidae	Cinygmula	0	0	0	0	0	0	0	28.6	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	80	0	40	17	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Capniidae	0	0	0	0	0	0	14	0	0	0
Insecta	Plecoptera	Chloroperlidae	Sweltsa	20	80	280	50	40	30	28.6	14	40	40

Notes: No./3-min kick = number of organisms per three minute kick; - = not applicable.

Table E.10: 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 2021

Taxon				Abundance									
Higher Level Classification		Family	Lowest Practical Level Identification	2012	2014	2015		2018	2019	2020	2021		
				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
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	20	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Amphinemura	0	0	130	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	716	44.7	122	1,350	799	597
Insecta	Plecoptera	Nemouridae	Zapada cinctipes	300	420	130	1,233	564	145	1,536	1,107	1,681	783
Insecta	Plecoptera	Peltoperlidae	Peltoperlidae	0	20	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Kogotus	0	0	0	0	0	0	14	0	0	0
Insecta	Plecoptera	Perlodidae	Skwala	0	20	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Pteronarcyidae	Pteronarcella	0	0	0	17	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	0	14	42.9	0	100
Insecta	Trichoptera	Brachycentridae	Brachycentrus	20	0	0	0	0	99.2	0	0	0	0
Insecta	Trichoptera	Brachycentridae	Micrasema	0	40	316	50	96	0	72.7	130	100	230
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	140	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Hydropsychidae	180	0	26.3	17	0	0	43.6	16	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche elsis	0	0	0	0	0	0	15	0	0	0
Insecta	Trichoptera	Hydroptilidae	Hydroptila	0	0	184	0	384	33.1	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	0	60	0	0	576	165	131	16	20	126
Insecta	Trichoptera	Limnephilidae	Limnephilidae	20	0	26.3	267	0	0	29.1	48.9	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	20	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	100	640	237	150	96	44.1	174	277	300	272
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila brunnea/vemna group	360	940	211	167	168	88.2	349	440	200	251
Malacostraca	Amphipoda	Gammaridae	Gammarus	440	0	66.7	0	0	0	42.9	143	100	60
Malacostraca	Amphipoda	Hyalellidae	Hyalella	0	20	33.3	0	0	0	0	14	0	0

Notes: No./3-min kick = number of organisms per three minute kick; - = not applicable.

Table E.11: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

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	-	Enchytraeidae	28	699	1,039	1,152	2,682	4,507	27	313	443	23	200	697
Clitellata	Tubificida	Naididae	70	19	841	1,190	1,371	2,133	0	0	0	40	67	0
Collembola	Collembola	Collembola	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	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
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

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.11: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density														
Higher Level Classification		Family	2018						2019						2020	
			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	GH_GH1_AS-1	GH_GH1_AS-2
Bivalvia	Veneroida	Pisidiidae	93	147	320	193	287	123	47	147	777	87	387	333	3,653	2,133
Clitellata	-	Enchytraeidae	0	0	13	67	37	23	13	40	23	7	93	7	800	160
Clitellata	Tubificida	Naididae	0	0	0	20	0	0	0	0	0	0	0	0	800	693
Collembola	Collembola	Collembola	0	0	0	0	0	0	0	13	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	3	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	27	213	40	320	73	70	13	20	43	13	80	7	53	107
Euchelicerata	Trombidiformes	Neoacaridae	0	0	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	373	907
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	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	0	0
Insecta	Coleoptera	Staphylinidae	0	0	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	0	0
Insecta	Diptera	Chironomidae	680	707	707	180	70	120	87	253	270	67	60	133	1,013	960
Insecta	Diptera	Dixidae	0	0	0	0	0	0	7	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	0	40	40	20	17	3	7	13	3	0	0	13	27	160
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0	27	0
Insecta	Diptera	Pelecorhynchidae	0	27	27	107	3	7	0	27	37	0	0	0	0	0
Insecta	Diptera	Psychodidae	1,333	3,947	1,267	1,987	750	307	87	427	737	60	927	87	133	53
Insecta	Diptera	Simuliidae	120	227	333	7	3	27	480	1,147	267	43	587	160	880	853
Insecta	Diptera	Tipulidae	40	53	40	27	10	20	27	40	17	3	47	33	243	373
Insecta	Ephemeroptera	Baetidae	173	427	227	293	70	93	720	2,653	1,350	220	1,200	1,033	80	53
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	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	0	0
Insecta	Plecoptera	Leuctridae	0	0	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	240	107
Insecta	Plecoptera	Perlodidae	13	17	0	0	0	3	0	0	7	0	13	7	27	0
Insecta	Plecoptera	Taeniopterygidae	0	0	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	53	53
Insecta	Trichoptera	Hydropsychidae	27	0	0	0	0	0	0	0	3	0	0	0	1,840	2,187
Insecta	Trichoptera	Hydroptilidae	0	0	0	0	10	33	7	0	10	0	0	7	0	0
Insecta	Trichoptera	Lepidostomatidae	80	267	53	40	110	37	67	93	37	3	0	67	53	267
Insecta	Trichoptera	Limnephilidae	0	0	0	0	0	0	7	0	0	0	0	7	0	0
Insecta	Trichoptera	Rhyacophilidae	387	413	440	153	90	107	253	867	163	33	187	67	0	0
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0	0	0	7	987	1,013
Malacostraca	Amphipoda	Hyalellidae	0	0	0	0	0	0	0	0	0	0	0	0	160	427

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.11: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek, Based on the Family Level of Taxonomy, 2016 to 2021

Taxon			Density											
Higher Level Classification		Family	2020						2021					
			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	1,200	373	1,947	2,307	2,947	500	3,204	624	2,436	1,440	3,804	3,588
Clitellata	-	Enchytraeidae	40	10	53	27	53	17	12	54	12	36	339	84
Clitellata	Tubificida	Naididae	0	0	0	13	0	0	0	0	0	0	0	0
Collembola	Collembola	Collembola	13	0	0	0	0	0	0	6	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	53	20	93	53	40	3	60	12	24	24	72	36
Euchelicerata	Trombidiformes	Neoacaridae	0	0	0	13	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	0	7	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	24	0	0
Insecta	Coleoptera	Elmidae	53	13	27	13	13	3	60	24	12	12	24	0
Insecta	Coleoptera	Staphylinidae	0	0	0	13	0	0	0	0	0	0	12	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	18	12	12	12	0
Insecta	Diptera	Chironomidae	347	127	347	520	773	87	24	192	144	108	552	108
Insecta	Diptera	Dixidae	0	0	27	0	0	0	0	6	0	0	0	0
Insecta	Diptera	Empididae	0	7	0	0	0	7	0	0	0	0	24	12
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0	27	27	27	3	48	84	3	3	72	12
Insecta	Diptera	Psychodidae	880	517	1,560	2,053	840	517	864	1,560	288	924	6,168	912
Insecta	Diptera	Simuliidae	53	67	53	27	93	13	0	48	96	72	108	24
Insecta	Diptera	Tipulidae	0	13	40	13	0	10	0	0	0	0	12	0
Insecta	Ephemeroptera	Baetidae	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
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	13	0	0	0	13	0	12	0	0	12	0	0
Insecta	Plecoptera	Chloroperlidae	13	23	27	53	27	0	12	6	36	0	120	0
Insecta	Plecoptera	Leuctridae	0	0	0	0	13	3	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	547	987	373	480	467	93	636	1,419	1,284	1,968	3,054	780
Insecta	Plecoptera	Perlodidae	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
Insecta	Trichoptera	Brachycentridae	40	53	147	240	173	460	84	84	84	180	360	516
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	3	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	0	0	0	0	13	7	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	160	37	187	240	320	27	12	24	72	12	180	60
Insecta	Trichoptera	Limnephilidae	0	0	0	0	13	0	0	0	12	0	0	0
Insecta	Trichoptera	Rhyacophilidae	107	230	347	213	533	27	144	312	267	651	1,035	240
Malacostraca	Amphipoda	Gammaridae	7	0	27	17	27	27	132	15	36	72	210	78
Malacostraca	Amphipoda	Hyalellidae	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 E.12: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Three-minute Kick Samples										Area-based Kick Samples		
Higher Level Classification		Family	2012	2014	2015		2018	2019	2020	2021			2016		
			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_GHBP-1	RG_GHBP-2	RG_GHBP-3
Bivalvia	Veneroida	Pisidiidae	0.0483	0	5.11	2.67	18	16	7.31	16	19	23	8.58	5.49	2.98
Clitellata	-	Enchytraeidae	0	0	3.41	2.13	0	0	0	0	0	0	0.636	11	11
Clitellata	Lumbriculida	Lumbriculidae	0	0	0	0	0	0.826	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0.532	2.79	13	3.47	1.20	0	0	0.771	0.935	0.587	1.59	0.305	9.22
Collembola	Collembola	Collembola	0	0	0	0	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	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
Euchelicerata	Trombidiformes	Lebertiidae	0.0725	0.310	1.44	0	1.51	1.03	0.292	0.257	0.312	2.64	1.78	3.36	3.53
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	0.445	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0	0	0	0	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	3.18	1.89	1.66
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	0.318	0	0.308
Insecta	Diptera	Chironomidae	14	17	34	5.60	8.43	11	2.63	3.60	6.23	4.11	9.22	4.58	14
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	0.611	0.814
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	0.954	3.93	1.88
Insecta	Diptera	Psychodidae	3.04	24	8.33	44	27	19	15	8.23	19	32	26	24	25
Insecta	Diptera	Simuliidae	77	13	8.71	2.40	0.602	3.31	13	3.60	2.49	0.293	3.81	9.16	2.71
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	0.636	1.22	0.814
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	7.31	0.771	0.623	0.293	1.91	0.611	0.814
Insecta	Ephemeroptera	Ephemerellidae	0	0	0.379	0	0	0	1.17	0.514	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0.193	0	0.379	0.267	0	0	0	0.514	0	0	0.318	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	2.54	0.305	2.44
Insecta	Plecoptera	Leuctridae	0	0	0.189	0	0	0	0	0	0	0	0.636	0	0
Insecta	Plecoptera	Nemouridae	0.725	6.50	2.46	20	19	5.23	34	44	39	20	27	25	12
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	0.303	0	0
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	0	0	0.271
Insecta	Trichoptera	Brachycentridae	0.0483	0.619	2.99	0.800	1.45	2.73	1.49	2.35	1.56	3.38	0.318	2.44	0.814
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	1.27	0.611	4.61
Insecta	Trichoptera	Lepidostomatidae	0	0.929	0	0	8.67	4.56	2.68	0.293	0.312	1.84	2.86	0.305	2.17
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	25	4.24	5.07	3.98	3.64	11	13	7.79	7.68	5.30	4.58	2.71
Malacostraca	Amphipoda	Gammaridae	1.06	0	0.631	0	0	0	0.877	2.57	1.56	0.880	0	0	0
Malacostraca	Amphipoda	Hyalellidae	0	0.310	0.316	0	0	0	0	0.257	0	0	0	0	0

Note: - = not applicable.

Table E.12: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Area-based Kick Samples											
Higher Level Classification		Family	2016			2017						2018		
			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	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3
Bivalvia	Veneroida	Pisidiidae	4.58	12	2.88	2.96	1.95	1.82	8.16	21	4.37	1.94	1.65	6.52
Clitellata	-	Enchytraeidae	11	22	35	1.25	12	17	1.36	7.67	22	0	0	0.272
Clitellata	Lumbriculida	Lumbriculidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	12	11	17	0	0	0	2.33	2.56	0	0	0	0
Collembola	Collembola	Collembola	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	Hypogastruridae	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	4.20	2.40	2.38	2.65	2.46	0.649	5.05	1.02	2.45	0.554	2.40	0.815
Euchelicerata	Trombidiformes	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0.297	0	0	0	0	0	0.213	0.277	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0.259	0	0	0	0.426	0	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	1.91	0	0	0.623	0.389	0.390	1.17	0.256	0.213	0.277	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	8.02	8.17	7.61	7.17	14	7.01	26	12	7.77	14	7.95	14
Insecta	Diptera	Dixidae	0	0	0	0.156	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	1.53	0.481	2.06	0	0.259	0.519	0.583	0	1.06	0	0.450	0.815
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0.763	1.52	0.206	0.156	0.908	0.260	0.583	1.79	0.213	0	0.300	0.543
Insecta	Diptera	Psychodidae	19	14	3.91	27	17	21	16	16	14	28	44	26
Insecta	Diptera	Simuliidae	3.05	0	4.73	5.45	12	11	3.11	6.78	11	2.49	2.55	6.79
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	3.82	1.44	1.23	3.58	2.33	3.38	1.17	3.07	4.47	0.831	0.600	0.815
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	1.15	1.44	0.412	2.80	0.908	0.519	0.194	0.767	2.02	3.60	4.80	4.62
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	2.02	2.59	0.260	0.583	0.256	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	1.09	0.389	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	0	0	0	0	0	0	0	0.256	0	0	0	0
Insecta	Plecoptera	Chloroperlidae	0.763	0.962	0.206	0.467	0.130	0.260	2.52	0	0	0.277	0.0375	0.272
Insecta	Plecoptera	Leuctridae	0	0.481	0	0	0	0	0.194	0	0.213	0	0	0
Insecta	Plecoptera	Nemouridae	11	11	3.09	35	28	27	28	18	13	37	27	28
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0	0	0.206	0.623	0.259	0	0	0.256	0	0.277	0.188	0
Insecta	Plecoptera	Pteronarcyidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	0	0.206	0.312	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	2.67	5.29	11	1.09	0.778	1.17	1.75	3.45	8.20	0.277	0.300	0.272
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0	0	0.554	0	0
Insecta	Trichoptera	Hydroptilidae	7.25	4.81	6.79	0	0	0	0.194	1.53	3.51	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0.382	0	0	2.02	1.17	0	0.583	1.28	0.426	1.66	3.00	1.09
Insecta	Trichoptera	Limnephilidae	0.382	0	0	0	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	5.73	3.77	1.23	3.58	2.72	8.44	0	2.94	3.73	8.03	4.65	8.97
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

Note: - = not applicable.

Table E.12: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Area-based Kick Samples											
Higher Level Classification		Family				2019						2020		
			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	GH_GH1_AS-1	GH_GH1_AS	RG_GHBP-1
Bivalvia	Veneroida	Pisidiidae	3.93	14	7.30	1.61	1.95	19	14	8.11	14	32	20	33
Clitellata	-	Enchytraeidae	1.36	1.73	1.38	0.459	0.533	0.563	1.06	1.96	0.286	6.99	1.52	1.09
Clitellata	Lumbriculida	Lumbriculidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0.407	0	0	0	0	0	0	0	0	6.99	6.60	0
Collembola	Collembola	Collembola	0	0	0	0	0.178	0	0	0	0	0	0	0.364
Collembola	Collembola	Hypogastruridae	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	0.532	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	6.50	3.46	4.14	0.459	0.266	1.05	2.13	1.68	0.286	0.466	1.02	1.46
Euchelicerata	Trombidiformes	Neoacaridae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0.407	0	0.592	0.459	0.266	0	0	0.140	0.286	3.26	8.63	0
Euchelicerata	Trombidiformes	Torrenticolidae	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	0.542	0.157	0.394	0.459	0	0	0	0.140	0	0	0	1.46
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0.229	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	3.66	3.30	7.10	2.98	3.37	6.52	11	1.26	5.71	8.86	9.14	9.47
Insecta	Diptera	Dixidae	0	0	0	0.229	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	0.407	0.786	0.197	0.229	0.178	0.0805	0	0	0.571	0.233	1.52	0
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0.233	0	0
Insecta	Diptera	Pelecorhynchidae	2.17	0.157	0.394	0	0.355	0.885	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	40	35	18	2.98	5.68	18	9.57	19	3.71	1.17	0.508	24
Insecta	Diptera	Simuliidae	0.136	0.157	1.58	17	15	6.44	6.91	12	6.86	7.69	8.12	1.46
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	0.542	0.472	1.18	0.917	0.533	0.402	0.532	0.979	1.43	2.13	3.55	0
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	5.96	3.30	5.52	25	35	33	35	25	44	0.699	0.508	3.64
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	0.364
Insecta	Plecoptera	Chloroperlidae	0.271	0.314	0.592	2.52	0.533	1.29	2.66	1.82	0.857	0	0	0.364
Insecta	Plecoptera	Leuctridae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	29	26	30	33	22	7.96	11	21	8.00	2.10	1.02	15
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0	0	0.197	0	0	0.161	0	0.280	0.286	0.233	0	0
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	0.678	1.42	11	0.917	0.533	0.402	0.532	1.54	6.57	0.466	0.508	1.09
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0.0805	0	0	0	16	21	0
Insecta	Trichoptera	Hydroptilidae	0	0.472	1.97	0.229	0	0.241	0	0	0.286	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0.813	5.19	2.17	2.29	1.24	0.885	0.532	0	2.86	0.466	2.54	4.37
Insecta	Trichoptera	Limnephilidae	0	0	0	0.229	0	0	0	0	0.286	0	0	0
Insecta	Trichoptera	Phryganeidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	3.12	4.25	6.31	8.72	12	3.94	5.32	3.92	2.86	0	0	2.91
Malacostraca	Amphipoda	Gammaridae	0	0	0	0	0	0	0	0	0.286	8.62	9.64	0.182
Malacostraca	Amphipoda	Hyalellidae	0	0	0	0	0	0	0	0	0	1.40	4.06	0

Note: - = not applicable.

Table E.12: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek, Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Area-based Kick Samples										
Higher Level Classification		Family	2020					2021					
			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	14	35	35	45	24	60	14	50	26	23	56
Clitellata	-	Enchytraeidae	0.369	0.957	0.402	0.810	0.800	0.226	1.20	0.248	0.646	2.09	1.30
Clitellata	Lumbriculida	Lumbriculidae	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0	0.201	0	0	0	0	0	0	0	0
Collembola	Collembola	Collembola	0	0	0	0	0	0	0.133	0	0	0	0
Collembola	Collembola	Hypogastruridae	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
Euchelicerata	Trombidiformes	Feltriidae	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
Euchelicerata	Trombidiformes	Lebertiidae	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	0.201	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0	0	0	0.320	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Torrenticolidae	0	0	0	0	0	0	0	0	0.431	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	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	0.201	0	0	0	0	0	0	0.0739	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0.400	0.248	0.215	0.0739	0
Insecta	Diptera	Chironomidae	4.67	6.22	7.84	12	4.16	0.452	4.27	2.97	1.94	3.40	1.67
Insecta	Diptera	Dixidae	0	0.478	0	0	0	0	0.133	0	0	0	0
Insecta	Diptera	Empididae	0.246	0	0	0	0.320	0	0	0	0	0.148	0.186
Insecta	Diptera	Muscidae	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	0	0.478	0.402	0.405	0.160	0.905	1.87	0.0620	0.0538	0.444	0.186
Insecta	Diptera	Psychodidae	19	28	31	13	25	16	35	5.95	17	38	14
Insecta	Diptera	Simuliidae	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
Insecta	Diptera	Tipulidae	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
Insecta	Ephemeroptera	Baetidae	8.49	5.26	4.63	3.04	13	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
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	0	0	0	0.202	0	0.226	0	0	0.215	0	0
Insecta	Plecoptera	Chloroperlidae	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	0.202	0.160	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	36	6.70	7.24	7.09	4.48	12	32	27	35	19	12
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	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
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Brachycentridae	1.97	2.63	3.62	2.63	22	1.58	1.87	1.73	3.23	2.22	7.99
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0.160	0	0	0	0	0	0
Insecta	Trichoptera	Hydroptilidae	0	0	0	0.202	0.320	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	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	0.202	0	0	0	0.248	0	0	0
Insecta	Trichoptera	Phryganeidae	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	8.49	6.22	3.22	8.10	1.28	2.71	6.93	5.51	12	6.38	3.71
Malacostraca	Amphipoda	Gammaridae	0	0.478	0.251	0.405	1.28	2.49	0.333	0.743	1.29	1.29	1.21
Malacostraca	Amphipoda	Hyalellidae	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.13: Abundance (No./3-min Kick) of Benthic Invertebrate Taxa in Samples from Lower Greenhills Creek Based on the Family Level of Taxonomy, 2012 to 2021

Taxon			Abundance									
Higher Level Classification		Family	2012	2014	2015		2018	2019	2020	2021		
			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
Bivalvia	Veneroida	Pisidiidae	20	0	540	167	1,180	590	357	886	1,220	1,580
Clitellata	-	Enchytraeidae	0	0	360	133	0	0	0	0	0	0
Clitellata	Lumbriculida	Lumbriculidae	0	0	0	0	0	30	0	0	0	0
Clitellata	Tubificida	Naididae	220	180	1,320	217	80	0	0	43	60	40
Collembola	Collembola	Hypogastruridae	0	0	0	0	0	0	0	14	0	0
Euchelicerata	Trombidiformes	Aturidae	0	0	108	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Feltriidae	0	80	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	14	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	30	20	152	0	100	38	14	14	20	180
Euchelicerata	Trombidiformes	Sperchontidae	30	0	0	0	0	13	0	0	0	0
Insecta	Coleoptera	Curculionidae	0	0	0	0	0	10	0	14	0	0
Insecta	Coleoptera	Elmidae	0	0	40	67	0	0	43	14	0	0
Insecta	Coleoptera	Staphylinidae	20	0	0	0	20	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	20	0	20	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	5,800	1,100	3,540	350	560	410	129	200	400	280
Insecta	Diptera	Empididae	80	260	180	33	0	0	0	0	20	0
Insecta	Diptera	Pelecorhynchidae	0	0	20	33	0	40	0	0	0	0
Insecta	Diptera	Psychodidae	1,260	1,520	880	2,750	1,780	700	714	457	1,240	2,200
Insecta	Diptera	Simuliidae	31,900	840	920	150	40	120	614	200	160	20
Insecta	Diptera	Stratiomyidae	0	0	0	0	0	0	0	0	0	20
Insecta	Diptera	Tipulidae	320	200	120	50	60	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	0	0	40	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	20	560	333	180	1,030	357	43	40	20
Insecta	Ephemeroptera	Ephemerellidae	0	0	40	0	0	0	57	29	0	0
Insecta	Ephemeroptera	Heptageniidae	80	0	40	17	0	0	0	29	0	0
Insecta	Plecoptera	Capniidae	0	0	0	0	0	0	14	0	0	0
Insecta	Plecoptera	Chloroperlidae	20	80	280	50	40	30	29	14	40	40
Insecta	Plecoptera	Leuctridae	0	0	20	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
Insecta	Plecoptera	Peltoperlidae	0	20	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	0	20	0	0	0	0	14	0	0	0
Insecta	Plecoptera	Pteronarcyidae	0	0	0	17	0	0	0	0	0	0
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	0	14	43	0	100
Insecta	Trichoptera	Brachycentridae	20	40	316	50	96	99	73	130	100	230
Insecta	Trichoptera	Hydropsychidae	320	0	26	17	0	0	58	16	0	0
Insecta	Trichoptera	Hydroptilidae	0	0	184	0	384	33	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	60	0	0	576	165	131	16	20	126
Insecta	Trichoptera	Limnephilidae	20	0	26	267	0	0	29	49	0	0
Insecta	Trichoptera	Phryganeidae	20	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	460	1,580	447	317	264	132	523	717	500	524
Malacostraca	Amphipoda	Gammaridae	440	0	67	0	0	0	43	143	100	60
Malacostraca	Amphipoda	Hyalellidae	0	20	33	0	0	0	0	14	0	0

Notes: No./3-min kick = number of organisms per three minute kick; - = not applicable.

Table E.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Lowest Practical Level of Taxonomy, 2019 to 2021

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
Bivalvia	Veneroida	Pisidiidae	Pisidium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	13	6.67	0	0	0	0	0	23	27	13	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	67	153	60	13	67	117	53	37	57	87	23	63	133	57
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	13	0	0	0	0	13	0	0	0	3.33	0	0	27	10
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	6.67	0	0	0	0	0	0	0	0	0	0	13	17
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	6.67	13	0	0	0	0	0	0	0	27	0
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	6.67	20	6.67	0	0	40	3.33	0	0	0	20	80	6.67
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	13	3.33
Insecta	Coleoptera	Elmidae	Heterlimnius	27	20	13	0	40	3.33	0	0	0	0	0	3.33	53	47
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	3.33
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	13	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
Insecta	Diptera	Ceratopogonidae	Probezzia	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
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0	0	0	0	0	0	0	28	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0	0	0	0	0	0	0	0	10
Insecta	Diptera	Chironomidae	Corynoneura	29	14	14	0	14	3.44	0	0	0	0	4.97	0	28	3.47
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0	0	0	0	0	14	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	6.97	0	0	3.44	115	31	18	79	25	29	28	3.47
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	14	0	0	0	0	0	0	0	0	21
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	0	0	7.50	9.95	0	0	0
Insecta	Diptera	Chironomidae	Krenosmittia	0	0	0	0	0	0	0	0	0	0	0	0	14	0
Insecta	Diptera	Chironomidae	Limnophyes	43	0	0	0	14	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	3.44	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	57	28	139	7.14	83	21	0	0	0	0	0	0	56	63
Insecta	Diptera	Chironomidae	Micropsectra	57	21	21	14	69	14	0	3.90	0	0	0	0	126	17
Insecta	Diptera	Chironomidae	Orthocladius complex	29	21	28	14	14	14	317	39	14	41	85	87	0	10
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0	1,914	335	55	682	174	130	14	3.47
Insecta	Diptera	Chironomidae	Paraphaenocladius	29	6.97	0	0	14	0	0	0	0	0	0	0	42	28
Insecta	Diptera	Chironomidae	Pentaneura	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	9.95	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	230	14	14	29	110	24	0	0	0	3.75	0	9.64	0	3.47
Insecta	Diptera	Chironomidae	Zalutschia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	57	21	6.97	14	0	6.87	14	3.90	0	0	4.97	58	98	94
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Meringodixa	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	6.67	6.67	0	3.38	53	0	0	0	20	57	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	0	0	6.67	3.33	0	0	0
Insecta	Diptera	Empididae	Oreogeton	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	3.35
Insecta	Diptera	Pelecorhynchidae	Glutops	14	0	0	0	0	0	40	0	0	0	6.67	0	13	0
Insecta	Diptera	Psychodidae	Pericoma	0	0	0	0	0	0	0	3.33	0	10	0	3.33	0	0
Insecta	Diptera	Psychodidae	Psychoda	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	6.67	13	0	0
Insecta	Diptera	Tipulidae	Dicranota	0	13	40	0	13	6.76	173	0	0	6.67	17	47	120	83
Insecta	Diptera	Tipulidae	Helius	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
Insecta	Diptera	Tipulidae	Pseudolimnophila	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
Insecta	Diptera	Tipulidae	Tipula	0	0	13	0	0	3.38	0	0	0	0	3.33	0	93	48
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	6.67	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	67	0	13	6.67	13	0	40	0	0	6.67	6.67	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0	13	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	6.67	0	0	0	0	0	0	0	0	13	20

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Lowest Practical Level of Taxonomy, 2019 to 2021

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
Insecta	Plecoptera	Capniidae	Eucapnopsis	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
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	6.67	6.67	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	13	0
Insecta	Plecoptera	Nemouridae	Malenka	13	6.67	0	0	0	6.67	13	0	0	6.67	3.33	3.33	35	29
Insecta	Plecoptera	Nemouridae	Zapada	800	150	283	127	293	167	1,640	107	40	463	223	493	259	58
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	27	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
Insecta	Plecoptera	Perlodidae	Megarcys	27	10	47	13	70	13	37	0	0	3.33	3.33	10	0	43
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	107	13	6.67	0	0	3.33	40	6.67	13	67	17	53	0	0
Insecta	Trichoptera	Apataniidae	Apatania	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
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	40	0	0	0	0	0	27	33
Insecta	Trichoptera	Hydropsychidae	Parapsyche	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
Insecta	Trichoptera	Limnephilidae	Chyranda	0	0	0	0	0	13	0	0	0	0	0	0	107	103
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0	13	0	0	3.33	0	3.33	0	6.67
Insecta	Trichoptera	Limnephilidae	Hesperophylax	0	0	0	0	0	0	0	0	0	0	0	0	40	100
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	13	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	27	6.67	6.67	3.33	0	3.33	27	0	0	3.33	13	6.67	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	13	10	0	0	77	17	40	0	3.33	6.67	3.33	3.33	53	13
Insecta	Trichoptera	Uenoidae	Neothremma	0	13	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 E.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Lowest Practical Level of Taxonomy, 2019 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2020										2021			
				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
Clitellata	-	Enchytraeidae	Enchytraeidae	27	0	0	13	67	47	33	27	80	3.33	0	0	6.00	12
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	40	333	53	200	20	60	160	310	53	3.33	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	33	0	0	6.67	0	0	0	0	0	3.33	0	0	12	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	27	0	0	13	0	0	0	0	27	0	36	24	42	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	13	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0	0	0	0	0	0	3.33	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	13	20	27	20	6.67	13	13	6.67	0	3.33	0	0	18	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	13	0	0	6.67	0	0	0	0	0	0	0	12	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	147	6.67	27	0	6.67	0	0	3.33	40	3.33	12	84	30	108
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	27	0	0	0	0	0	13	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	6.67	3.33	13	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0	0	0	0	0	3.33	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	6.79	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	585	20	140	90	0	0	0	0	0	3.38	0	0	0	12
Insecta	Diptera	Chironomidae	Brundiniella	0	7.27	0	21	6.67	0	0	0	0	6.75	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	6.67	28	0	6.67	34	7.91	0	0	0	0	0	9.00	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	28	6.95	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
Insecta	Diptera	Chironomidae	Eukiefferiella	7.13	0	0	0	0	0	7.91	6.74	55	3.38	0	0	0	0
Insecta	Diptera	Chironomidae	Heleniella	14	0	28	14	0	0	16	10	28	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	0	0	10	0	0	0	0
Insecta	Diptera	Chironomidae	Krenosmittia	0	0	0	0	0	0	0	0	0	3.38	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	28	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
Insecta	Diptera	Chironomidae	Metriocnemus	178	33	112	35	13	0	0	0	14	6.75	0	12	0	0
Insecta	Diptera	Chironomidae	Micropsectra	114	0	560	0	0	14	28	71	344	88	24	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	43	13	196	0	6.67	75	79	51	151	14	0	0	0	12
Insecta	Diptera	Chironomidae	Pagastia	0	6.67	53	0	360	1,871	873	748	1,362	57	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	36	0	0	0	0	0	0	0	14	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0	0	0	12	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	27	0	6.67	6.80	6.92	6.74	28	10	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	7.13	13	28	21	6.67	0	0	0	41	3.38	0	12	0	0
Insecta	Diptera	Chironomidae	Zalutschia	0	0	0	0	0	0	0	0	0	51	0	0	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	471	73	53	104	0	6.80	55	17	28	0	0	12	9.00	36
Insecta	Diptera	Dixidae	Dixa	0	6.67	0	0	0	0	13	0	13	0	0	0	0	0
Insecta	Diptera	Dixidae	Meringodixa	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	14	0	0	0	20	85	107	70	161	23	0	0	12	12
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	35	6.67	10	67	10	0	0	0	0
Insecta	Diptera	Empididae	Oreogeton	6.83	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	6.00	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	6.67	0	6.79	50	20	40	3.33	134	33	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	0	13	0	0	6.67	27	27	6.67	67	10	0	0	6.00	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0	13	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	6.67	13	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	123	40	267	48	47	100	53	40	67	27	60	0	36	24
Insecta	Diptera	Tipulidae	Helius	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	27	0	0	0	0	0	0	3.33	0	0	6.00	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	6.83	0	0	0	0	0	0	0	0	0	0	0	0	12
Insecta	Diptera	Tipulidae	Tipula	89	6.67	53	6.79	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	6.67	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	6.67	120	27	20	0	0	0	0	0	0	12	24	18	12
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	6.67	0	6.67	13	0	0	0	0	3.33	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	20	6.67	0	0	0	0	0	0	0	0	12	36	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Lowest Practical Level of Taxonomy, 2019 to 2021

Taxon				Density													
Higher Level Classification		Family	Lowest Practical Level Identification	2020										2021			
				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	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0	0	0	0	0	0	103	25	0
Insecta	Plecoptera	Capniidae	Paracapnia	560	673	1,707	613	193	200	127	100	147	160	120	461	353	300
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	67	6.67	53	0	13	0	6.67	3.33	80	20	0	0	12	0
Insecta	Plecoptera	Leuctridae	Leuctridae	6.67	6.67	0	0	0	6.67	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	27	17	0	0	0	0	0	0	17	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	20	69	240	80	367	300	353	420	317	133	12	24	18	24
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0	0	3.33	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	47	6.67	0	6.67	47	100	20	47	133	27	0	24	12	0
Insecta	Plecoptera	Perlodidae	Megarcys	40	20	107	20	3.33	0	17	6.67	77	10	0	6.00	12	18
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	67	73	50	40	13	0	36	0	12
Insecta	Trichoptera	Apataniidae	Apatania	0	6.67	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	96	12	24	96
Insecta	Trichoptera	Glossosomatidae	Glossosoma	6.67	20	133	0	67	20	0	0	13	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	3.33	13	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Chyranda	473	0	27	33	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	47	60	20	20	40	10	24	24	0	12
Insecta	Trichoptera	Limnephilidae	Hesperophylax	160	6.67	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	33	27	6.67	33	13	47	0	0	6.00	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	6.67	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
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	33	47	187	20	13	20	53	30	60	6.67	0	12	6.00	0
Insecta	Trichoptera	Uenoidae	Neothremma	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 E.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Lowest Practical Level of Taxonomy, 2019 to 20

Taxon				Density							
Higher Level Classification		Family	Lowest Practical Level Identification	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
Bivalvia	Veneroida	Pisidiidae	Pisidium	0	0	6.00	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	6.00	0	30	0	0	12
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	12	0	0
Collembola	Collembola	-	Collembola	0	0	0	0	42	24	72	18
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	18	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	6.00	0	0	0	0	0	6.00
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	12	18	12	9.00	0	12	0	0
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	12	6.86	0	7.23	6.87	14	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	14	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	6.00	0	0	3.61	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0	7.23	34	14	0	32
Insecta	Diptera	Chironomidae	Heleniella	6.00	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Krenosmittia	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	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0	0	12	18	21	0	12	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	6.86	12	11	34	28	0	0
Insecta	Diptera	Chironomidae	Pagastia	0	0	60	90	254	619	294	123
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	6.86	0	3.61	0	14	0	0
Insecta	Diptera	Chironomidae	Zalutschia	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	6.00	14	18	18	28	69	0	6.48
Insecta	Diptera	Dixidae	Dixa	12	0	0	0	0	12	0	0
Insecta	Diptera	Dixidae	Meringodixa	6.00	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	30	18	6.00	72	60	66
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Oreogeton	0	0	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	51	12	15	12	0	0
Insecta	Diptera	Psychodidae	Pericoma	0	0	12	3.00	18	24	18	18
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	6.00	0	6.00	15	6.00	24	18	6.00
Insecta	Diptera	Tipulidae	Helius	0	0	0	0	0	0	6.00	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	0	0	0	0	6.00	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	24	15	36	228	162	72
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	6.00	6.00	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	12	0	3.00	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.14: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Lowest Practical Level of Taxonomy, 2019 to 20

Taxon				Density							
Higher Level Classification		Family	Lowest Practical Level Identification	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
Insecta	Plecoptera	Capniidae	Eucapnopsis	98	50	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	148	413	180	72	54	336	42	84
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	18	12	12	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	12	18	3.00	6.00	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	42	96	306	162	282	1,320	336	390
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	6.00	3.00	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	11	84	30	36
Insecta	Plecoptera	Perlodidae	Megarcys	12	33	3.00	12	32	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	12	0	18	9.00	60	240	108	60
Insecta	Trichoptera	Apataniidae	Apatania	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	168	66	12	201	36	24	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	6.00	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Chyranda	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	6.00	0	0	3.00	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Hesperophylax	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	18	12	6.00	24	0	24
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	3.00	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	6.00	18	102	60	48	60	6.00	6.00
Insecta	Trichoptera	Uenoidae	Neothremma	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.15: **Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Lowest Practical Level of Taxonomy, 2019 to 2021**

Taxon				Area-based Kicks					
Higher Level Classification		Family	Lowest Practical Level Identification	2019					
				RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0.429	0.414	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0.792	9.73	1.93	0.828	1.41	6.72
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0.158	0	0	0	0	0.768
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0.423	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0.414	0.282	0
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0.423	0.643	0.414	0	0
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0.317	1.27	0.429	0	0.847	0.192
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0.282	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	2.56	1.77	2.47	1.33	2.04	7.32
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0.341	0.884	0.448	0	0.292	0.198
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0.224	0	0	0.198
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0.292	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Krenosmittia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0.512	0	0	0	0.292	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0.198
Insecta	Diptera	Chironomidae	Metriocnemus	0.682	1.77	4.48	0.444	1.75	1.19
Insecta	Diptera	Chironomidae	Micropsectra	0.682	1.33	0.672	0.887	1.46	0.791
Insecta	Diptera	Chironomidae	Orthocladius complex	0.341	1.33	0.896	0.887	0.292	0.791
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0.341	0.442	0	0	0.292	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	2.73	0.884	0.448	1.77	2.33	1.38
Insecta	Diptera	Chironomidae	Zalutschia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	0.682	1.33	0.224	0.887	0	0.396
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Meringodixa	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0.214	0.414	0	0.195
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0
Insecta	Diptera	Empididae	Oreogeton	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0.164	0	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0	0.846	1.29	0	0.282	0.390
Insecta	Diptera	Tipulidae	Helius	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0.429	0	0	0.195
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0.414	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0.792	0	0.429	0.414	0.282	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0.414	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	77	64	73	81	78	66
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0.423	0.214	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0.158	0.423	0	0	0	0.384
Insecta	Plecoptera	Nemouridae	Zapada	9.51	9.51	9.11	7.87	6.21	9.60
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0.317	0.634	1.50	0.828	1.48	0.768
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	1.27	0.846	0.214	0	0	0.192
Insecta	Trichoptera	Apataniidae	Apatania	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Chyranda	0	0	0	0	0	0.768
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Hesperophylax	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0.317	0.423	0.214	0.207	0	0.192
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0.158	0.634	0	0	1.62	0.960
Insecta	Trichoptera	Uenoidae	Neothremma	0	0.846	0	0	0	0

Note: - = not applicable.

Table E.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Lowest Practical Level of Taxonomy, 2019 to 2021

Taxon				Area-based Kicks					
Higher Level Classification		Family	Lowest Practical Level Identification	2019					
				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
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	1.39	2.72	0.821
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	1.02	6.04	23	5.17	2.38	3.90
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0.199	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0.764	0.549	0	0	0	1.23
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0	0	0	0	0	0.205
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0.508	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	2.20	5.14	7.30	4.69	2.54	1.78
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0.447	1.02	0
Insecta	Diptera	Chironomidae	Krenosmittia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	0	0.643	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	6.05	6.43	5.47	2.46	8.63	5.35
Insecta	Diptera	Chironomidae	Pagastia	37	55	22	41	18	8.02
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	1.02	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0	0	0.224	0	0.594
Insecta	Diptera	Chironomidae	Zalutschia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	0.275	0.643	0	0	0.508	3.56
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	0	0
Insecta	Diptera	Dixidae	Meringodixa	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	1.02	0	0	0	2.04	3.49
Insecta	Diptera	Empididae	Clinocera	0	0	0	0.398	0.340	0
Insecta	Diptera	Empididae	Oreogeton	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0.764	0	0	0	0.680	0
Insecta	Diptera	Psychodidae	Pericoma	0	0.549	0	0.596	0	0.205
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0.680	0.821
Insecta	Diptera	Tipulidae	Dicranota	3.31	0	0	0.398	1.70	2.87
Insecta	Diptera	Tipulidae	Helius	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0.340	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0.764	0	0	0.398	0.680	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0.255	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	11	6.04	20	9.94	30	32
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	0	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0.255	0	0	0.398	0.340	0.205
Insecta	Plecoptera	Nemouridae	Zapada	31	18	16	28	23	30
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0.509	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0.700	0	0	0.199	0.340	0.616
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0.764	1.10	5.33	3.98	1.70	3.29
Insecta	Trichoptera	Apataniidae	Apatania	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0.764	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Chyranda	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0.255	0	0	0.199	0	0.205
Insecta	Trichoptera	Limnephilidae	Hesperophylax	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0.509	0	0	0.199	1.36	0.411
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0.764	0	1.33	0.398	0.340	0.205
Insecta	Trichoptera	Uenoidae	Neothremma	0	0	0	0	0	0

Note: - = not applicable.

Table E.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Lowest Practical Level of Taxonomy, 2019 to 2021

Taxon				Area-based Kicks					
Higher Level Classification		Family	Lowest Practical Level Identification	2020					
				RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0.765	0	0	0.930
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	3.86	3.92	1.15	21	1.27	14
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0.772	0.691	0.956	0	0	0.465
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0.386	1.15	0.765	0	0	0.930
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0.772	0	0	0	0	0.930
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	2.32	0.461	0.382	1.23	0.633	1.40
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0.386	0.230	0.382	0	0	0.465
Insecta	Coleoptera	Elmidae	Heterlimnius	1.54	3.23	4.21	0.410	0.633	0
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0	0.230	0.765	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0.474
Insecta	Diptera	Chironomidae	Brillia	13	9.36	17	1.23	3.32	6.31
Insecta	Diptera	Chironomidae	Brundiniella	0.808	0	0	0.447	0	1.46
Insecta	Diptera	Chironomidae	Chaetocladius	0	0.720	0	0.410	0.663	0
Insecta	Diptera	Chironomidae	Corynoneura	0.808	0.240	0	0	0.663	0.485
Insecta	Diptera	Chironomidae	Diplocladius	0.404	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0.808	0.240	0.204	0	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	1.44	0.409	0	0.663	0.970
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Krenosmittia	0.404	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0.663	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	1.62	4.32	5.11	2.05	2.65	2.43
Insecta	Diptera	Chironomidae	Micropsectra	3.64	1.20	3.27	0	13	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	0.720	1.23	0.820	4.64	0
Insecta	Diptera	Chironomidae	Pagastia	0.404	0.240	0	0.410	1.27	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	1.21	1.92	1.02	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0.633	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0.240	0.204	0.820	0.663	1.46
Insecta	Diptera	Chironomidae	Zalutschia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	2.83	6.48	14	4.47	1.27	7.28
Insecta	Diptera	Dixidae	Dixa	0	0	0	0.410	0	0
Insecta	Diptera	Dixidae	Meringodixa	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	0.392	0	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0
Insecta	Diptera	Empididae	Oreogeton	0	0	0.196	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0.232	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0.386	0	0	0.410	0	0.474
Insecta	Diptera	Psychodidae	Pericoma	0	0	0	0.820	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	3.47	5.71	3.52	2.46	6.33	3.32
Insecta	Diptera	Tipulidae	Helius	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0.633	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0.196	0	0	0
Insecta	Diptera	Tipulidae	Tipula	2.70	3.33	2.55	0.410	1.27	0.474
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0.410	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0.191	7.38	0.633	1.40
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0.410	0	0.465
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0.386	1.38	0.574	0.410	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	41	25	16	41	41	43
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	1.91	0.410	1.27	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0.386	0	0.191	0.410	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0.999	2.00	0.765	1.07	0	0
Insecta	Plecoptera	Nemouridae	Zapada	7.49	3.99	0.574	4.26	5.70	5.58
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0.772	0.922	1.34	0.410	0	0.465
Insecta	Plecoptera	Perlodidae	Megarcys	0	3.00	1.15	1.23	2.53	1.40
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	0	0	0	0	0
Insecta	Trichoptera	Apataniidae	Apatania	0	0	0	0.410	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0.772	2.30	0.191	1.23	3.16	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Chyranda	3.09	7.14	14	0	0.633	2.33
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0.461	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Hesperophylax	1.16	6.91	4.59	0.410	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0.386	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	1.54	0.922	0.956	2.87	4.43	1.40
Insecta	Trichoptera	Uenoidae	Neothremma	0	0	0	0	0	0

Note: - = not applicable.

Table E.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Lowest Practical Level of Taxonomy, 2019 to 2021

Taxon				Area-based Kicks					
Higher Level Classification		Family	Lowest Practical Level Identification	2020					
				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
Clitellata	-	Enchytraeidae	Enchytraeidae	4.65	1.46	1.50	1.26	2.13	0.408
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	1.40	1.88	7.20	15	1.42	0.408
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0.408
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0.709	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0	0	0.408
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0.465	0.418	0.600	0.315	0	0.408
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	0.465	0	0	0.158	1.06	0.408
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0	0	0.600	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0.300	0.158	0.354	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0	0.408
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	0	0	0.414
Insecta	Diptera	Chironomidae	Brundiniella	0.465	0	0	0	0	0.827
Insecta	Diptera	Chironomidae	Chaetocladius	0.465	1.07	0.356	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0.356	0.319	1.46	0.414
Insecta	Diptera	Chironomidae	Heleniella	0	0	0.712	0.478	0.731	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	1.24
Insecta	Diptera	Chironomidae	Krenosmittia	0	0	0	0	0	0.414
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0.930	0	0	0	0.366	0.827
Insecta	Diptera	Chironomidae	Micropsectra	0	0.426	1.25	3.35	9.14	11
Insecta	Diptera	Chironomidae	Orthocladius complex	0.465	2.34	3.56	2.39	4.02	1.65
Insecta	Diptera	Chironomidae	Pagastia	25	59	39	35	36	7.03
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0.366	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0.465	0.213	0.311	0.319	0.731	1.24
Insecta	Diptera	Chironomidae	Tvetenia	0.465	0	0	0	1.10	0.414
Insecta	Diptera	Chironomidae	Zalutschia	0	0	0	0	0	6.20
Insecta	Diptera	Chironomidae	Zavrelimyia	0	0.213	2.49	0.797	0.731	0
Insecta	Diptera	Dixidae	Dixa	0	0	0.600	0	0.356	0
Insecta	Diptera	Dixidae	Meringodixa	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	1.40	2.65	4.80	3.29	4.27	2.86
Insecta	Diptera	Empididae	Clinocera	0	1.11	0.300	0.494	1.78	1.22
Insecta	Diptera	Empididae	Oreogeton	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	3.49	0.626	1.80	0.158	3.56	4.08
Insecta	Diptera	Psychodidae	Pericoma	0.465	0.835	1.20	0.315	1.78	1.22
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0.356	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0.315	0.356	0
Insecta	Diptera	Tipulidae	Dicranota	3.26	3.13	2.40	1.89	1.78	3.27
Insecta	Diptera	Tipulidae	Helius	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0.408
Insecta	Diptera	Tipulidae	Pseudolimnophila	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	0	0	0	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0.930	0	0	0	0	0.408
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	14	6.26	5.70	4.73	3.90	20
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0.930	0	0.300	0.158	2.13	2.45
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0.209	0	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0.443	0
Insecta	Plecoptera	Nemouridae	Zapada	26	9.39	16	20	8.41	16
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0.158	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	3.26	3.13	0.900	2.21	3.54	3.27
Insecta	Plecoptera	Perlodidae	Megarcys	0.233	0	0.750	0.315	2.04	1.22
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	2.09	3.30	2.37	1.06	1.63
Insecta	Trichoptera	Apataniidae	Apatania	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	4.65	0.626	0	0	0.354	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0.158	0.354	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Chyranda	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	3.26	1.88	0.900	0.946	1.06	1.22
Insecta	Trichoptera	Limnephilidae	Hesperophylax	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	2.33	0.835	0.300	1.58	0.354	5.71
Insecta	Trichoptera	Limnephilidae	Philocasca	0.465	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0.930	0.626	2.40	1.42	1.59	0.816
Insecta	Trichoptera	Uenoidae	Neothremma	0	0	0	0	0	0

Note: - = not applicable.

Table E.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Lowest Practical Level of Taxonomy, 2019 to 2021

Taxon				Area-based Kicks					
Higher Level Classification		Family	Lowest Practical Level Identification	2021					
				RG_GAUT-1	RG_GAUT-2	RG_GAUT-3	RG_GAUT-4	RG_GAUT-5	RG_GAUT-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0.885	1.71	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0	0	0
Collembola	Collembola	-	Collembola	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	1.77	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	8.57	2.61	6.19	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	2.65	0	0	0.778
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	1.31	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	2.86	9.15	4.42	15	2.15	2.33
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0	0	1.71	2.15	0.889
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	1.33	0	0	1.78
Insecta	Diptera	Chironomidae	Corynoneura	0	0	0	0	1.08	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	1.08	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Krenosmittia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	1.31	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	5.71	0	0	0	0	0
Insecta	Diptera	Chironomidae	Orthocladius complex	0	0	0	1.71	0	0.889
Insecta	Diptera	Chironomidae	Pagastia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	2.86	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	1.31	0	0	0	0.889
Insecta	Diptera	Chironomidae	Zalutschia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	0	1.31	1.33	5.13	1.08	1.78
Insecta	Diptera	Dixidae	Dixa	0	0	0	0	2.15	0
Insecta	Diptera	Dixidae	Meringodixa	0	0	0	0	1.08	0
Insecta	Diptera	Empididae	Chelifera/Metachela	0	0	1.77	1.71	0	0
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0
Insecta	Diptera	Empididae	Oreogeton	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0.885	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	0	0	0	0	0	0
Insecta	Diptera	Psychodidae	Pericoma	0	0	0.885	0	0	0
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	14	0	5.31	3.42	1.08	0
Insecta	Diptera	Tipulidae	Helius	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0.885	0	0	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	1.71	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	2.86	2.61	2.65	1.71	0	0
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	2.86	3.92	0	0	0	1.56
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	11	3.64	0	18	6.42
Insecta	Plecoptera	Capniidae	Paracapnia	29	50	52	43	26	54
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	0	1.77	0	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	0	0	0	0	0	1.56
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	2.86	2.61	2.65	3.42	7.53	12
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	2.61	1.77	0	0	0
Insecta	Plecoptera	Perlodidae	Megarcys	0	0.654	1.77	2.56	2.15	4.28
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	0	3.92	0	1.71	2.15	0
Insecta	Trichoptera	Apataniidae	Apatania	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	23	1.31	3.54	14	30	8.56
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Chyranda	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	5.71	2.61	0	1.71	1.08	0
Insecta	Trichoptera	Limnephilidae	Hesperophylax	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	0	0	0.885	0	0	0
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	0	1.31	0.885	0	1.08	2.33
Insecta	Trichoptera	Uenoidae	Neothremma	0	0	0	0	0	0

Note: - = not applicable.

Table E.15: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Lowest Practical Level of Taxonomy, 2019 to 2021

Taxon				Area-based Kicks					
Higher Level Classification		Family	Lowest Practical Level Identification	2021					
				RG_GANF-1	RG_GANF-2	RG_GANF-3	RG_GANF-4	RG_GANF-5	RG_GANF-6
Bivalvia	Veneroida	Pisidiidae	Pisidium	0.645	0	0	0	0	0
Clitellata	-	Enchytraeidae	Enchytraeidae	0.645	0	2.75	0	0	1.25
Clitellata	Tubificida	Naididae	Tubificinae	0	0	0	0.366	0	0
Collembola	Collembola	-	Collembola	0	0	3.86	0.733	6.19	1.88
Euchelicerata	Trombidiformes	Hydryphantidae	Wandesia	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	Hygrobates	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	1.94	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	Limnesia	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	Sperchon	0	0	0	0	0	0.625
Insecta	Coleoptera	Dytiscidae	Dytiscidae	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	Heterlimnius	1.29	1.12	0	0.366	0	0
Insecta	Coleoptera	Hydrophilidae	Hydrophilidae	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	Staphylinidae	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Atrichopogon	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Probezzia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Brillia	0	0.899	0.631	0.420	0	0
Insecta	Diptera	Chironomidae	Brundiniella	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chaetocladius	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Corynoneura	0	0.449	0	0	0	0
Insecta	Diptera	Chironomidae	Diplocladius	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Eukiefferiella	0	0.899	3.16	0.420	0	3.38
Insecta	Diptera	Chironomidae	Heleniella	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Hydrobaenus	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Krenosmittia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Limnophyes	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Macropelopia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Metriocnemus	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Micropsectra	1.29	2.25	1.89	0	1.05	0
Insecta	Diptera	Chironomidae	Orthocladius complex	1.29	1.35	3.16	0.839	0	0
Insecta	Diptera	Chironomidae	Pagastia	6.45	11	23	19	25	13
Insecta	Diptera	Chironomidae	Paraphaenocladius	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pentaneura	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Pseudodiamesa	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tvetenia	0	0.449	0	0.420	0	0
Insecta	Diptera	Chironomidae	Zalutschia	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Zavrelimyia	1.94	2.25	2.52	2.10	0	0.675
Insecta	Diptera	Dixidae	Dixa	0	0	0	0.366	0	0
Insecta	Diptera	Dixidae	Meringodixa	0	0	0	0	0	0
Insecta	Diptera	Empididae	Chelifera/Metachela	3.23	2.24	0.551	2.20	5.15	6.88
Insecta	Diptera	Empididae	Clinocera	0	0	0	0	0	0
Insecta	Diptera	Empididae	Oreogeton	0	0	0	0	0	0
Insecta	Diptera	Empididae	Wiedemannia	0	0	0	0	0	0
Insecta	Diptera	Pelecorhynchidae	Glutops	5.48	1.49	1.38	0.366	0	0
Insecta	Diptera	Psychodidae	Pericoma	1.29	0.373	1.65	0.733	1.55	1.88
Insecta	Diptera	Psychodidae	Psychoda	0	0	0	0	0	0
Insecta	Diptera	Simuliidae	Simuliidae	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Dicranota	0.645	1.87	0.551	0.733	1.55	0.625
Insecta	Diptera	Tipulidae	Helius	0	0	0	0	0.515	0
Insecta	Diptera	Tipulidae	Limnophila	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	0	0	0.551	0	0	0
Insecta	Diptera	Tipulidae	Rhabdomastix	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	Tipula	0	0	0	0	0	0
Insecta	Ephemeroptera	Ameletidae	Ameletus	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	Baetis	2.58	1.87	3.31	6.96	14	7.50
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	0	0.746	0.551	0	0	0
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	0	0.373	0	0	0	0
Insecta	Plecoptera	Capniidae	Eucapnopsis	0	0	0	0	0	0
Insecta	Plecoptera	Capniidae	Paracapnia	19	8.96	4.96	10	3.61	8.75
Insecta	Plecoptera	Chloroperlidae	Chloroperlidae	0	2.24	1.10	0.366	0	0
Insecta	Plecoptera	Leuctridae	Leuctridae	1.94	0.373	0.551	0	0	0
Insecta	Plecoptera	Nemouridae	Malenka	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	Zapada	33	20	26	40	29	41
Insecta	Plecoptera	Peltoperlidae	Yoraperla	0.645	0.373	0	0	0	0
Insecta	Plecoptera	Perlodidae	Isoperla	0	0	0.964	2.56	2.58	3.75
Insecta	Plecoptera	Perlodidae	Megarcys	0.323	1.49	2.89	0	0	0
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	1.94	1.12	5.51	7.33	9.28	6.25
Insecta	Trichoptera	Apataniidae	Apatania	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	Anagapetus	1.29	25	3.31	0.733	0	0
Insecta	Trichoptera	Glossosomatidae	Glossosoma	0	0	0	0	0	0
Insecta	Trichoptera	Hydropsychidae	Parapsyche	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatidae	0	0.746	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Chyranda	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Ecclisomyia	0	0.373	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Hesperophylax	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Limnephilidae	1.94	1.49	0.551	0.733	0	2.50
Insecta	Trichoptera	Limnephilidae	Philocasca	0	0.373	0	0	0	0
Insecta	Trichoptera	Limnephilidae	Psychoglypha	0	0	0	0	0	0
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	11	7.46	4.41	1.83	0.515	0.625
Insecta	Trichoptera	Uenoidae	Neothremma	0	0	0	0	0	0

Note: - = not applicable.

Table E.16: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Family Level of Taxonomy, 2019 to 2021

Taxon			Density													
Higher Level Classification		Family	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
Bivalvia	Veneroida	Pisidiidae	0	0	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	0	0
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	Collembola	67	153	60	13	67	117	53	37	57	87	23	63	133	57
Euchelicerata	Trombidiformes	Hydryphantidae	13	0	0	0	0	13	0	0	0	3	0	0	27	10
Euchelicerata	Trombidiformes	Hygrobatidae	0	7	0	0	0	0	0	0	0	0	0	0	13	17
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	7	13	0	0	0	0	0	0	0	27	0
Euchelicerata	Trombidiformes	Limnesiidae	0	0	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	80	7
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	13	3
Insecta	Coleoptera	Elmidae	27	20	13	0	40	3	0	0	0	0	0	3	53	47
Insecta	Coleoptera	Hydrophilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Insecta	Coleoptera	Staphylinidae	0	0	0	0	13	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
Insecta	Diptera	Chironomidae	746	153	307	100	427	216	2,360	413	87	813	313	313	893	392
Insecta	Diptera	Dixidae	0	0	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	0	3
Insecta	Diptera	Pelecorhynchidae	14	0	0	0	0	0	40	0	0	0	7	0	13	0
Insecta	Diptera	Psychodidae	0	0	0	0	0	0	0	3	0	10	0	3	0	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	7	13	0	0
Insecta	Diptera	Tipulidae	0	13	53	0	13	10	173	0	0	7	20	47	213	131
Insecta	Ephemeroptera	Ameletidae	0	0	0	7	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	67	0	13	7	13	0	40	0	0	7	7	0	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	13	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	7	0	0	0	0	0	0	0	0	13	20
Insecta	Plecoptera	Capniidae	6,493	1,007	2,273	1,307	3,693	1,150	587	37	50	167	290	517	1,400	357
Insecta	Plecoptera	Chloroperlidae	0	7	7	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	13	0
Insecta	Plecoptera	Nemouridae	813	157	283	127	293	173	1,653	107	40	470	227	497	293	87
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	27	0	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	27	10	47	13	70	13	37	0	0	3	3	10	27	57
Insecta	Plecoptera	Taeniopterygidae	107	13	7	0	0	3	40	7	13	67	17	53	0	0
Insecta	Trichoptera	Apataniidae	0	0	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	27	33
Insecta	Trichoptera	Hydropsychidae	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
Insecta	Trichoptera	Limnephilidae	27	7	7	3	0	17	40	0	0	7	13	10	160	210
Insecta	Trichoptera	Rhyacophilidae	13	10	0	0	77	17	40	0	3	7	3	3	53	13
Insecta	Trichoptera	Uenoidae	0	13	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 E.16: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Family Level of Taxonomy, 2019 to 2021

Taxon			Density													
Higher Level Classification		Family	2020										2021			
			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	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	27	0	0	13	67	47	33	27	80	3	0	0	6	12
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	Collembola	40	333	53	200	20	60	160	310	53	3	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	33	0	0	7	0	0	0	0	0	3	0	0	12	0
Euchelicerata	Trombidiformes	Hygrobatidae	27	0	0	13	0	0	0	0	27	0	36	24	42	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	13	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	0	0	0	0	0	0	0	0	0	3	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	13	20	27	20	7	13	13	7	0	3	0	0	18	0
Insecta	Coleoptera	Dytiscidae	13	0	0	7	0	0	0	0	0	0	0	12	0	0
Insecta	Coleoptera	Elmidae	147	7	27	0	7	0	0	3	40	3	12	84	30	108
Insecta	Coleoptera	Hydrophilidae	27	0	0	0	0	0	13	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	7	3	13	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	7	0	0	0	0	0	3	0	0	0	0
Insecta	Diptera	Chironomidae	1,454	173	1,280	292	407	2,007	1,073	910	2,064	257	36	36	18	60
Insecta	Diptera	Dixidae	0	7	0	0	0	0	13	0	13	0	0	0	0	0
Insecta	Diptera	Empididae	21	0	0	0	20	120	113	80	228	33	0	0	18	12
Insecta	Diptera	Pelecorhynchidae	0	7	0	7	50	20	40	3	134	33	0	0	0	0
Insecta	Diptera	Psychodidae	0	13	0	0	7	27	27	7	80	10	0	0	6	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	7	13	0	0	0	0	0
Insecta	Diptera	Tipulidae	218	47	347	54	47	100	53	40	67	30	60	0	42	36
Insecta	Ephemeroptera	Ameletidae	0	7	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	7	120	27	20	0	0	0	0	0	0	12	24	18	12
Insecta	Ephemeroptera	Ephemerellidae	0	7	0	7	13	0	0	0	0	3	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	20	7	0	0	0	0	0	0	0	0	12	36	0	0
Insecta	Plecoptera	Capniidae	560	673	1,707	613	193	200	127	100	147	160	120	564	378	300
Insecta	Plecoptera	Chloroperlidae	67	7	53	0	13	0	7	3	80	20	0	0	12	0
Insecta	Plecoptera	Leuctridae	7	7	0	0	0	7	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	47	87	240	80	367	300	353	420	333	133	12	24	18	24
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	3	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	87	27	107	27	50	100	37	53	210	37	0	30	24	18
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	67	73	50	40	13	0	36	0	12
Insecta	Trichoptera	Apataniidae	0	7	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	7	20	133	0	67	20	0	0	13	0	96	12	24	96
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	3	13	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	633	7	27	33	87	87	27	53	53	57	24	24	6	12
Insecta	Trichoptera	Rhyacophilidae	33	47	187	20	13	20	53	30	60	7	0	12	6	0
Insecta	Trichoptera	Uenoidae	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 E.16: Density (No./m²) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Family Level of Taxonomy, 2019 to 2021

Taxon			Density							
Higher Level Classification		Family	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
Bivalvia	Veneroida	Pisidiidae	0	0	6	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	0	6	0	30	0	0	12
Clitellata	Tubificida	Naididae	0	0	0	0	0	12	0	0
Collembola	Collembola	Collembola	0	0	0	0	42	24	72	18
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	18	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	6	0	0	0	0	0	6
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	12	18	12	9	0	12	0	0
Insecta	Coleoptera	Hydrophilidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	30	48	102	159	378	756	306	162
Insecta	Diptera	Dixidae	18	0	0	0	0	12	0	0
Insecta	Diptera	Empididae	0	0	30	18	6	72	60	66
Insecta	Diptera	Pelecorhynchidae	0	0	51	12	15	12	0	0
Insecta	Diptera	Psychodidae	0	0	12	3	18	24	18	18
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Tipulidae	6	0	6	15	12	24	24	6
Insecta	Ephemeroptera	Ameletidae	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0	0	24	15	36	228	162	72
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	6	6	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	12	0	3	0	0	0	0
Insecta	Plecoptera	Capniidae	246	462	180	72	54	336	42	84
Insecta	Plecoptera	Chloroperlidae	0	0	0	18	12	12	0	0
Insecta	Plecoptera	Leuctridae	0	12	18	3	6	0	0	0
Insecta	Plecoptera	Nemouridae	42	96	306	162	282	1,320	336	390
Insecta	Plecoptera	Peltoperlidae	0	0	6	3	0	0	0	0
Insecta	Plecoptera	Perlodidae	12	33	3	12	42	84	30	36
Insecta	Plecoptera	Taeniopterygidae	12	0	18	9	60	240	108	60
Insecta	Trichoptera	Apataniidae	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	168	66	12	201	36	24	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	6	0	0	0	0
Insecta	Trichoptera	Limnephilidae	6	0	18	18	6	24	0	24
Insecta	Trichoptera	Rhyacophilidae	6	18	102	60	48	60	6	6
Insecta	Trichoptera	Uenoidae	0	0	0	0	0	0	0	0

Notes: No./m^2= number of organisms per square metre; - = not applicable.

Table E.17: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Family Level of Taxonomy, 2019 to 2021

Taxon			Area-based Kick Samples													
Higher Level Classification		Family	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
Bivalvia	Veneroida	Pisidiidae	0	0	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	0	0
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	Collembola	0.792	9.73	1.93	0.828	1.41	6.72	1.02	6.04	23	5.17	2.38	3.90	3.86	3.92
Euchelicerata	Trombidiformes	Hydryphantidae	0.158	0	0	0	0	0.768	0	0	0	0.199	0	0	0.772	0.691
Euchelicerata	Trombidiformes	Hygrobatidae	0	0.423	0	0	0	0	0	0	0	0	0	0	0.386	1.15
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0.414	0.282	0	0	0	0	0	0	0	0.772	0
Euchelicerata	Trombidiformes	Limnesiidae	0	0	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	2.32	0.461
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0	0.386	0.230
Insecta	Coleoptera	Elmidae	0.317	1.27	0.429	0	0.847	0.192	0	0	0	0	0	0.205	1.54	3.23
Insecta	Coleoptera	Hydrophilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0.230
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0.282	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
Insecta	Diptera	Chironomidae	8.87	9.73	9.86	6.21	9.04	13	45	68	35	49	32	19	26	27
Insecta	Diptera	Dixidae	0	0	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	0	0.232
Insecta	Diptera	Pelecorhynchidae	0.164	0	0	0	0	0	0.764	0	0	0	0.680	0	0.386	0
Insecta	Diptera	Psychodidae	0	0	0	0	0	0	0	0.549	0	0.596	0	0.205	0	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0	0	0	0.680	0.821	0	0
Insecta	Diptera	Tipulidae	0	0.846	1.71	0	0.282	0.584	3.31	0	0	0.398	2.04	2.87	6.18	9.04
Insecta	Ephemeroptera	Ameletidae	0	0	0	0.414	0	0	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	0	0
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0	0	0	0.255	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	0	0	0.414	0	0	0	0	0	0	0	0	0.386	1.38
Insecta	Plecoptera	Capniidae	77	64	73	81	78	66	11	6.04	20	9.94	30	32	41	25
Insecta	Plecoptera	Chloroperlidae	0	0.423	0.214	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	0.386	0
Insecta	Plecoptera	Nemouridae	9.67	9.94	9.11	7.87	6.21	9.98	32	18	16	28	23	31	8.49	5.99
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0.509	0	0	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	0.772	3.92
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	0	0
Insecta	Trichoptera	Apataniidae	0	0	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	0.772	2.30
Insecta	Trichoptera	Hydropsychidae	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
Insecta	Trichoptera	Limnephilidae	0.317	0.423	0.214	0.207	0	0.960	0.764	0	0	0.398	1.36	0.616	4.63	15
Insecta	Trichoptera	Rhyacophilidae	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
Insecta	Trichoptera	Uenoidae	0	0.846	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.17: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Family Level of Taxonomy, 2019 to 2021

Taxon			Area-based Kick Samples													
Higher Level Classification		Family	2020										2021			
			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	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	-	Enchytraeidae	0.765	0	0	0.930	4.65	1.46	1.50	1.26	2.13	0.408	0	0	0.885	1.71
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collembola	Collembola	Collembola	1.15	21	1.27	14	1.40	1.88	7.20	15	1.42	0.408	0	0	0	0
Euchelicerata	Trombidiformes	Hydryphantidae	0.956	0	0	0.465	0	0	0	0	0	0.408	0	0	1.77	0
Euchelicerata	Trombidiformes	Hygrobatidae	0.765	0	0	0.930	0	0	0	0	0.709	0	8.57	2.61	6.19	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0.930	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	0	0	0	0	0	0	0	0	0	0.408	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0.382	1.23	0.633	1.40	0.465	0.418	0.600	0.315	0	0.408	0	0	2.65	0
Insecta	Coleoptera	Dytiscidae	0.382	0	0	0.465	0	0	0	0	0	0	0	1.31	0	0
Insecta	Coleoptera	Elmidae	4.21	0.410	0.633	0	0.465	0	0	0.158	1.06	0.408	2.86	9.15	4.42	15
Insecta	Coleoptera	Hydrophilidae	0.765	0	0	0	0	0	0.600	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0.300	0.158	0.354	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0.474	0	0	0	0	0	0.408	0	0	0	0
Insecta	Diptera	Chironomidae	42	11	30	20	28	63	48	43	55	31	8.57	3.92	2.65	8.55
Insecta	Diptera	Dixidae	0	0.410	0	0	0	0	0.600	0	0.356	0	0	0	0	0
Insecta	Diptera	Empididae	0.587	0	0	0	1.40	3.76	5.10	3.79	6.05	4.08	0	0	2.65	1.71
Insecta	Diptera	Pelecorhynchidae	0	0.410	0	0.474	3.49	0.626	1.80	0.158	3.56	4.08	0	0	0	0
Insecta	Diptera	Psychodidae	0	0.820	0	0	0.465	0.835	1.20	0.315	2.14	1.22	0	0	0.885	0
Insecta	Diptera	Simuliidae	0	0	0	0	0	0	0	0.315	0.356	0	0	0	0	0
Insecta	Diptera	Tipulidae	6.27	2.87	8.23	3.79	3.26	3.13	2.40	1.89	1.78	3.67	14	0	6.19	5.13
Insecta	Ephemeroptera	Ameletidae	0	0.410	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Ephemeroptera	Baetidae	0.191	7.38	0.633	1.40	0	0	0	0	0	0	2.86	2.61	2.65	1.71
Insecta	Ephemeroptera	Ephemerellidae	0	0.410	0	0.465	0.930	0	0	0	0	0.408	0	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0.574	0.410	0	0	0	0	0	0	0	0	2.86	3.92	0	0
Insecta	Plecoptera	Capniidae	16	41	41	43	14	6.26	5.70	4.73	3.90	20	29	61	56	43
Insecta	Plecoptera	Chloroperlidae	1.91	0.410	1.27	0	0.930	0	0.300	0.158	2.13	2.45	0	0	1.77	0
Insecta	Plecoptera	Leuctridae	0.191	0.410	0	0	0	0.209	0	0	0	0	0	0	0	0
Insecta	Plecoptera	Nemouridae	1.34	5.33	5.70	5.58	26	9.39	16	20	8.86	16	2.86	2.61	2.65	3.42
Insecta	Plecoptera	Peltoperlidae	0	0	0	0	0	0	0	0.158	0	0	0	0	0	0
Insecta	Plecoptera	Perlodidae	2.49	1.64	2.53	1.86	3.49	3.13	1.65	2.52	5.58	4.49	0	3.27	3.54	2.56
Insecta	Plecoptera	Taeniopterygidae	0	0	0	0	0	2.09	3.30	2.37	1.06	1.63	0	3.92	0	1.71
Insecta	Trichoptera	Apataniidae	0	0.410	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Glossosomatidae	0.191	1.23	3.16	0	4.65	0.626	0	0	0.354	0	23	1.31	3.54	14
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0.158	0.354	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Limnephilidae	18	0.410	0.633	2.33	6.05	2.71	1.20	2.52	1.42	6.94	5.71	2.61	0.885	1.71
Insecta	Trichoptera	Rhyacophilidae	0.956	2.87	4.43	1.40	0.930	0.626	2.40	1.42	1.59	0.816	0	1.31	0.885	0
Insecta	Trichoptera	Uenoidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.17: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Gardine Creek, Based on the Family Level of Taxonomy, 201

Taxon			Area-based Kick Samples							
Higher Level Classification		Family	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
Bivalvia	Veneroida	Pisidiidae	0	0	0.645	0	0	0	0	0
Clitellata	-	Enchytraeidae	0	0	0.645	0	2.75	0	0	1.25
Clitellata	Tubificida	Naididae	0	0	0	0	0	0.366	0	0
Collembola	Collembola	Collembola	0	0	0	0	3.86	0.733	6.19	1.88
Euchelicerata	Trombidiformes	Hydryphantidae	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Hygrobatidae	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	1.94	0	0	0	0	0
Euchelicerata	Trombidiformes	Limnesiidae	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Sperchontidae	0	0.778	0	0	0	0	0	0.625
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Elmidae	2.15	2.33	1.29	1.12	0	0.366	0	0
Insecta	Coleoptera	Hydrophilidae	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Staphylinidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	5.38	6.23	11	20	35	23	26	17
Insecta	Diptera	Dixidae	3.23	0	0	0	0	0.366	0	0
Insecta	Diptera	Empididae	0	0	3.23	2.24	0.551	2.20	5.15	6.88
Insecta	Diptera	Pelecorhynchidae	0	0	5.48	1.49	1.38	0.366	0	0
Insecta	Diptera	Psychodidae	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
Insecta	Diptera	Tipulidae	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
Insecta	Ephemeroptera	Baetidae	0	0	2.58	1.87	3.31	6.96	14	7.50
Insecta	Ephemeroptera	Ephemerellidae	0	0	0	0.746	0.551	0	0	0
Insecta	Ephemeroptera	Heptageniidae	0	1.56	0	0.373	0	0	0	0
Insecta	Plecoptera	Capniidae	44	60	19	8.96	4.96	10	3.61	8.75
Insecta	Plecoptera	Chloroperlidae	0	0	0	2.24	1.10	0.366	0	0
Insecta	Plecoptera	Leuctridae	0	1.56	1.94	0.373	0.551	0	0	0
Insecta	Plecoptera	Nemouridae	7.53	12	33	20	26	40	29	41
Insecta	Plecoptera	Peltoperlidae	0	0	0.645	0.373	0	0	0	0
Insecta	Plecoptera	Perlodidae	2.15	4.28	0.323	1.49	3.86	2.56	2.58	3.75
Insecta	Plecoptera	Taeniopterygidae	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
Insecta	Trichoptera	Glossosomatidae	30	8.56	1.29	25	3.31	0.733	0	0
Insecta	Trichoptera	Hydropsychidae	0	0	0	0	0	0	0	0
Insecta	Trichoptera	Lepidostomatidae	0	0	0	0.746	0	0	0	0
Insecta	Trichoptera	Limnephilidae	1.08	0	1.94	2.24	0.551	0.733	0	2.50
Insecta	Trichoptera	Rhyacophilidae	1.08	2.33	11	7.46	4.41	1.83	0.515	0.625
Insecta	Trichoptera	Uenoidae	0	0	0	0	0	0	0	0

Note: - = not applicable.

Table E.18: Summary of Benthic Invertebrate Endpoints Collected by Area-based (1/3 m^2) Kick and Sweep Sampling at Greenhills and Gardine Creeks, September 2021

Watercourse	Biological Area Code	Station	Density (No. org/m^2)	Biomass (g/m^2)	LPL Richness (No. of taxa)	Family Richness	EPT (%)	Ephemeroptera (%)	Plecoptera (%)	Trichoptera (%)	Diptera (%)
Upper Greenhills Creek	RG_GHUT	1	11,952	7.1	27	15	20	0	19	0.80	76
		2	4,836	2.7	17	12	7.4	0	5.0	2.5	87
		3	6,048	5.9	24	12	19	0	14	4.8	76
		4	7,200	4.1	20	12	11	0	5.3	5.7	87
		5	5,472	2.5	15	10	15	0	7.0	8.3	84
		6	6,243	4.3	24	17	27	0.38	20	6.5	70
	RG_GHNF	1	11,067	4.3	25	12	32	0	31	1.3	66
		2	13,680	6.9	22	11	41	0	38	2.8	59
		3	15,504	4.0	21	9.0	28	0	27	0.31	73
		4	2,256	0.79	20	12	47	0	37	10	50
		5	2,688	1.8	19	11	43	0	41	2.2	55
		6	14,304	4.0	22	10	33	0	33	0	66
	RG_GHFF	1	3,360	1.7	9.0	7.0	9.3	0	8.9	0.36	90
		2	1,593	1.0	22	16	7.0	0	5.7	1.3	92
		3	1,128	0.61	18	14	28	0.53	23	4.3	69
		4	1,836	1.0	13	10	11	0	11	0.33	88
		5	2,964	1.6	16	13	15	0	13	2.0	83
		6	5,532	3.1	17	10	13	0.22	13	0	85
Lower Greenhills Creek	RG_GHBP	1	5,304	12	15	14	17	0	12	4.5	18
		2	4,500	6.4	24	19	41	0.13	32	9.3	42
		3	4,842	11	19	17	37	0.50	27	9.0	11
		4	5,574	12	18	17	51	0.43	36	15	20
		5	16,230	21	23	19	30	0.44	20	10	43
		6	6,462	12	16	14	25	0.19	12	13	17
Gardine Creek	RG_GAUT	1	420	0.85	12	10	66	5.7	31	29	23
		2	918	1.1	18	13	83	6.5	71	5.2	3.9
		3	678	0.66	23	17	72	2.7	64	5.3	12
		4	702	1.1	16	12	68	1.7	50	15	15
		5	558	0.58	17	11	88	0	56	32	10
		6	771	1.7	16	10	91	1.6	78	11	6.2
	RG_GANF	1	930	1.1	23	19	74	2.6	57	14	22
		2	804	0.99	30	20	73	3.0	35	36	26
		3	1,089	1.2	25	18	54	3.9	42	8.3	39
		4	3,276	2.1	24	18	71	7.0	61	3.3	28
		5	1,164	0.77	13	11	59	14	44	0.52	35
		6	960	0.48	17	14	70	7.5	59	3.1	26

Notes: No. org/m^2 = number of organisms per square metre; g/m^2 = grams per square metre; LPL = lowest practical level; EPT = Ephemeroptera, Plecoptera, and Trichoptera; % = percent.

Table E.19: Summary of Benthic Invertebrate Endpoints Collected by Timed Kick and Sweep Sampling at Greenhills Creek, September 2021[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	2,360	20	12	66	0	66	0	33	1,553	0	1,553	0	787
		2	8,060	23	12	46	0	45	1.5	53	3,740	0	3,620	120	4,280
		3	2,480	17	12	45	0	45	0.4	54	1,120	0	1,110	10	1,335
Lower Greenhills Creek	RG_GHCKD	1	5,557	28	23	64	1.8	45	17	15	3,543	100	2,514	929	857
		2	6,420	20	15	50	0.62	39	9.7	28	3,180	40	2,520	620	1,820
		3	6,820	21	16	36	0.29	22	13	37	2,420	20	1,520	880	2,520

Notes: LPL = Lowest Practical Level; No. = number; EPT = Ephemeroptera, Plecoptera, Trichoptera; % = percent; CABIN = Canadian Aquatic Biomonitoring Network; RAEMP = Regional Aquatic Effects Monitoring Program.

[a] Samples were collected using three-minute kicks consistent with CABIN protocols.

[b] Biological monitoring area RG_GHCKD is a RAEMP monitoring area.

Table E.20: Comparison of Benthic Invertebrate Community Endpoints Among Treated (RG_GHBP) and Untreated Areas of Greenhills Creek, 2016 to 2021

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./m²)	log_{10}	0.011	<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	B	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	AB	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	B	-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	AB	1.8	A	2.2	A	0.41
Total Biomass (g/m²)	log_{10}	0.018	<0.001	<0.001	2016	6.7	1.2	1.1	1.1	A	B	B	B	-8.8	-9.2	-9.2	AB	baseline	C	baseline	BC	baseline	B	baseline
					2017	2.9	1.9	0.89	0.63	A	AB	C	BC	-1.0	-3.8	-3.0	B	-4.3	ABC	0.64	C	-1.4	B	-0.57
					2018	3.6	3.6	2.0	1.4	A	A	B	AB	0.037	-1.6	-0.96	B	-3.2	AB	1.5	ABC	0.51	AB	1.5
					2019	3.0	1.4	0.80	0.95	A	AB	B	B	-0.75	-1.2	-1.3	B	-4.2	BC	0.24	BC	-0.38	B	-0.86
					2020	4.1	4.6	3.2	1.7	AB	A	B	AB	0.22	-1.8	-0.52	B	-2.5	A	1.8	AB	1.2	A	2.8
					2021	12	4.1	1.3	3.0	A	B	BC	C	-2.8	-3.6	-5.8	A	2.8	A	1.6	A	2.6	AB	0.45
LPL Richness	none	<0.001	<0.001	<0.001	2016	26	19	19	20	A	B	B	B	-2.0	-1.6	-1.9	AB	baseline	BC	baseline	A	baseline	AB	baseline
					2017	26	24	20	17	A	AB	C	BC	-1.2	-4.7	-3.0	A	0.048	A	1.5	AB	-1.1	AB	0.32
					2018	22	16	20	15	A	B	B	A	-2.6	-2.8	-0.64	ABC	-1.1	C	-0.96	B	-1.6	A	0.38
					2019	21	17	19	19	A	A	A	A	-1.4	-0.92	-0.66	BC	-1.3	BC	-0.42	AB	-0.45	AB	0.11
					2020	23	20	22	18	A	AB	B	A	-1.4	-2.5	-0.25	ABC	-0.82	ABC	0.37	AB	-0.73	A	1.0
					2021	19	21	16	21	AB	A	A	B	0.36	0.36	-1.0	C	-1.8	AB	0.58	A	0.17	B	-1.1
Family Richness	none	0.052	0.016	<0.001	2016	19	12	13	12	A	B	B	B	-3.6	-3.3	-3.0	A	baseline	A	baseline	A	baseline	A	baseline
					2017	19	13	13	11	A	B	B	B	-4.0	-5.4	-3.8	A	-0.083	A	1.0	A	-0.69	A	0.10
					2018	17	8.5	14	9.2	A	B	B	A	-5.0	-4.6	-1.5	A	-1.2	B	-2.9	A	-1.5	A	0.70
					2019	17	10	13	11	A	B	B	B	-3.0	-2.7	-1.9	A	-0.92	AB	-1.4	A	-0.62	A	-0.10
					2020	18	11	14	11	A	C	C	B	-3.6	-3.4	-1.9	A	-0.50	AB	-0.86	A	-0.54	A	0.70
					2021	17	13	12	11	A	B	B	B	-1.6	-2.6	-2.2	A	-1.2	A	1.0	A	-0.69	A	-0.80
%EPT	log_{10}	<0.001	0.001	<0.001	2016	30	30	10	32	A	A	A	B	-0.072	0.36	-5.0	B	baseline	A	baseline	BC	baseline	D	baseline
					2017	36	23	19	65	B	BC	A	C	-2.3	3.2	-3.3	AB	0.80	AB	-0.72	A	2.6	BC	3.1
					2018	45	19	35	31	A	B	A	A	-5.6	-2.3	-1.7	AB	1.9	ABC	-1.3	BC	-0.12	A	5.9
					2019	60	13	27	25	A	C	B	B	-9.1	-5.1	-4.8	A	3.3	C	-2.4	C	-0.92	AB	4.6
					2020	32	16	30	47	A	B	A	A	-1.9	1.1	-0.16	B	0.29	BC	-1.8	AB	1.4	AB	5.3
					2021	32	15	12	37	A	B	A	B	-1.8	0.38	-2.4	B	0.23	BC	-1.9	BC	0.46	CD	0.90
%Ephemeroptera	rank	<0.001	<0.001	<0.001	2016	0.98	0	0.15	0	A	B	B	B	-1.6	-1.6	-1.3	BC	baseline	A	- [c]	AB	- [c]	C	baseline
					2017	1.5	0	1.4	0.51	A	B	B	A	-1.4	-0.92	-0.13	AB	0.88	A	- [c]	A	- [c]	A	5.6
					2018	4.7	0	1.1	0	A	C	C	B	-3.3	-3.3	-2.5	AB	6.1	A	- [c]	B	- [c]	AB	4.3
					2019	34	0	0.30	0	A	B	B	B	-4.5	-4.5	-4.4	A	53	A	- [c]	AB	- [c]	BC	0.69
					2020	4.9	0	2.0	0	A	B	B	A	-2.1	-2.1	-1.3	AB	6.4	A	- [c]	AB	- [c]	A	8.1
					2021	0.31	0	0	0	A	AB	B	AB	-1.3	-1.3	-1.3	C	-1.1	A	- [c]	B	- [c]	C	-0.67
%Plecoptera	log_{10}	<0.001	<0.001	<0.001	2016	14	26	7.0	32	B	A	A	C	0.88	1.1	-0.88	BC	baseline	A	baseline	B	baseline	D	baseline
					2017	24	22	15	65	B	B	A	B	-0.32	2.6	-1.3	AB	0.78	AB	-0.59	A	2.6	BC	1.9
					2018	30	18	32	31	A	A	A	A	-3.7	0.37	0.56	A	1.0	ABC	-1.1	B	-0.056	A	3.9
					2019	17	11	25	24	AB	B	A	A	-0.78	0.68	0.72	ABC	0.27	C	-2.6	B	-0.97	AB	3.2
					2020	11	11	26	45	B	B	A	A	0.058	2.0	1.3	C	-0.34	BC	-2.6	AB	1.3	AB	3.4
					2021	21	10	11	34	A	B	A	B	-1.6	1.0	-1.4	AB	0.59	C	-2.9	AB	0.29	CD	1.2
%Trichoptera	rank	0.012	<0.001	<0.001	2016	12	2.1	3.1	0.34	A	B	C	B	-2.1	-2.4	-1.9	A	baseline	AB	baseline	AB	baseline	A	baseline
					2017	8.0	0.80	2.3	0	A	BC	C	AB	-2.0	-2.2	-1.5	A	-0.86	BC	-0.99	B	-0.67	A	-0.69
					2018	10	0.26	1.3	0	A	BC	C	B	-4.1	-4.2	-3.6	A	-0.35	C	-1.4	B	-0.67	A	-1.6
					2019	9.4	1.1	1.2	1.0	A	B	B	B	-1.5	-1.5	-1.5	A	-0.56	ABC	-0.79	AB	1.4	A	-1.6
					2020	12	6.2	2.4	1.4	A	B	B	B	-1.5	-2.8	-2.5	A	-0.017	A	3.0	AB	2.2	A	-0.60
					2021	9.5	5.2	0.84	1.8	A	AB	BC	C	-1.6	-2.9	-3.2	A	-0.53	A	2.3	A	2.9	A	-2.0
%Diptera	rank	<0.001	0.009	<0.001	2016	39	61	87	60	C	B	B	A	2.6	2.4	5.6	A	baseline	B	baseline	AB	baseline	A	baseline
					2017	43	70	77	30	B	A	B	A	5.2	-2.6	6.7	A	0.50	AB	1.9	C	-2.8	AB	-6.7
					2018	46	73	64	62	B	A	A	A	4.1	2.4	2.7	A	0.88	A	2.7	AB	0.24	C	-16
					2019	27	80	73	69	C	A	B	AB	9.0	7.1	7.8	A	-1.4	A	4.3	A	0.85	BC	-9.7
					2020	33	77	66	49	C	A	B	A	6.0	2.2	4.6	A	-0.68	A	3.4	BC	-1.0	BC	-14
					2021	19	80	87	63	C	A	B	A	8.3	5.9	9.1	A	-2.3	A	4.3	AB	0.27	A	-0.21

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./m^2 = number or organisms per metre squared; < = less than; g = grams; LPL = lowest practical level; EPT = Ephemeroptera, Plecoptera, and Trichoptera; - = not applicable; > = greater than; SD = standard deviation. Letters A, B, and C 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 E.21: Statistical Comparisons of Benthic Invertebrate Community Endpoints for Biological Monitoring Areas on Gardine Creek (RG_GAUT and RG_GANF), 2019 to 2021

Biological Monitoring Area	Endpoints	Test [a]	Data Transformation	Test P-value	MCT			MOD [b]		
					2019	2020	2021	2019 vs 2020	2019 vs 2021	2020 vs 2021
RG_GAUT	Density (No./m²)	ANOVA	log_{10}	<0.001	2,858	2,356	655	-0.28	-2.1	-2.6
	Total Biomass (g/m²)	ANOVA	log_{10}	<0.001	1.8	7.3	0.93	2.4	-1.1	-2.2
	LPL Richness	ANOVA	none	<0.001	21	31	16	5.0	-2.5	-3.9
	Family Richness	ANOVA	log_{10}	0.002	13	18	12	3.6	-0.56	-2.2
	%EPT	ANOVA	none	<0.001	85	55	78	-5.3	-1.3	3.2
	%Ephemeroptera	K-W	rank	0.064	0.36	1.1	2.2	1.4	3.5	1.3
	%Plecoptera	ANOVA	none	<0.001	84	43	59	-7.0	-4.3	1.3
	%Trichoptera	ANOVA	none	0.013	1.1	10	16	11	18	0.92
	%Diptera	ANOVA	log_{10}	<0.001	9.9	31	10	4.7	0.077	-2.7
RG_GANF	Density (No./m²)	ANOVA	log_{10}	0.358	1,133	2,011	1,200	0.56	0.055	-0.93
	Total Biomass (g/m²)	ANOVA	log_{10}	0.056	0.49	2.1	1.0	1.0	0.49	-1.2
	LPL Richness	ANOVA	none	0.007	17	29	21	1.9	0.64	-1.7
	Family Richness	ANOVA	log_{10}	0.022	11	19	16	1.2	0.88	-1.2
	%EPT	ANOVA	none	0.003	47	37	67	-0.69	1.4	2.2
	%Ephemeroptera	K-W	rank	0.002	0.20	0	5.4	-0.67	18	- [c]
	%Plecoptera	ANOVA	none	0.040	46	31	50	-1.00	0.29	1.8
	%Trichoptera	K-W	rank	0.014	1.1	4.0	5.8	4.4	7.0	3.1
	%Diptera	ANOVA	log_{10}	0.004	43	54	29	0.69	-1.2	-2.4

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 of organisms per square metre; ANOVA = Analysis of Variance; < = less than; g/m^2 = grams per square metre; LPL = Lowest Practical Level; % = percent; EPT = combined Ephemeroptera, Plecoptera, and Trichoptera; - = not calculated; > = greater than; HSD = Honestly Significant Difference; K-W = Kruskal-Wallis; M-W = Mann-Whitney; SD = standard deviation.

[a] Statistical tests included ANOVA followed by Tukey's HSD post hoc tests, or K-W H-tests followed by M-W U-tests.

[b] MOD = ($MCT_{later\ year}$ - $MCT_{early\ yea}$r)/$SD_{early\ year}$.

[c] MOD could not be calculated because the SD was "0".

Table E.22: 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 (218 to 2020) Treatment: Significant Year Interactions

Endpoint	Term	P-value	Treated Versus Untreated MOD [a,b]							
			2016				2017			
			2018	2019	2020	2021	2018	2019	2020	2021
Biomass (g/m²)	BA	<0.001	-							
	CI	<0.001								
	BA x CI	0.042								
	Year(BA)	<0.001								
	Area(CI)	<0.001								
	Year(BA) x CI	0.018	2.0	1.1	2.2	0.39	0.79	-0.1	1.1	-0.77
	Area(CI) x BA	0.731	-							
	Area(CI) x Year(BA)	0.119								
%Ephemeroptera	BA	<0.001	-							
	CI	<0.001								
	BA x CI	<0.001								
	Year(BA)	<0.001								
	Area(CI)	0.193								
	Year(BA) x CI	<0.001	-1.9	-18	-2.7	0.32	-1.4	-17	-2.2	0.82
	Area(CI) x BA	0.969	-							
	Area(CI) x Year(BA)	0.913								
%Trichoptera	BA	0.461	-							
	CI	<0.001								
	BA x CI	0.838								
	Year(BA)	0.002								
	Area(CI)	0.056								
	Year(BA) x CI	0.060	0.17	1.0	0.028	1.3	-1.2	-0.41	-1.4	-0.12
	Area(CI) x BA	0.202	-							
	Area(CI) x Year(BA)	0.475								

P-value for relevant BACI term <0.1.
Treated area decreased relative to untreated area.
Treated area increased relative to untreated area.

Notes: MOD = Magnitude of Difference; g/m^2 = grams per square metre; BA = Before-After; < = less than; CI = Control-Impact; % = percent; SD = standard deviation.

[a] MOD = ($AfterYear_{treated}$ -$AfterYear_{untreated}$)-($BeforeYear_{treated}$ -$BeforeYear_{untreated}$) /SD.

[b] Unshaded MODs were not significant in the post-hoc analysis. A p-value of 0.1, corrected for the number of tests, was used.

Table E.23: 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 2021) Treatment: Significant Year and Area Interactions

Endpoint	Term	P-value	MOD for Years Before (2016 & 2017) and After (2018 to 2021) Treatment [a,b]																							
			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	2018	2019	2020	2021	2018	2019	2020	2021	2018	2019	2020	2021	2018	2019	2020	2021	2018	2019	2020	2021
Density (No./m^2)	BA	<0.001																								
	CI	<0.001																								
	BA x CI	0.002																								
	Year(BA)	<0.001	-								-								-							
	Area(CI)	<0.001																								
	Year(BA) x CI	0.566																								
	Area(CI) x BA	0.327																								
	Area(CI) x Year(BA)	0.034	2.3	2.1	2.7	1.8	0.22	0.041	0.64	-0.23	2.0	2.4	1.3	2.6	1.3	1.8	0.57	1.9	1.0	1.3	2.1	0.73	0.47	0.67	1.5	0.16
LPL Richness	BA	<0.001																								
	CI	<0.001																								
	BA x CI	0.007																								
	Year(BA)	0.062	-								-								-							
	Area(CI)	0.178																								
	Year(BA) x CI	0.308																								
	Area(CI) x BA	0.169																								
	Area(CI) x Year(BA)	<0.001	0.28	1.1	1.3	2.7	-1.3	-0.50	-0.22	1.2	-0.33	1.1	0.22	2.3	0.78	2.2	1.3	3.4	1.7	1.6	2.0	0.95	1.4	1.3	1.7	0.67
Family Richness	BA	0.003																								
	CI	<0.001																								
	BA x CI	0.306																								
	Year(BA)	0.238	-								-								-							
	Area(CI)	<0.001																								
	Year(BA) x CI	0.915																								
	Area(CI) x BA	0.193																								
	Area(CI) x Year(BA)	0.012	-0.47	0.079	0	1.7	-1.1	-0.55	-0.63	1.0	-0.39	0.24	-0.079	0.39	0.24	0.87	0.55	1.0	1.7	0.79	1.0	0.47	1.5	0.63	0.87	0.32
%EPT	BA	0.871																								
	CI	<0.001																								
	BA x CI	0.001																								
	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	-2.6	-4.8	-1.6	-1.7	-1.3	-3.6	-0.36	-0.47	-1.6	-3.2	1.1	0.10	-4.3	-5.9	-1.6	-2.6	0.98	-1.3	2.0	0.036	0.51	-1.8	1.6	-0.43
%Plecoptera	BA	0.090																								
	CI	0.008																								
	BA x CI	0.281																								
	Year(BA)	<0.001	-								-								-							
	Area(CI)	<0.001																								
	Year(BA) x CI	0.023																								
	Area(CI) x BA	<0.001																								
	Area(CI) x Year(BA)	<0.001	-2.3	-2.0	-1.4	-2.4	-0.78	-0.51	0.13	-0.90	-1.5	-0.50	1.7	-0.49	-4.0	-3.0	-0.81	-3.0	1.3	1.7	2.7	-0.19	1.3	1.7	2.7	-0.18
%Diptera	BA	0.289																								
	CI	<0.001																								
	BA x CI	0.004																								
	Year(BA)	0.030	-								-								-							
	Area(CI)	<0.001																								
	Year(BA) x CI	<0.001																								
	Area(CI) x BA	<0.001																								
	Area(CI) x Year(BA)	<0.001	0.40	2.8	1.8	3.0	0.26	2.7	1.6	2.9	-0.75	1.2	-0.88	1.1	3.1	5.0	3.0	4.9	-3.2	-0.72	-2.0	0.83	-1.6	0.90	-0.36	2.5

- P-value for relevant BACI term <0.1.
- Treated area decreased relative to untreated area.
- Treated area increased relative to untreated area.

Notes: MOD = Magnitude of Difference; No./m^2 = number of organisms per square metre; BA = Before-After; < = less than; CI = Control-Impact; LPL = Lowest Practical Level; % = percent; EPT = combined Ephemeroptera, Plecoptera, and Trichoptera; SD = standard deviation.

[a] MOD = $(AfterYear_{treated} - AfterYear_{untreated}) - (BeforeYear_{treated} - BeforeYear_{untreated})$ /SD.

[b] Unshaded MODs were not significant in the post-hoc analysis. A p-value of 0.1, corrected for the number of tests, was used.

Table E.24: Summary of Benthic Invertebrate Taxa Present at RG_GHBP on Lower Greenhills Creek Before (2016 and 2017) But Not After (2018 to 2021) Initation of Antiscalant Addition

Taxon				Incidence of Taxa Present in 2016 and 2017 But Absent in 2018 to 2021											
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
Clitellata	Tubificida	Naididae	Chaetogaster	-	-	-	-	-	-	-	-	-	X	-	-
Clitellata	Tubificida	Naididae	Tubificinae	X	X	X	-	-	X	-	-	-	X	-	-
Insecta	Diptera	Chironomidae	Diamesa	-	-	-	-	-	-	-	-	X	-	-	-
Insecta	Diptera	Chironomidae	Hydrobaenus	-	-	X	-	-	-	-	-	-	-	-	-
Insecta	Diptera	Chironomidae	Macropelopia	-	-	-	-	-	-	-	-	-	X	-	-
Insecta	Diptera	Chironomidae	Psectrocladius	-	-	-	-	-	-	-	-	X	-	-	-
Insecta	Diptera	Chironomidae	Rheotanytarsus	X	X	X	X	X	X	-	-	-	-	-	-
Insecta	Diptera	Chironomidae	Stempellina	-	-	-	-	-	-	-	-	-	-	-	X
Insecta	Diptera	Chironomidae	Tanytarsus	-	-	-	-	-	-	-	-	-	X	X	X
Insecta	Diptera	Chironomidae	Tvetenia	-	X	-	-	-	-	-	X	X	-	-	-
Insecta	Diptera	Tipulidae	Limnophila	-	-	-	-	-	-	X	-	-	-	-	-
Insecta	Ephemeroptera	Ephemerellidae	Ephemerellidae	-	-	-	-	-	-	X	X	X	X	X	-
Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	X	-	-	-	-	-	X	X	-	-	-	-
Insecta	Plecoptera	Taeniopterygidae	Taeniopterygidae	-	-	X	-	-	X	X	-	-	-	-	-
Insecta	Trichoptera	Brachycentridae	Brachycentrus	-	-	-	-	-	-	X	-	-	-	X	-

Taxon is present in samples from one pre-treatment year (e.g., 2016) but not the other (e.g., 2017).

Notes: X = taxon present in sample; - = taxon not present in sample.

Table E.25: Supporting Measures Associated with Petite Ponar Benthic Invertebrate Community Sampling at RG_GHP, September 2021

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	22-Sep-21		23-Sep-21		21-Sep-21		21-Sep-21		23-Sep-21		22-Sep-21	
UTMs (NAD83, Zone 11U) - Easting	653445		653654		653477		653682		653537		653681	
UTMs (NAD83, Zone 11U) - Northing	5546030		5546040		5545992		5545999		5545698		5545955	
Station Depth (m)	2.75		2.00		4.50		3.50		5.50		4.50	
Habitat Characteristics												
Temperature (°C)	10.2	10.2	10.4	10.2	10.1	9.5	10.0	10.0	10.3	9.9	10.1	10.0
DO (% sat)	107.1	71.1	111.2	110.8	101.3	98.1	103.4	94.5	107.9	97.4	103.8	89.9
DO (mg/L)	10.04	6.66	10.42	10.44	9.56	9.42	9.85	8.95	10.10	9.21	9.75	8.51
pH	8.32	8.14	8.34	8.33	8.33	8.27	8.28	8.29	8.33	8.22	8.32	8.22
Conductance (µS/cm)	1,207	1,219	1,208	1,201	1,200	1,186	1,196	1,195	1,208	1,200	1,202	1,198
Specific Conductance (µS/cm)	1,680	1,700	1,680	1,680	1,680	1,690	1,680	1,670	1,680	1,690	1,680	1,680
Secchi Depth (m)	2.75		2.00		4.50		3.50		2.38		3.63	
Water Colour, Clarity	dark green, slightly turbid		dark green, slightly turbid		green, slightly turbid		green, slightly turbid		dark green, slightly turbid		dark green, slightly turbid	
Benthic Invertebrate Sampling [a]												
Sample Texture	95% sand and fines, 5% organics		80% sand and fines, 10% organics		100% sand and fines		99% sand and fines, 1% organics		100% sand and fines		100% sand and fines	
Macrophytes (in sampler)	N		A		-		N		N		N	
Algae (in sampler)	C		N		-		C		N		N	
Comments	Abundant filamentous algae.		Unable to sample sediment due to *Chara* covering substrate.		-		Abundant filamentous algae. Some present in sediment sample.		-		-	

Notes: ID = identifier; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; m = metres; °C = degrees Celsius; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; % = percent; N = none; A = abundant; - = no data/not recorded; C = common; cm = centimetres.

[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. One sample jar per station was submitted to the laboratory for analysis.

Table E.26: **Densities (No./m²) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond, Based on the Lowest Practical Level of Taxonomy, 2018 to 2021**

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	13,847	13,984	6,234	36,683	637	5,408	9,610	4,340	5,304	10,781	1,981	7,543
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Hirudinida	Erpobdellidae	Erpobdellidae	0	0	0	0	0	17	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	Tubificinae	0	69	0	34	34	0	34	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0	0	69	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	17	69	0	17	0	0	0
Gastropoda	Basommatophora	Planorbidae	Gyraulus	0	276	0	0	0	0	34	1,516	0	34	0	0
Insecta	Coleoptera	Dytiscidae	Hydroporus	0	0	0	0	0	0	0	69	0	0	0	0
Insecta	Coleoptera	Haliplidae	Haliplus	69	0	0	34	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	0	0	0	0	52	0	103	69	9	0	0	0
Insecta	Diptera	Chaoboridae	Chaoboridae	0	0	34	0	69	0	0	0	0	0	146	0
Insecta	Diptera	Chironomidae	Ablabesmyia	573	4,684	177	103	0	17	218	1,309	53	212	0	69
Insecta	Diptera	Chironomidae	Apsectrotanypus	0	0	0	0	0	0	36	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	982	69	989	413	7,602	2,789	145	1,516	115	212	560	451
Insecta	Diptera	Chironomidae	Cryptochironomus	82	276	0	34	70	0	0	0	0	0	9	0
Insecta	Diptera	Chironomidae	Dicrotendipes	0	69	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paramerina	0	0	0	0	0	0	36	0	0	0	0	0
Insecta	Diptera	Chironomidae	Paratanytarsus	82	69	0	34	35	0	36	0	0	0	0	0
Insecta	Diptera	Chironomidae	Polypedilum	0	69	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Procladius	245	276	2,366	3,651	855	5,491	145	138	2,009	1,695	577	3,678
Insecta	Diptera	Chironomidae	Psectrocladius	573	138	177	0	0	0	400	69	79	530	0	0
Insecta	Diptera	Chironomidae	Sergentia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stictochironomus	0	69	0	0	35	0	0	0	18	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	82	69	459	138	428	314	291	207	1,163	141	1,145	520
Insecta	Ephemeroptera	Baetidae	Callibaetis	207	896	620	551	34	293	241	758	155	34	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	69	9	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	0	0	0	0	0	0	0	26	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	103	34	17	121	276	69	146	388	34	138
Malacostraca	Amphipoda	Hyalellidae	Hyalella	413	1,171	103	964	258	413	207	1,929	34	1,068	9	69

Notes: No./m^2 = number of organisms per square metre; - = not applicable.

Table E.26: Densities (No./m²) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond, Based on the Lowest Practical Level of Taxonomy, 2018 to 2021

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	8,727	5,818	4,069	4,502	2,900	5,879	7,965	9,697	5,307	4,831	6,779	6,952
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0	0	0	9	0	0	0
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	554	0	0	0	0	9
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	69	0	9	0	0	0	0	0	9
Gastropoda	Basommatophora	Planorbidae	Gyraulus	139	13,160	0	139	26	0	554	9,212	9	0	0	26
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	69	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	35	17	9	0	0	17	225	182	190
Insecta	Diptera	Chironomidae	Ablabesmyia	731	416	18	146	0	0	208	416	0	17	0	0
Insecta	Diptera	Chironomidae	Apsectrotanypus	0	0	37	0	9	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	292	3,602	1,502	803	1,768	796	416	277	87	0	502	199
Insecta	Diptera	Chironomidae	Cryptochironomus	0	0	0	0	0	9	69	416	69	139	43	17
Insecta	Diptera	Chironomidae	Dicrotendipes	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	69	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	621	37	70	554	139	251	779	130	1,255
Insecta	Diptera	Chironomidae	Psectrocladius	1,024	0	55	1,607	37	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	17	139	0	52	52	182	459
Insecta	Ephemeroptera	Baetidae	Callibaetis	0	1,801	139	208	0	9	416	623	0	312	0	9
Insecta	Ephemeroptera	Caenidae	Caenis	0	0	0	0	0	0	69	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	69	78	0	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	139	0	0	9	0	9	0	0	0	0	9
Malacostraca	Amphipoda	Gammaridae	Gammarus	831	554	234	797	43	225	69	407	147	450	139	173
Malacostraca	Amphipoda	Hyalellidae	Hyalella	416	139	17	242	0	0	69	2,078	0	17	0	26

Note: No./m^2 = number of organisms per square metre; - = not applicable.

Table E.27: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond, Based on the Lowest Practical Level of Taxonomy, 2018 to 2021

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	81	62	55	86	6.3	36	81	36	58	71	44	59
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0	0	0.57	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	0.58	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	Gyraulus	0	1.2	0	0	0	0	0	13	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Hydroporus	0	0	0	0	0	0	0	0.57	0	0	0	0
Insecta	Coleoptera	Haliplidae	Haliplus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	0	0	0	0	0.51	0	0.87	0.57	0	0	0	0
Insecta	Diptera	Chaoboridae	Chaoboridae	0	0	0	0	0.68	0	0	0	0	0	3.3	0
Insecta	Diptera	Chironomidae	Ablabesmyia	3.3	21	1.6	0	0	0	1.8	11	0.58	1.4	0	0.54
Insecta	Diptera	Chironomidae	Apsectrotanypus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	5.7	0	8.8	0.97	75	19	1.2	13	1.3	1.4	13	3.5
Insecta	Diptera	Chironomidae	Cryptochironomus	0	1.2	0	0	0.69	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Dicrotendipes	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	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	Procladius	1.4	1.2	21	8.6	8.4	37	1.2	1.1	22	11	13	29
Insecta	Diptera	Chironomidae	Psectrocladius	3.3	0.62	1.6	0	0	0	3.4	0.57	0.87	3.5	0	0
Insecta	Diptera	Chironomidae	Sergentia	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stictochironomus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	0	0	4.1	0	4.2	2.1	2.4	1.7	13	0.94	26	4.1
Insecta	Ephemeroptera	Baetidae	Callibaetis	1.2	4.0	5.5	1.3	0	2.0	2.0	6.2	1.7	0	0	2.7
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	0.96	0	0	0	0	0	0.57	0	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	0	0	0.92	0	0	0.81	2.3	0.57	1.6	2.6	0.77	1.1
Malacostraca	Amphipoda	Hyalellidae	Hyalella	2.4	5.2	0.92	2.3	2.6	2.8	1.7	16	0	7.1	0	0.54

Note: - = not applicable.

Table E.27: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond, Based on the Lowest Practical Level of Taxonomy, 2018 to 2021

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	22	61	48	58	84	70	41	89	71	85	74
Clitellata	-	Enchytraeidae	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0
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	4.9	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	Lebertia	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Mideopsidae	Mideopsis	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Pionidae	Pionidae	1.0	0	0	0.74	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	Gyraulus	1.0	51	0	1.5	0.52	0	4.9	39	0	0	0	0
Insecta	Coleoptera	Dytiscidae	Hydroporus	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Haliplidae	Haliplus	2.1	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	Bezzia	2.1	0	0	0	0	0	1.2	0	0	0	0	0
Insecta	Diptera	Chaoboridae	Chaoboridae	0	0	0	0	0	0	0	0	0	3.3	2.3	2.0
Insecta	Diptera	Chironomidae	Ablabesmyia	5.4	1.6	0	1.6	0	0	1.8	1.8	0	0	0	0
Insecta	Diptera	Chironomidae	Apsectrotanypus	0	0	0.55	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Chironomus	2.2	14	23	8.6	36	11	3.7	1.2	1.5	0	6.3	2.1
Insecta	Diptera	Chironomidae	Cryptochironomus	0	0	0	0	0	0	0.61	1.8	1.2	2.0	0.54	0
Insecta	Diptera	Chironomidae	Dicrotendipes	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	1.1	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	Procladius	2.2	0.53	6.3	6.6	0.75	1.0	4.9	0.59	4.2	11	1.6	13
Insecta	Diptera	Chironomidae	Psectrocladius	7.6	0	0.82	17	0.75	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Sergentia	0	0.53	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Chironomidae	Stictochironomus	0	0	0	0	0	0	0	0.59	0	0	0	0
Insecta	Diptera	Chironomidae	Tanytarsus	1.1	0.53	2.7	2.0	2.6	0	1.2	0	0.87	0.76	2.3	4.9
Insecta	Ephemeroptera	Baetidae	Callibaetis	0	6.9	2.1	2.2	0	0	3.7	2.6	0	4.6	0	0
Insecta	Ephemeroptera	Caenidae	Caenis	0	0	0	0	0	0	0.61	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	0	0	0	0	0.61	0	0	0	0	0
Insecta	Trichoptera	Phryganeidae	Phryganeidae	0	0.53	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	Gammarus	6.2	2.1	3.5	8.5	0.87	3.2	0.61	1.7	2.5	6.6	1.7	1.9
Malacostraca	Amphipoda	Hyalellidae	Hyalella	3.1	0.53	0	2.6	0	0	0.61	8.8	0	0	0	0

Note: - = not applicable.

Table E.28: Densities (No./m²) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond, Based on the Family Level of Taxonomy, 2018 to 2021

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	13,847	13,984	6,234	36,683	637	5,408	9,610	4,340	5,304	10,781	1,981	7,543
Clitellata	-	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Hirudinida	Erpobdellidae	0	0	0	0	0	17	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	69	0	34	34	0	34	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0	0	69	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	17	69	0	17	0	0	0
Gastropoda	Basommatophora	Planorbidae	0	276	0	0	0	0	34	1,516	0	34	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	69	0	0	0	0
Insecta	Coleoptera	Haliplidae	69	0	0	34	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	52	0	103	69	9	0	0	0
Insecta	Diptera	Chaoboridae	0	0	34	0	69	0	0	0	0	0	146	0
Insecta	Diptera	Chironomidae	2,618	5,787	4,168	4,374	9,024	8,611	1,309	3,238	3,436	2,790	2,291	4,719
Insecta	Ephemeroptera	Baetidae	207	896	620	551	34	293	241	758	155	34	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	69	9	0	0	0
Insecta	Trichoptera	Phryganeidae	0	0	0	0	0	0	0	0	26	0	0	0
Malacostraca	Amphipoda	Gammaridae	0	0	103	34	17	121	276	69	146	388	34	138
Malacostraca	Amphipoda	Hyalellidae	413	1,171	103	964	258	413	207	1,929	34	1,068	9	69

Notes: No./m^2 = number of organisms per square metre; - = not applicable.

Table E.28: Densities (No./m²) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond, Based on the Family Level of Taxonomy, 2018 to 2021

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	8,727	5,818	4,069	4,502	2,900	5,879	7,965	9,697	5,307	4,831	6,779	6,952
Clitellata	-	Enchytraeidae	0	0	0	0	0	0	0	0	9	0	0	0
Clitellata	Hirudinida	Erpobdellidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	554	0	0	0	0	9
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	69	0	9	0	0	0	0	0	9
Gastropoda	Basommatophora	Planorbidae	139	13,160	0	139	26	0	554	9,212	9	0	0	26
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	69	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	35	17	9	0	0	17	225	182	190
Insecta	Diptera	Chironomidae	2,632	4,433	2,216	3,359	1,983	892	1,385	1,455	468	987	857	1,931
Insecta	Ephemeroptera	Baetidae	0	1,801	139	208	0	9	416	623	0	312	0	9
Insecta	Ephemeroptera	Caenidae	0	0	0	0	0	0	69	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	69	78	0	0	0	0
Insecta	Trichoptera	Phryganeidae	0	139	0	0	9	0	9	0	0	0	0	9
Malacostraca	Amphipoda	Gammaridae	831	554	234	797	43	225	69	407	147	450	139	173
Malacostraca	Amphipoda	Hyalellidae	416	139	17	242	0	0	69	2,078	0	17	0	26

Notes: No./m^2 = number of organisms per square metre; - = not applicable.

Table E.29: **Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond, Based on the Family Level of Taxonomy, 2018 to 2021**

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	81	62	55	86	6.3	36	81	36	58	71	44	59
Clitellata	-	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Hirudinida	Erpobdellidae	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
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0	0	0.57	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	0.58	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	0	1.2	0	0	0	0	0	13	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0.57	0	0	0	0
Insecta	Coleoptera	Haliplidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	0	0	0	0	0.51	0	0.87	0.57	0	0	0	0
Insecta	Diptera	Chaoboridae	0	0	0	0	0.68	0	0	0	0	0	3.3	0
Insecta	Diptera	Chironomidae	15	26	37	10	89	58	11	27	38	18	51	37
Insecta	Ephemeroptera	Baetidae	1.2	4.0	5.5	1.3	0	2.0	2.0	6.2	1.7	0	0	2.7
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	0.96	0	0	0	0	0	0.57	0	0	0	0
Insecta	Trichoptera	Phryganeidae	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	0	0	0.92	0	0	0.81	2.3	0.57	1.6	2.6	0.77	1.1
Malacostraca	Amphipoda	Hyalellidae	2.4	5.2	0.92	2.3	2.6	2.8	1.7	16	0	7.1	0	0.54

Note: - = not applicable.

Table E.29: Relative Abundance (Percent[%]) of Benthic Invertebrate Taxa in Samples from Greenhills Creek Sedimentation Pond, Based on the Family Level of Taxonomy, 2018 to 2021

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	22	61	48	58	84	70	41	89	71	85	74
Clitellata	-	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Hirudinida	Erpobdellidae	0	0	0	0	0	0	0	0	0	0	0	0
Clitellata	Tubificida	Naididae	0	0	0	0	0	0	4.9	0	0	0	0	0
Euchelicerata	Trombidiformes	Lebertiidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Mideopsidae	0	0	0	0	0	0	0	0	0	0	0	0
Euchelicerata	Trombidiformes	Pionidae	1.0	0	0	0.74	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Planorbidae	1.0	51	0	1.5	0.52	0	4.9	39	0	0	0	0
Insecta	Coleoptera	Dytiscidae	0	0	0	0	0	0	0	0	0	0	0	0
Insecta	Coleoptera	Haliplidae	2.1	0	0	0	0	0	0	0	0	0	0	0
Insecta	Diptera	Ceratopogonidae	2.1	0	0	0	0	0	1.2	0	0	0	0	0
Insecta	Diptera	Chaoboridae	0	0	0	0	0	0	0	0	0	3.3	2.3	2.0
Insecta	Diptera	Chironomidae	20	17	33	36	40	13	12	6.2	7.8	14	11	21
Insecta	Ephemeroptera	Baetidae	0	6.9	2.1	2.2	0	0	3.7	2.6	0	4.6	0	0
Insecta	Ephemeroptera	Caenidae	0	0	0	0	0	0	0.61	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	0	0	0	0	0.61	0	0	0	0	0
Insecta	Trichoptera	Phryganeidae	0	0.53	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Gammaridae	6.2	2.1	3.5	8.5	0.87	3.2	0.61	1.7	2.5	6.6	1.7	1.9
Malacostraca	Amphipoda	Hyalellidae	3.1	0.53	0	2.6	0	0	0.61	8.8	0	0	0	0

Note: - = not applicable.

Table E.30: Summary of Benthic Invertebrate Community Endpoints Associated with Petite Ponar Sampling in Greenhills Creek Sedimentation Pond, September 2021

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	11,299	28	15	11	4.4	4.3	0	0.077	14	71	4.9
	2	23,619	63	13	8.0	2.64	2.64	0	0	6.2	41	39
	3	5,965	19	11	7.0	0	0	0	0	8.1	89	0.15
	4	6,823	27	9.0	6.0	4.6	4.6	0	0	18	71	0
	5	7,957	34	7.0	4.0	0	0	0	0	13	85	0
	6	9,351	28	15	12	0.19	0.093	0	0.093	23	74	0.28

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.

APPENDIX F
COMPARISON OF KICK SAMPLING METHODS

APPENDIX F COMPARISON OF KICK SAMPLING METHODS

F1 INTRODUCTION

F1.1 Background

At its outset in 2016, the objective of the Greenhills and Gardine Creeks Aquatic Monitoring Program was to measure changes (i.e., improvement or degradation) in aquatic ecosystem health of Greenhills Creek in response to calcite management.[1] Surber sampling was recommended by Minnow in 2016 to assess benthic invertebrate biomass and total density (as general indicators of the amount of food available to fish) as well as endpoints related to taxon richness (as an indication of diversity) and proportions of major taxa (e.g., the proportion of Ephemeroptera, Plecoptera, and Trichoptera [%EPT]; Minnow 2016). However, Surber and other types of area-based sampling (e.g., Hess sampling) could not be completed effectively in Greenhills Creek due to calcification of the substrates. Consequently, area-based kick sampling was implemented in place of Surber sampling in Greenhills Creek starting in 2016, and in Gardine Creek starting in 2019.[2] Additionally, the presence of barrage tufa and calcified woody debris, which together create step-pools within the creek channels, prevent the safe collection of three-minute Canadian Aquatic Biomonitoring Network (CABIN) kicks (i.e., timed kicks) at some stations or limit the area of true riffle habitat that can be covered. For these reasons, area-based kicks continue to be used to support the Greenhills and Gardine Creeks Aquatic Monitoring Program and timed kicks are completed at specific locations (as site conditions allow) to address specific data needs (see Sections 2.4 and 3.3 of the main report and Minnow 2021a).

In previous years of monitoring and reporting for the Greenhills and Gardine Creeks Aquatic Monitoring Program, data collected using the area-based kick sampling method were compared to regional reference area normal ranges. The regional reference area normal ranges are used in the Regional Aquatic Effects Monitoring Program (RAEMP) to evaluate benthic invertebrate community endpoints and were calculated using all timed kick data collected from reference areas between 2012 and 2019 (i.e., n = 175 samples from 46 reference sampling areas; Minnow 2020).

The study team acknowledged the inconsistencies in the methods underlying the area-based kick data and the reference area normal ranges (in addition to biological triggers;

[1] The overarching objective of the program was unchanged until 2021, when the scope of the program was updated to address other influences and activities that are proposed or underway in the Greenhills Creek watershed (see Section 1.1 of the main report).

[2] The area-based approach used for the Greenhills and Gardine Creeks Aquatic Monitoring Program was reviewed and approved by Teck Coal Limited's (Teck's) Environmental Monitoring Committee (EMC).

see Appendix G). Therefore, to support improvements to the Greenhills and Gardine Creeks Aquatic Monitoring Program study design and data interpretation, timed kick sampling stations were added to Upper Greenhills Creek (i.e., at RG_GHNF) in 2021 (see Section 2.4 of the main report). Additional timed stations are planned for inclusion at RG_GHFF on Upper Greenhills Creek in 2022 (Minnow 2022). Timed kick data collected from RG_GHNF and the RAEMP monitoring area on Lower Greenhills Creek (RG_GHCKD) were used in 2021 to facilitate comparisons to regional data. The approach followed in 2021 will be similar for 2022 (Minnow 2022). Additionally, the analyses presented herein were completed to determine the comparability of benthic invertebrate community endpoints calculated from area-based kick samples versus timed kick samples collected from the same location.

F1.2 Objectives

The objectives of the comparisons were to:

- Determine whether benthic invertebrate community data collected using area-based kicks and timed kicks can be directly compared;
- Determine if and how the area-based versus timed kick methods differ in their representation of the benthic invertebrate community; and
- Assess which kick method has the greatest ability to detect changes in benthic invertebrate community endpoints over time.

Ultimately, the comparisons will support interpretation of benthic invertebrate community data collected as part of the Greenhills and Gardine Creeks Aquatic Monitoring Program.

F2 METHODS

F2.1 Data Set

Comparisons among benthic invertebrate community data collected using area-based kick and timed kick methods were completed using data from RG_GHBP (area-based) and RG_GHCKD (timed) on Lower Greenhills Creek (Appendix Figure F.1). These areas are co-located on Reach 2 of Greenhills Creek, about 0.35 kilometres (km) upstream from the confluence with the Fording River and, as such, represent comparable habitat without inputs between them. Biological monitoring area RG_GHBP is sampled annually as part of the Greenhills and Gardine Creeks Aquatic Effects Monitoring Program (see Sections 2.4 and 3.3 of the main report) and RG_GHCKD is sampled annually as part of the RAEMP (Minnow 2020, 2021b).[3] A detailed description of field sampling methods for the area-based and timed kick samples can be found in Section 2.4.1 of the main report. Details related to laboratory analyses can be found in report Section 2.4.2.

Benthic invertebrate community data collected from RG_GHBP and RG_GHCKD between 2018 and 2021 were included in the comparisons. For the area-based kicks at RG_GHBP, six replicate samples were collected per year. For the timed kicks at RG_GHCKD, one replicate per year was collected from 2018 to 2020 and three replicates were collected in 2021.

F2.2 Data Analysis

The benthic invertebrate community data were compiled and standardized at the lowest practical level (LPL) of taxonomy to ensure consistent resolution among taxa. Benthic invertebrate community endpoints that reflect the diversity, richness, and percent composition of sensitive (e.g., Ephemeroptera) and tolerant (e.g., Diptera) organisms were calculated. Organism densities (i.e., the number of organisms per square metre [no./m^2]) were calculated from area-based kick samples and directly compared to abundance data from timed kick samples (i.e., number of organisms per three-minute kick [no./3-min kick]).

Comparisons between sampling methods were conducted using Generalized Linear Models (GLMs). Error distributions were selected to match the distributions of each endpoint (i.e., richness endpoints were fit with a quasipoisson distribution, percent composition and evenness endpoints were fit with a quasibinomial distribution, and abundance/density were fit with a log-gaussian distribution). To assess the magnitude of effects attributed to sampling

[3] Data for RG_GHBP are reported annually in the Greenhills and Gardine Creeks Aquatic Monitoring Program annual report, whereas data for RG_GHCKD are primarily reported under the RAEMP, which operates on a three-year reporting cycle (Minnow 2020, 2021b).

LEGEND

- RAEMP Benthic Invertebrate Community Sampling Location
- Teck Routine Water Quality Monitoring Location
- Lower Greenhills Creek Benthic Invertebrate Community Sampling Location
- Reach Break
- Discharge Location
- Antiscalant Addition Facility

Benthic Invertebrate Community Sampling Locations on Lower Greenhills Creek

0 65 130 260 Meters

N W E S

Projection: North American Datum 1983 UTM Zone 11U

Date June 2022
Project 227202.0016

minnow environmental inc.

Figure F.1

methods, a full interaction model was fit for each endpoint that included a *Method* and *Year* factor term, as well as a *Method x Year* interaction. The significance of each term was evaluated using an Analysis of Variance (ANOVA) with Type 3 sums of squares. The magnitude of variance explained by each term was evaluated using partial η^2 (Eta^2). Partial Eta^2 describes the proportion of the total variation attributable to a given term, partialing out (excluding) other terms from the total explained variation. To investigate each method's result more closely, two additional models were built using only area-based and only timed kick data. These method models only had a *Year* factor term. To evaluate the methods' abilities to capture differences over time, the standard deviation of each method models estimated marginal means (EMMs) was divided by the full interaction model's residual standard deviation. This provides a measure of variation over time for each method in consistent units of standard deviation. To evaluate each method's consistency among replicates, the standard deviation of 2021 data from each method was divided by the full interaction model's residual standard deviation. This provides a measure of variation within each method in consistent units of standard deviation.

F3 RESULTS

Benthic invertebrate densities (area-based kicks) and abundances (timed kicks) were not directly comparable. The model results suggested the area-based and timed kick methods differ in a consistent manner over time (i.e., non-significant interaction p-value) with abundances tending to be higher than densities. However, the interaction p-value was close to significant and visual inspection of the endpoints suggested different trends over time depending on which sampling method was used (Appendix Figure F.2; Appendix Table F.1). The non-significant interaction p-value was likely due to the imbalanced sample sizes. Had additional replicates of timed kick samples been collected in 2018 to 2020, the interaction would have likely been significant (based on variances seen among timed kick replicates collected from RG_GHCKD in 2021 and the relatively high interaction Eta^2 of 0.20, compared to 0.16 for the *Method* term; Appendix Table F.1).

Relative to the area-based kick samples, co-located timed kick samples were typically indicative of more diverse benthic invertebrate communities with higher EPT richness (sensitive taxa) and lower dipteran richness (tolerant taxa) compared to area-based samples (Appendix Figure F.2; Appendix Table F.2). Overall, the community composition endpoints varied between the two field sampling methods, and the patterns were inconsistent over time (Appendix Figure F.2). This is consistent with previous observations, which suggests that rarer taxa are less likely to be present in samples collected from a smaller area (area-based kicks; Minnow 2018).

The *Method* term, or the *Method x Year* interaction was significant in six of 12 endpoints in the full interaction models (Appendix Table F.1). When *Method* alone was significant, it explained about 15 percent (%) of the explained variance in the model. When the interaction term was significant, it explained 22 to 25% of the explained variance in the model. Overall, the method models suggested significant differences between years for both area-based and timed kick samples for four endpoints: abundance/density, %Ephemeroptera, %Plecoptera, and %Chironomidae (Appendix Table F.1). The area-based kick method detected significant differences between years for two additional endpoints: %EPT and %Diptera. The timed kick method detected significant differences between years for three additional endpoints: Simpson’s evenness, %Oligochaeta, and dipteran richness (Appendix Table F.1).

Overall, the data for the timed kick method tended to show greater differences between years for richness endpoints and most percent composition endpoints. Differences in sample sizes made robust conclusions difficult, but if the patterns remained consistent with more replicates being collected, it would suggest the timed kick method may be more sensitive to differences

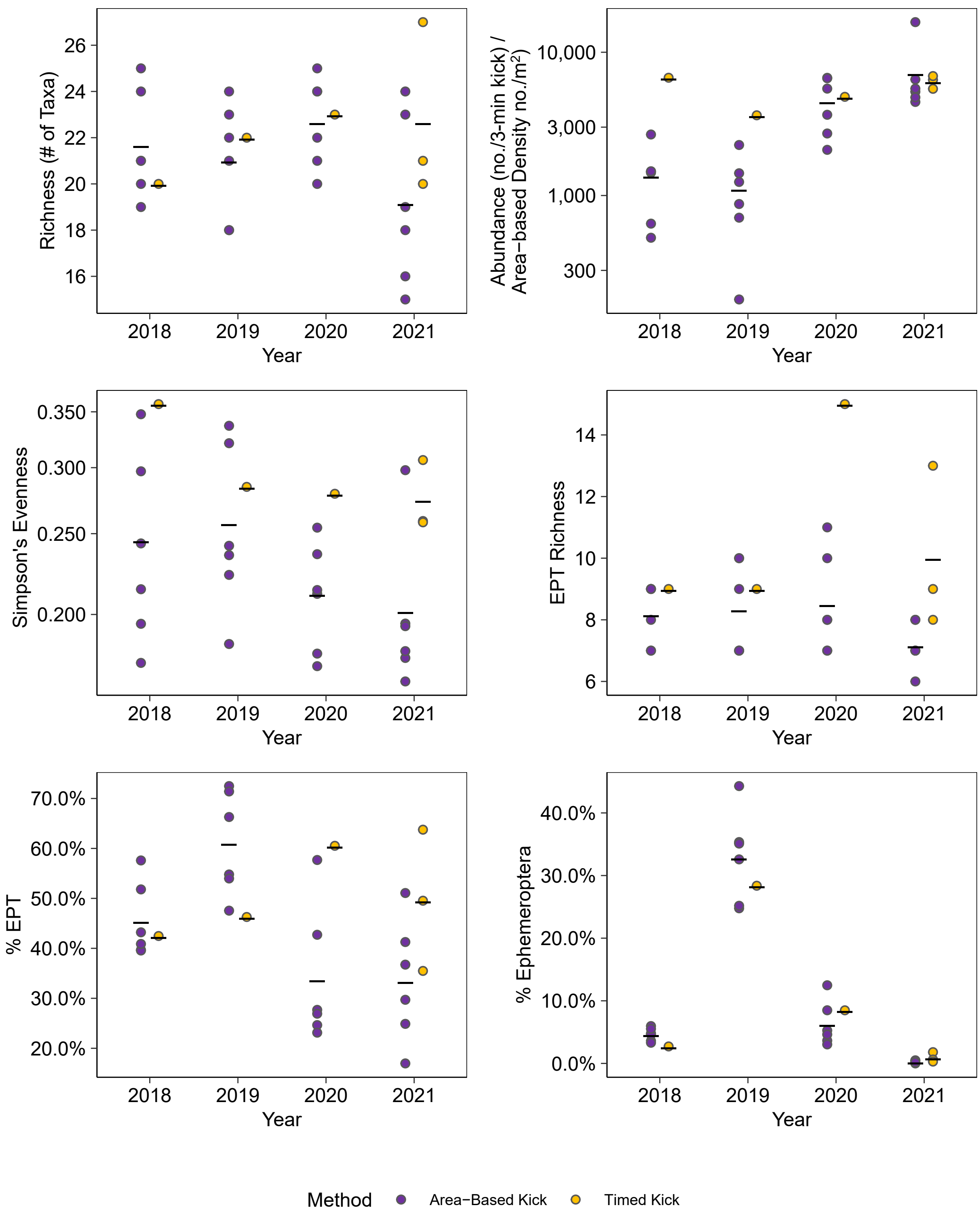


Figure F.2: Comparisons of Benthic Invertebrate Community Endpoints for Area−Based and Timed Kick Samples, Lower Greenhills Creek, September 2018 to 2021

Notes: Black bars represent Estimated Marginal Means from Generalized Linear Models. CABIN = Canadian Aquatic Biomonitoring Network). EPT = Ephemeroptera, Plecoptera, Trichoptera.

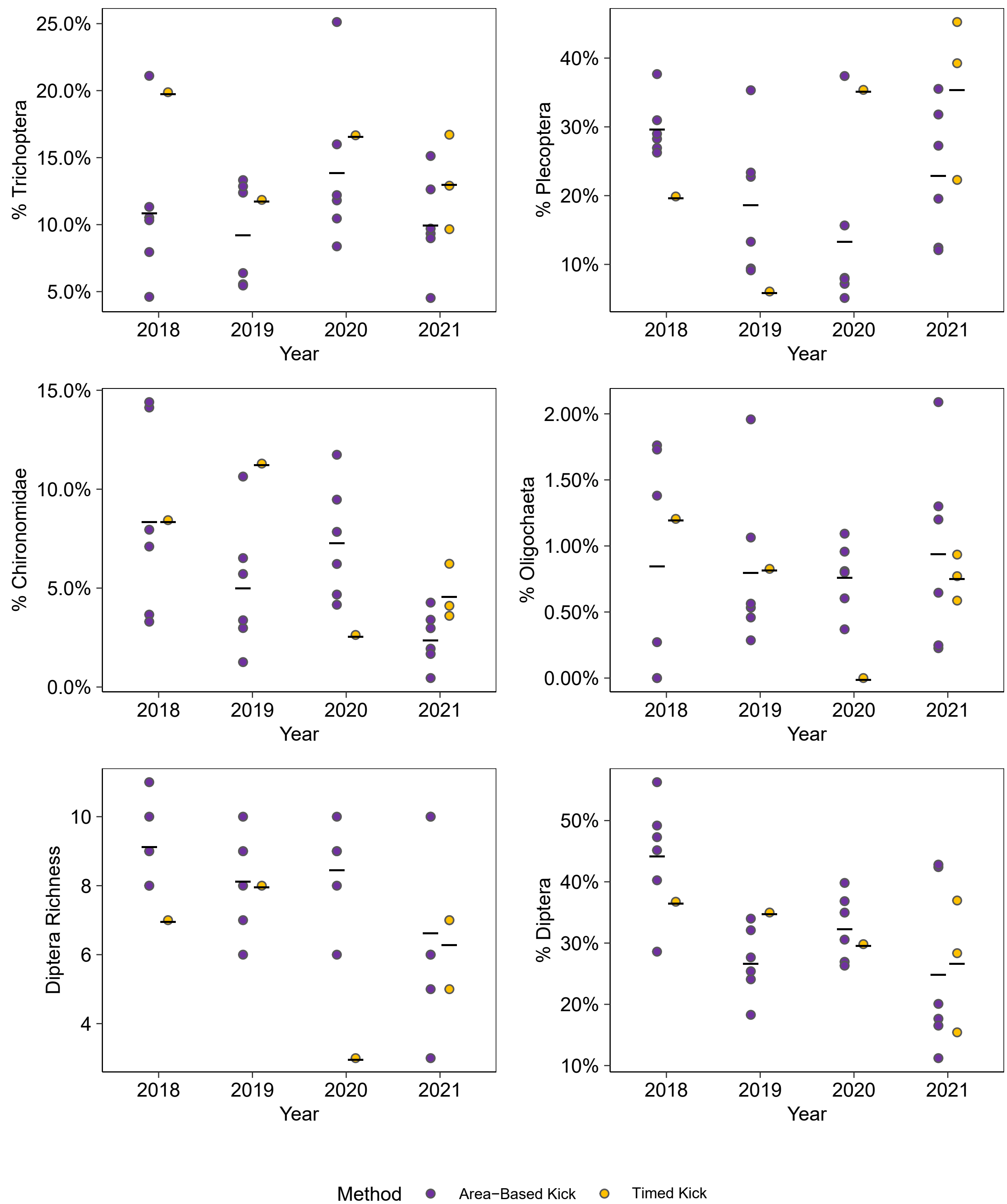


Figure F.2: Comparisons of Benthic Invertebrate Community Endpoints for Area−Based and Timed Kick Samples, Lower Greenhills Creek, September 2018 to 2021

Notes: Black bars represent Estimated Marginal Means from Generalized Linear Models. CABIN = Canadian Aquatic Biomonitoring Network). EPT = Ephemeroptera, Plecoptera, Trichoptera.

Table F.1: Generalized Linear Model Results Comparing Benthic Invertebrate Community Data from Area-based and Timed Kick and Sweep Samples, Lower Greenhills Creek, September 2018 to 2021

Endpoint	Model	Full Model[a]						Method Differences[d]					
		Term Effect-size[b]			Term P-values[c]			Year P-value[e]		Between-years Variance[f]		Residual Variance[g]	
		Year	Method	Interaction	Year	Method	Interaction	Timed	Area-Kick	Timed	Area-Kick	Timed	Area-Kick
Richness (no. of Taxa)	Quasipoisson	0.18	0.013	0.095	0.18	0.59	0.51	0.93	0.15	2.5	2.8	1.5	1.6
CABIN Abundance (no./3-minute kick) / Area-based Density (no./m^2)	Log-Gaussian	0.54	0.16	0.20	<0.001	0.042	0.15	<0.001	<0.001	0.66	1.4	0.31	2.2
Simpson's Evenness	Quasibinomial	0.18	0.14	0.045	0.18	0.056	0.79	0.084	0.20	0.38	0.26	0.60	1.1
EPT Richness	Quasipoisson	0.13	0.013	0.22	0.34	0.59	0.096	0.37	0.24	6.8	1.4	1.9	0.66
%EPT	Quasibinomial	0.50	0.0025	0.24	<0.001	0.82	0.068	0.82	<0.001	0.37	0.63	1.4	1.3
%Ephemeroptera	Quasibinomial	0.93	0.031	0.12	<0.001	0.40	0.39	<0.001	<0.001	1.3	1.6	0.87	0.47
%Trichoptera	Quasibinomial	0.13	0.10	0.036	0.34	0.11	0.85	0.35	0.36	0.28	0.16	0.82	0.96
%Plecoptera	Quasibinomial	0.27	0.030	0.26	0.047	0.41	0.052	0.061	0.048	0.66	0.32	1.2	1.1
%Chironomidae	Quasibinomial	0.40	0.00000029	0.21	0.0020	1.0	0.11	<0.001	0.0030	0.34	0.23	0.57	0.82
%Oligochaeta	Quasibinomial	0.013	0.011	0.13	0.96	0.63	0.35	<0.001	0.97	0.082	0.013	0.33	1.2
Dipteran Richness	Quasipoisson	0.21	0.048	0.25	0.12	0.29	0.067	0.0060	0.13	3.7	1.8	0.81	1.9
%Diptera	Quasibinomial	0.39	0.021	0.053	0.0030	0.49	0.75	0.86	0.0020	0.25	0.48	1.4	1.7

P-value <0.1.

Notes: CABIN = Canadian Aquatic Biomonitoring Network; no. = number; m^2 = square metre; < = less than; EPT = combined Ephemeroptera, Plecoptera, and Trichoptera; % = percent.

[a] Full model fit with *Method* and *Year* terms as well as their interactions in a Generalized Linear Model using error distribution listed in Model column.

[b] Effect size measured as Partial Eta^2 reflecting the proportion of variance explained by each term in the model.

[c] Term significance assessed using Type-3 Sums of Squares.

[d] Method differences evaluated as separate models fit to CABIN and area-based kick data with a *Year* factor as the only predictor.

[e] P-value of the *Year* term in the two method specific models.

[f] The amount of inter-annual variation represented as the standard deviation of annual mean endpoints (as estimated marginal means of the full model) divided by the residual standard deviation of the full model.

[g] The amount of intra-annual variation represented as the standard deviation of each method's 2021 data divided by the residual standard deviation of the full model.

Table F.2: Generalized Linear Model Results By Year and Method for Benthic Invertebrate Community Data Collected Using Area-based and Timed Kick and Sweep Samples, Lower Greenhills Creek, September 2018 to 2021

Endpoint	Year	Area-based Mean	Timed Mean	Timed SD
Richness (no. of Taxa)	2018	22	20	0.79
	2019	21	22	
	2020	23	23	
	2021	19	23	
CABIN Abundance (no./3-minute kick) / Area-based Density (no./m^2)	2018	1,367	6,640	645
	2019	1,114	3,630	
	2020	4,541	4,886	
	2021	7,152	6,266	
Simpson's Evenness	2018	0.25	0.36	0.062
	2019	0.26	0.28	
	2020	0.21	0.28	
	2021	0.20	0.27	
EPT Richness	2018	8.2	9.0	0.82
	2019	8.3	9.0	
	2020	8.5	15	
	2021	7.2	10	
%EPT	2018	45	43	28
	2019	61	46	
	2020	34	61	
	2021	33	50	
%Ephemeroptera	2018	4.6	2.7	8.0
	2019	33	28	
	2020	6.3	8.5	
	2021	0.30	0.90	
%Trichoptera	2018	11	20	10
	2019	9.3	12	
	2020	14	17	
	2021	10	13	
%Plecoptera	2018	30	20	25
	2019	19	6.1	
	2020	14	35	
	2021	23	36	
%Chironomidae	2018	8.4	8.4	7.0
	2019	5.1	11	
	2020	7.4	2.6	
	2021	2.5	4.6	
%Oligochaeta	2018	0.86	1.2	2.0
	2019	0.81	0.83	
	2020	0.77	0	
	2021	0.95	0.76	
Dipteran Richness	2018	9.2	7.0	0.47
	2019	8.2	8.0	
	2020	8.5	3.0	
	2021	6.7	6.3	
%Diptera	2018	45	37	25
	2019	27	35	
	2020	33	30	
	2021	25	27	

Mean result for the area-based kick samples falls outside the mean ± SD of the timed kick data.

Notes: SD = standard deviation; no. = number; m^2 = square metre; < = less than; EPT = combined Ephemeroptera, Plecoptera, and Trichoptera; % = percent; ± = plus or minus.

in these endpoints over time. Additionally, based on 2021 data, the timed kick method used at RG_GHCKD tended to result in lower variance between replicates for most endpoints, relative to the area-based kicks (RG_GHBP). This suggest the timed kick data may have more power to detect changes over time than area-based kick samples.

F4 SUMMARY

Comparisons of benthic invertebrate community endpoints calculated from co-located area-based and timed kick samples were completed in an effort to improve data interpretation (starting in 2021) and study design development (starting in 2022) for the Greenhills and Gardine Creeks Aquatic Monitoring Program. The results of the comparisons indicated that benthic invertebrate density (area-based) and abundance (timed) data collected from the same areas were not directly comparable. Additionally, timed kick samples were typically indicative of more diverse benthic invertebrate communities with higher EPT richness and lower dipteran richness, which is consistent with previous observations. Overall, the community composition endpoints varied between the two field sampling methods, and the patterns were inconsistent over time.

Overall, the timed kick sampling method showed greater differences between years for richness and most community composition endpoints. Despite the smaller number of replicates in the RG_GHCKD data set (see Section F2.1, above), the results suggested the timed kick method may be most sensitive to differences in richness and percent composition endpoints. This, coupled with the lower variance between replicates for most endpoints relative to area-based sampling, suggests the timed kick data may have more power to detect changes in community endpoints over time.

F5 REFERENCES

Minnow Environmental Inc. (Minnow). 2016. Proposal to Evaluate Aquatic Ecosystem Changes Associated with Calcite Treatment in Greenhills Creek. Prepared for Teck Coal Limited, Sparwood, BC.

Minnow. 2018. Upper Greenhills Creek Aquatic Baseline. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 177202.0032.

Minnow. 2020. Regional Aquatic Effects Monitoring Program (RAEMP) Report, 2017 to 2019. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 187202.0011.

Minnow. 2021a. Study Design for the 2021 Greenhills and Gardine Creeks Aquatic Monitoring Program. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 217202.0052.

Minnow. 2021b. Study Design for the Regional Aquatic Effects Monitoring Program, 2021 to 2023. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 207202.0006.

Minnow. 2022. Study Design for the 2022 Greenhills and Gardine Creeks Aquatic Monitoring Program. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 227202.0016.

APPENDIX G
BIOLOGICAL TRIGGERS

APPENDIX G BIOLOGICAL TRIGGERS

G1 INTRODUCTION

G1.1 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 Teck's 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. 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. For WCT, the biological trigger can be applied to selenium concentrations in individual muscle tissue samples.

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), Local Aquatic Effects Monitoring Program (LAEMP), and Greenhills and Gardine Creeks Aquatic Monitoring Program reports. 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.

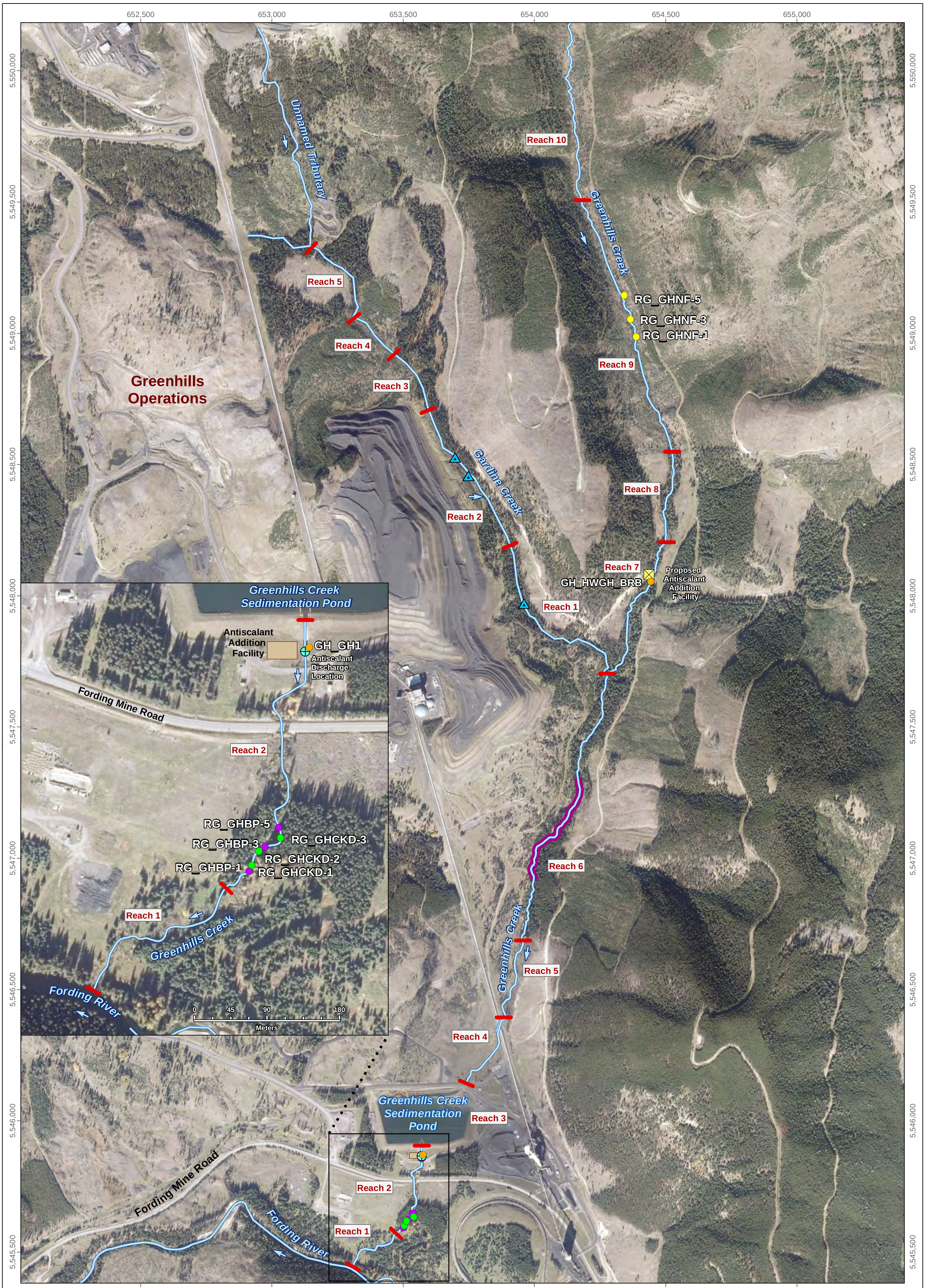
The 2021 Greenhills and Gardine Creeks Aquatic Monitoring Program represents the second time that biological triggers have been evaluated and reported (i.e., implemented) as part of focused monitoring on Lower Greenhills Creek (Minnow 2021a). The year 2021 is also the first year during which biological triggers were applied to Upper Greenhills Creek. To date, biological triggers have not been applied to Gardine Creek.

G1.2 Application of Biological Triggers to Greenhills Creek

As outlined in Section G1.1, analyses for biological triggers are meant to be complementary to other analyses completed to support answering the Greenhills and Gardine Creeks Aquatic Monitoring Program study questions, as well as analyses presented in the RAEMP and LAEMP reports. The biological trigger analyses for 2021 included each of the three measurement endpoints (%EPT and selenium concentrations in benthic invertebrate tissues and WCT muscle). Fish tissue chemistry sampling was not completed as part of the 2021 Greenhills and Gardine Creeks Aquatic Monitoring Program as a proactive response to the reported WCT population decline in Management Unit 1 (Cope 2020). However, tissue selenium concentrations were quantified for one incidental WCT mortality that occurred in Reach 1 of Lower Greenhills Creek in 2021 (see Appendix I of the main report). The biological triggers pertaining to selenium concentrations in WCT muscle were applied to this individual fish.

For Upper Greenhills Creek, biological triggers for %EPT and selenium concentrations in composite-taxa benthic invertebrate tissue samples were assessed based on the 2021 data for one location, RG_GHNF[1], which is located in Reach 9 (Appendix Figure G.1). For the purposes of the biological triggers analysis, predictions were based on projected water 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

[1] Three, timed kick samples were collected from RG_GHNF, in addition to the area-based kick samples typical of the Greenhills and Gardine Creeks Aquatic Monitoring Program, to support comparisons to biological triggers for %EPT (Minnow 2021b).



LEGEND

- Teck Routine Water Quality Monitoring Location
- RAEMP Benthic Invertebrate Community and Composite Tissue Sampling Location
- Upper Greenhills Creek Benthic Invertebrtae Community and Composite Tissue Sampling Location
- Lower Greenhills Creek Composite Tissue Sampling Location
- Remediation Area Selected (2023)
- Proposed Antiscalant Addition Facility Location (2022)
- Seep
- Antiscalant Discharge Location
- Antiscalant Addition Facility
- Reach Break

Water Quality and Benthic Invertebrate Sampling Locations for the Evaluation of Biological Triggers, 2021

0 0.25 0.5 1
Kilometers

N W E S

Projection: North American Datum 1983 UTM Zone 11U
Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Date: June 2022
Project 227202.0016

minnow environmental inc.

Figure G.1

Document Path: C:\Users\capol\Trinity Consultants, Inc\Teck - 227202.0016 - 2022 GGCAMP\D - GIS\2021 GGCAMP Report\22-16 Figure G.1 WQ and BI Sampling Locations for the Evaluation of Bio Triggers.mxd 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 in Reach 7 of Upper Greenhills Creek, above the confluence with Gardine Creek, were used (Appendix Figure G.1).

For Lower Greenhills Creek, the evaluations of biological triggers for %EPT and selenium concentrations in benthic invertebrate and WCT tissues were based on water quality projections for routine water quality monitoring station GH_GH1. 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 antiscalant addition facility (Appendix Figure G.1). 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, benthic invertebrate tissue chemistry data from RG_GHBP, and WCT tissue chemistry data from Reach 1 of Lower Greenhills Creek. Monitoring area RG_GHCKD is a long-term monitoring location that has been evaluated as part of the RAEMP since 2012 (Minnow 2014, 2020a, 2021c) and is located approximately 285 metres (m) downstream from routine water quality monitoring station GH_GH1 (Appendix Figure G.1). Monitoring area RG_GHBP is co-located with RG_GHCKD and is routinely monitored as part of the Greenhills and Gardine Creeks Aquatic Monitoring Program (Appendix Figure G.1; Minnow 2018, 2019, 2020b, 2021a,b).[2]

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 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 used (i.e., the sampler kicks within a fixed area of 1/3 square metres [m^2], rather than collecting samples using timed kicks).[3] 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

[2] The 2021 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.

[3] For further details regarding the benthic invertebrate community sampling completed as part of the Greenhills Creek and Gardine Creek Aquatic Monitoring Program, see Section 2.4.1 of the main report.

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 2021 monitoring program report.

G2 METHODS

G2.1 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 2021 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 10^{th} percentile of the habitat adjusted normal range;
- an ADIT score of 1 corresponds to expected %EPT between the 10^{th} percentile and the 2.5^{th} 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 2.5^{th} percentile and half of the 2.5^{th} 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
- 2.5^{th} percentile and ≥ 0.

In summary, this component of the biological trigger for %EPT asks 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.

G2.2 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 2021 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 2021 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 micrograms per gram dry weight [µg/g dw], respectively) were included in relevant plots.

G2.3 Westslope Cutthroat Trout Muscle Tissue Selenium

As indicated in Section G1.2, the biological trigger for selenium concentrations in WCT muscle was applied to a single incidental mortality identified in Reach 1 of Greenhills Creek in September 2021.[4] The selenium concentration reported for the WCT muscle sample was compared to the upper limit of the regional reference area normal range (i.e., the 97.5th percentile concentration for reference area data). Up-to-date reference area normal ranges are reported in the RAEMP and LAEMPs and are recalculated, as needed, when new data become available (Minnow 2021c; Teck 2019). The WCT muscle tissue selenium concentration was also compared to the upper limit of the 95% prediction interval based on bioaccumulation models. For a given selenium concentration in water, the best estimate of the expected WCT muscle selenium concentration was generated using a two-step

[4] The incidental mortality was a juvenile WCT with a fork length of 5.7 centimetres (cm) and weight of 2 grams (g). No external health anomalies (e.g., fin erosion, tumours) were noted.

bioaccumulation model (water to invertebrates and then invertebrates to fish eggs) followed by application of a conversion factor for translating egg selenium concentrations to muscle selenium concentrations. Prediction errors for new replicate samples (i.e., individual fish) are based on a different data set that relates fish directly to water. The detailed methods for estimating the upper limit of the 95% prediction interval for selenium concentrations in WCT muscle (given any projected value of aqueous selenium) are discussed in detail in the Biological Trigger Development for the Elk Valley Adaptive Management Plan (Azimuth, *in prep*).

G3 RESULTS

G3.1 Percent Ephemeroptera, Plecoptera, and Trichoptera

For the benthic invertebrate community samples collected from RG_GHNF and RG_GHCKD (three samples per area) in 2021, %EPT was consistently lower than habitat-adjusted normal ranges but generally higher than predicted ADIT scores for each location (Appendix Figure G.2; Appendix Table G.1). The only exception was a single sample from RG_GHCKD; %EPT in RG_GHCKD-3 (36%) was lower than the 2.5th percentile of the habitat-adjusted normal range (i.e., 76%) and the predicted ADIT score (37%; Appendix Figure G.2; Appendix Table G.1). Therefore, it can be concluded that biological triggers were not exceeded at RG_GHNF on Upper Greenhills Creek, but that the biological trigger was exceeded at RG_GHCKD on Lower Greenhills Creek in 2021.

G3.2 Benthic Invertebrate Tissue Selenium

None of the samples collected from RG_GHNF on Upper Greenhills Creek in September 2021 (n = 3) exceeded the biological trigger for benthic invertebrate tissue selenium concentrations, but all of the samples from Lower Greenhills Creek (n = 3 at RG_GHBP in February 2021 and n = 3 in two areas in September 2021) exceeded the biological trigger (Appendix Figure G.3; Appendix Table G.2). Selenium concentrations in benthic invertebrate tissues from RG_GHNF were lower overall (i.e., ranging from 10 to 11 µg/g dw) compared to samples collected from RG_GHCKD (i.e., ranging from 16 to 22 µg/g dw) and RG_GHBP (i.e., ranging from 21 to 34 µg/g dw; Appendix Table G.2).

The high frequency and magnitude of exceedances at RG_GHCKD and RG_GHBP is likely attributed to proximity to 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 (i.e., RG_GHCKD and RG_GHBP) (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 2021 and likely contributed to enhanced selenium bioaccumulation (ADEPT 2022).

G3.3 Westslope Cutthroat Trout Muscle Tissue Selenium

The single WCT muscle sample collected opportunistically from Reach 1 of Lower Greenhills Creek in September 2021 exceeded the biological trigger for selenium. The selenium concentration in the WCT muscle sample (29 µg/g dw) was higher than the upper 97.5th

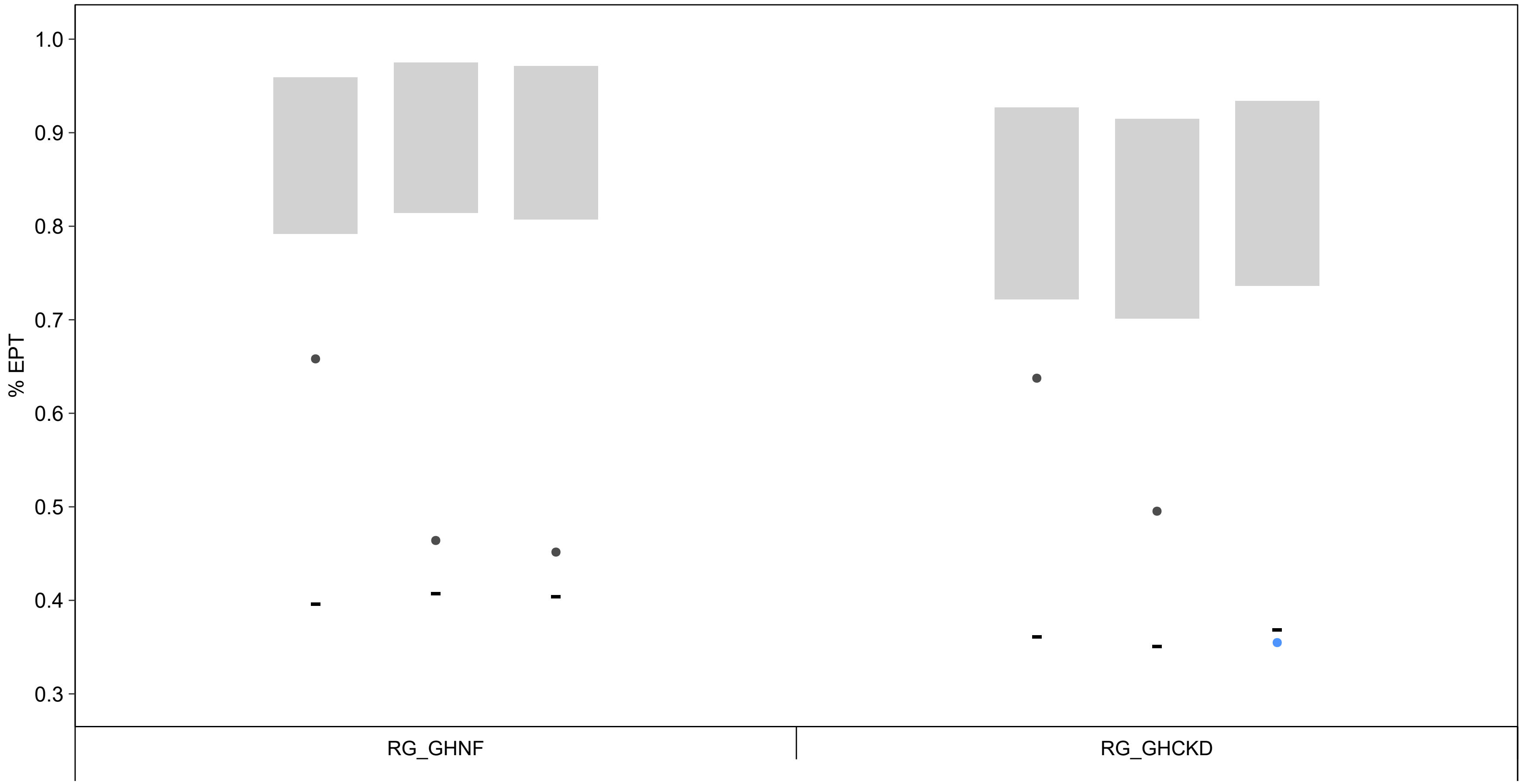


Figure G.2: Measured Proportion of Ephemeroptera, Plecoptera, and Trichoptera Combined (%EPT) Relative to Predictions, Upper (RG_GHNF) and Lower (RG_GHCKD) Greenhills Creek, 2021

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 G.1: Biological Trigger Analysis for Combined Proportions of Ephemeroptera, Plecoptera, and Trichoptera (%EPT) in Benthic Invertebrate Community Samples from Greenhills Creek, September 2021

Watercourse	Biological Monitoring Area	Replicate	Reported Value	ADIT Score	Lower 2.5th Percentile of the Habitat Adjusted Normal Range
Upper Greenhills Creek	RG_GHNF	1	66	40	79
		2	46	41	81
		3	45	40	81
Lower Greenhills Creek	RG_GHCKD	1	64	36	72
		2	50	35	70
		3	35	37	74

Shaded cells signify individual replicates that were associated with a biological trigger (i.e. %EPT was below both the lower 2.5th percentile of the habitat-adjusted normal range and the predicted ADIT score

Note: ADIT = Aquatic Data Integration Tool.

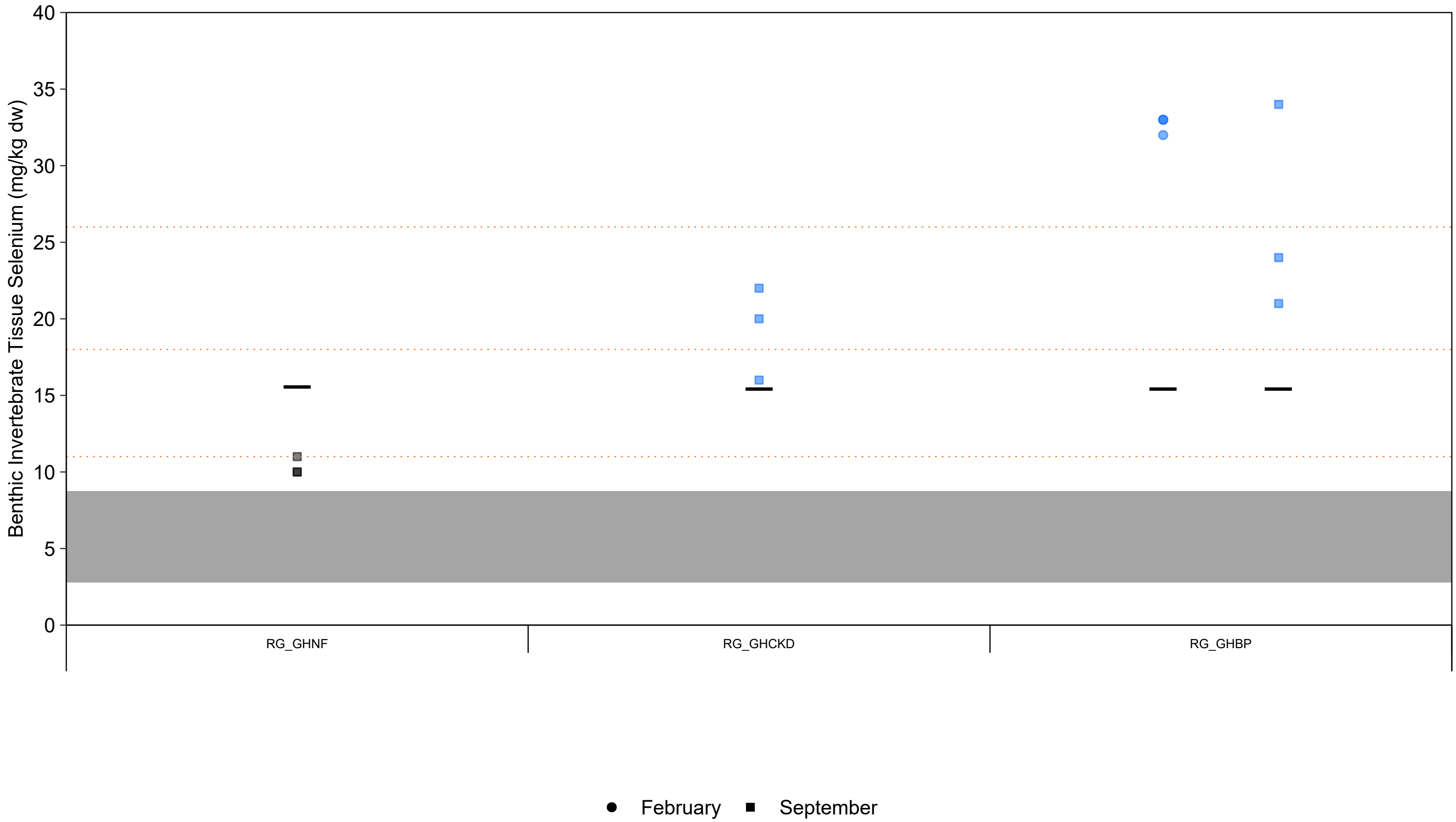


Figure G.3: Measured Selenium Concentrations in Composite-Taxa Benthic Invertebrate Tissue Samples Relative to Predictions Upper (RG_GHNF) and Lower (RG_GHCKD and RG_GHBP) Greenhills Creek, 2021

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 95th prediction interval of the bioaccumulation model. Blue dots 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 EVWQP benchmarks (11, 18, and 26 mg/kg dw, respectively) for dietary effects to juvenile fish.

Table G.2: Biological Trigger Analysis for Selenium Concentrations in Benthic Invertebrate Tissue Samples from Greenhills Creek, September 2021

Watercourse	Biological Monitoring Area	Date	Predicted Selenium Water Concentration (mg/L)	Benthic Invertebrate Selenium Tissue		
				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	10-Sep-21	221	16	8.7	10
			221	16	8.7	11
		11-Sep-21	221	16	8.7	10
Lower Greenhills Creek	RG_GHCKD	11-Sep-21	198	15	8.7	20
			198	15	8.7	16
			198	15	8.7	22
	RG_GHBP	17-Feb-21	198	15	8.7	33
			198	15	8.7	33
			198	15	8.7	32
		14-Sep-21	198	15	8.7	21
			198	15	8.7	34
			198	15	8.7	24

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 habitat-adjusted normal range).

Notes: mg/L = milligrams per litre; % = percent; mg/kg dw = milligrams per kilogram dry weight.

percentile concentration of the reference area normal range (5.7 µg/g dw) and the upper 95% prediction limit (16 µg/g dw) that was calculated based on projected water quality.

G4 SUMMARY

Biological triggers for %EPT and benthic invertebrate tissue selenium concentrations were not exceeded at Upper Greenhills Creek; however, biological triggers for %EPT and selenium concentrations in benthic invertebrate tissues and WCT muscle were exceeded at Lower Greenhills Creek. Specifically, the biological trigger for %EPT was exceeded in one (n = 3) sample and tissue selenium concentrations in all benthic invertebrate (n = 9) and WCT muscle (n = 1) samples from Lower Greenhills Creek exceeded the biological trigger. The results for benthic invertebrate and WCT muscle tissue selenium in Lower Greenhills Creek are 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 Greenhills and Gardine Creeks Aquatic Monitoring Program. However, uncertainty remains around the cause of the observed %EPT response in one of the n = 3 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.

G5 REFERENCES

ADEPT (ADEPT Environmental Sciences Ltd.). 2022. Elk Valley Selenium Speciation Monitoring Program – 2021 Annual Report. Prepared for Teck Coal Limited, Sparwood, BC.

Cope, S. 2020. Upper Fording River Westslope Cutthroat Trout Population Monitoring Project: 2019. Prepared for Teck Coal Limited, Sparwood, BC. Report prepared by Westslope Fisheries Ltd., Cranbrook, BC. 48 p. + 2 app.

Golder Associates (Golder). 2014. Benchmark Derivation Report for Selenium. Annex E of the Elk Valley Water Quality Plan. Prepared for Teck Coal Limited, Sparwood, BC.

Golder. 2020. Updates to the Lotic and Lentic Bioaccumulation Models for Selenium in the Elk Valley. Prepared for Teck Coal Limited, Sparwood, BC.

Golder. 2021. Elk Valley Selenium Speciation Program 2021 Study Design. Prepared for Teck Coal Limited, Sparwood, BC.

Minnow (Minnow Environmental Inc.). 2014. 2012 Biological Monitoring Program for Coal Mines in the Elk River Valley, BC. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 2456.

Minnow. 2018. Lower Greenhills Creek Aquatic Baseline. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 177202.0043.

Minnow. 2019. Lower Greenhills Creek Monitoring Program Report 2018. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 187202.0028.

Minnow. 2020a. Regional Aquatic Effects Monitoring Program (RAEMP) Report, 2017 to 2019. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 187202.0011.

Minnow. 2020b. Greenhills Creek Aquatic Monitoring Program 2019 Report. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 197202.0005.

Minnow. 2021a. Greenhills Creek and Gardine Creek Aquatic Monitoring Program Report – 2020. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 207202.0014.

Minnow. 2021b. Study Design for the 2021 Greenhills and Gardine Creeks Aquatic Monitoring Program. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 217202.0052.

Minnow. 2021c. Study Design for the Regional Aquatic Effects Monitoring Program, 2021 to 2023. Prepared for Teck Coal Limited, Sparwood, BC. Minnow Project 207202.0006.

Teck (Teck Coal Limited). 2014. Elk Valley Water Quality Plan. Submitted to the British Columbia Minister of Environment for approval on July 22, 2014.

Teck. 2018. Water Quality Adaptive Management Plan for Teck Coal Operations in the Elk Valley. December 21, 2018.

Teck. 2019. Elk Valley Water Quality Plan 2019 Implementation Plan Adjustment. July 2019.

Teck. 2021. Water Quality Adaptive Management Plan for Teck Coal Operations in the Elk Valley – 2021 Update. December 15, 2021.

APPENDIX H
BENTHIC INVERTEBRATE
TISSUE CHEMISTRY

Table H.1: Chemistry Data for Benthic Invertebrate Tissue Samples Collected from Greenhills and Gardine Creeks, February and September 2021

Analyte	Units	Upper Greenhills Creek												
		RG_GHUT						RG_GHNF			RG_GHFF			
		February			September			September			September			
		RG_GHUT-1	RG_GHUT-2	RG_GHUT-3	RG_GHUT-1	RG_GHUT-3	RG_GHUT-5	RG_GHNF-1	RG_GHNF-3	RG_GHNF-5	RG_GHFF-1	RG_GHFF-3	RG_GHFF-5	RG_GHFF_LUM-1 [a]
		17-Feb-21	17-Feb-21	17-Feb-21	13-Sep-21	13-Sep-21	13-Sep-21	10-Sep-21	10-Sep-21	10-Sep-21	10-Sep-21	10-Sep-21	10-Sep-21	10-Sep-21
% Moisture	%	85.1	84.1	87	78.7	83.1	79.8	82.7	83.9	84.4	82.1	78.1	79.9	60.5
Aluminum (Al)	µg/g dw	414	730	930	3944	4933	2245	1211	1089	1059	965	1220	2058	59
Antimony (Sb)	µg/g dw	0.042	0.054	0.067	0.166	0.223	0.105	0.058	0.061	0.052	0.058	0.068	0.100	0.024
Arsenic (As)	µg/g dw	<0.431	0.509	0.538	1.1	0.961	0.576	0.615	0.615	0.643	<0.423	0.494	0.522	<0.423
Barium (Ba)	µg/g dw	7.1	9.4	15	49	61	23	22	17	19	33	29	56	19
Boron (B)	µg/g dw	0.596	0.830	1.1	2.8	3.8	1.6	1.1	1.6	1.0	1.6	1.9	2.6	0.117
Cadmium (Cd)	µg/g dw	3.1	2.7	2.8	3.8	3.6	2.9	1.5	1.2	0.689	0.488	0.436	0.418	2.00
Calcium (Ca)	µg/g dw	3965	4854	5123	7,889	9,146	4,946	10,478	6,189	9,311	11,361	9,154	15,104	5,611
Chromium (Cr)	µg/g dw	9.7	7.4	9.3	9.3	20	9.0	7.5	5.3	6.0	7.7	16	20	7.3
Cobalt (Co)	µg/g dw	0.663	0.580	0.848	1.60	2.30	1.60	0.642	0.447	0.384	0.330	0.911	1.3	0.339
Copper (Cu)	µg/g dw	12	12	16	32	43	39	17	16	17	17	18	19	14
Iron (Fe)	µg/g dw	396	416	533	1243	1524	672	457	369	359	435	678	863	192
Lead (Pb)	µg/g dw	0.124	0.210	0.258	1.1	1.5	0.758	0.285	0.251	0.243	0.315	0.637	0.401	0.0440
Lithium (Li)	µg/g dw	1.3	1.5	1.6	1.7	2.1	1.5	1.3	1.1	0.914	1.2	1.2	1.3	0.342
Magnesium (Mg)	µg/g dw	2170	2385	2690	3,073	2,996	3,083	3,243	2,625	2,606	2,841	2,847	3,155	2,469
Manganese (Mn)	µg/g dw	30	33	33	49	61	43	42	32	29	36	29	28	13
Mercury (Hg)	µg/g dw	<0.032	0.036	0.036	0.081	0.072	0.072	0.035	0.052	0.087	0.068	0.041	0.072	0.081
Molybdenum (Mo)	µg/g dw	0.246	0.266	0.307	0.474	0.502	0.418	0.290	0.232	0.203	0.335	0.251	0.223	0.139
Nickel (Ni)	µg/g dw	24	19	22	27	47	24	20	21	17	22	40	51	12
Phosphorus (P)	µg/g dw	13516	14081	12712	15,254	14,261	15,069	14,220	13,850	12,973	15,742	12,935	13,083	10,814
Potassium (K)	µg/g dw	9421	12352	9770	15,637	14,627	15,451	12,196	13,164	9,905	14,794	13,541	13,943	8,402
Selenium (Se)	µg/g dw	8.8	6.4	5.9	7.9	7.5	7.9	10	11	10	14	8.4	8.4	13
Silver (Ag)	µg/g dw	0.025	0.028	0.032	0.099	0.135	0.117	0.050	0.084	0.092	0.117	0.135	0.216	0.171
Sodium (Na)	µg/g dw	5375	6380	5096	5,109	4,785	6,161	4,797	4,968	3,061	5,928	5,098	3,973	5,043
Strontium (Sr)	µg/g dw	2.6	3.0	4.3	7.1	8.7	3.8	6.0	5.4	4.8	9.1	7.4	9.1	8.2
Thallium (Tl)	µg/g dw	0.036	0.047	0.045	0.116	0.126	0.087	0.068	0.066	0.101	0.041	0.038	0.049	0.009
Tin (Sn)	µg/g dw	0.569	0.809	1.6	1.1	1.1	0.851	0.909	0.877	1.3	1.1	0.630	1.3	0.256
Titanium (Ti)	µg/g dw	30	56	73	284	389	181	89	69	58	67	85	147	3.8
Uranium (U)	µg/g dw	0.145	0.134	0.213	0.241	0.307	0.208	0.201	0.273	0.191	0.209	0.215	0.287	0.018
Vanadium (V)	µg/g dw	1.1	1.5	2.2	5.3	8.0	3.2	2.0	2.1	1.7	1.3	2.1	2.7	0.266
Zinc (Zn)	µg/g dw	245	145	156	238	218	178	147	135	220	176	164	151	174

Selenium concentration exceeds the 45 µg/g dw preliminary Level 1 Benchmark for maternal amphibian diet (Massé et al. 2015).
Selenium concentration exceeds the 41 µg/g dw Level 3 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 22 µg/g dw Level 2 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 15 µg/g dw Level 1 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 27 µg/g dw Level 3 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 20 µg/g dw Level 2 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 13 µg/g dw Level 1 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 26 µg/g dw Level 3 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 18 µg/g dw Level 2 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 11 µg/g dw Level 1 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 8.74 µg/g dw 97.5th percentile reference concentration (i.e., the upper boundary of the normal range) used to identify a difference from reference (Minnow 2020).

Notes: % = percent; µg/g dw = micrograms per gram dry weight; < = less than; EVWQP = Elk Valley Water Quality Plan.

[a] This sample is a single-taxa sample containing annelids (LUM) only; all other creek samples are composite-taxa samples.

Table H.1: Chemistry Data for Benthic Invertebrate Tissue Samples Collected from Greenhills and Gardine Creeks, February and September 2021

Analyte	Units	Lower Greenhills Creek						Gardine Creek					
		RG_GHBP						RG_GAUT			RG_GANF		
		February			September			September			September		
		RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GHBP-1	RG_GHBP-2	RG_GHBP-3	RG_GAUT-1	RG_GAUT-2	RG_GAUT-5	RG_GANF-1	RG_GANF-2	RG_GANF-3
		17-Feb-21	17-Feb-21	17-Feb-21	14-Sep-21	14-Sep-21	14-Sep-21	16-Sep-21	16-Sep-21	16-Sep-21	15-Sep-21	15-Sep-21	15-Sep-21
% Moisture	%	82.6	82.1	80.1	80.0	81.1	79.3	80.0	79.5	85.5	69.9	75.4	77.6
Aluminum (Al)	µg/g dw	1,144	1,251	655	1,506	977	878	6,541	14,715	13,927	1164	766	2867
Antimony (Sb)	µg/g dw	0.076	0.111	0.062	0.057	0.070	0.053	0.258	0.495	0.432	0.053	0.053	0.125
Arsenic (As)	µg/g dw	1.1	0.768	0.499	1.8	1.2	1.3	0.818	1.2	1.2	<0.423	<0.423	0.961
Barium (Ba)	µg/g dw	25	37	15	147	78	98	123	281	265	59	27	77
Boron (B)	µg/g dw	1.9	3.4	0.915	2.4	2.1	1.5	6.4	15.0	17.0	1.6	1.2	3.1
Cadmium (Cd)	µg/g dw	0.816	0.917	0.374	0.671	0.763	0.549	1.9	4.00	1.3	0.458	0.671	0.907
Calcium (Ca)	µg/g dw	2339	3887	2727	83,627	39,060	57,497	3,442	5,141	4,859	5,808	4,870	16,862
Chromium (Cr)	µg/g dw	6.2	7.5	3.0	7.4	6.9	7.8	21	31	28	6.0	8.7	28
Cobalt (Co)	µg/g dw	1.10	0.995	0.781	0.806	0.557	0.720	1.9	3.8	3.8	0.511	0.585	2.5
Copper (Cu)	µg/g dw	17	25	23	64	50	50	31	28	18	16	16	22
Iron (Fe)	µg/g dw	533	646	207	552	479	428	1,574	3,922	4,001	448	373	1276
Lead (Pb)	µg/g dw	0.347	0.503	0.213	0.277	0.308	0.201	1.2	2.6	2.4	0.340	0.228	0.585
Lithium (Li)	µg/g dw	0.703	1.1	0.445	3.1	2.7	2.3	2.8	5.2	4.5	0.767	0.600	1.5
Magnesium (Mg)	µg/g dw	2144	2723	2407	3,188	2,769	3,019	1,501	2,384	2,626	1,906	1,556	2,533
Manganese (Mn)	µg/g dw	74	67	62	27	47	39	120	325	115	43	39	45
Mercury (Hg)	µg/g dw	0.120	0.120	0.084	0.054	0.085	0.047	0.0930	0.116	0.101	0.109	0.081	0.0540
Molybdenum (Mo)	µg/g dw	0.246	0.430	0.246	0.679	0.601	0.496	0.653	0.993	1.30	0.287	0.209	0.655
Nickel (Ni)	µg/g dw	23	29	17	24	23	23	41	57	61	13	15	56
Phosphorus (P)	µg/g dw	9137	10329	12142	11,315	12,447	12,659	10,741	13,436	9,501	11,621	10,625	13,497
Potassium (K)	µg/g dw	7674	7791	10117	11,045	13,656	11,908	12,441	17,449	21,859	10,182	8,016	13,301
Selenium (Se)	µg/g dw	33	33	32	21	34	24	3.9	5.1	3.9	4.8	3.8	5.0
Silver (Ag)	µg/g dw	0.107	0.151	0.145	0.715	0.606	0.538	0.184	0.273	0.136	0.143	0.129	0.234
Sodium (Na)	µg/g dw	2445	3377	3605	4,905	6,472	5,091	4,988	5,078	10,209	4,285	2,228	3,183
Strontium (Sr)	µg/g dw	5.3	8.6	3.9	80	42	61	13	23	21	9.8	5.6	15
Thallium (Tl)	µg/g dw	0.089	0.040	0.039	0.120	0.127	0.122	0.103	0.204	0.208	0.041	0.035	0.107
Tin (Sn)	µg/g dw	0.305	0.516	0.179	0.481	0.422	0.343	1.00	1.90	0.906	0.218	0.376	1.9
Titanium (Ti)	µg/g dw	85	100	39	102	57	49	373	990	841	70	44	196
Uranium (U)	µg/g dw	0.122	0.252	0.093	0.272	0.141	0.124	0.161	0.359	0.407	0.059	0.044	0.133
Vanadium (V)	µg/g dw	2.2	2.5	1.2	2.3	1.8	1.4	7.4	21	18	1.90	1.10	3.9
Zinc (Zn)	µg/g dw	246	267	237	74	157	96	185	255	137	146	152	113

Selenium concentration exceeds the 45 µg/g dw preliminary Level 1 Benchmark for maternal amphibian diet (Mass é et al. 2015).
Selenium concentration exceeds the 41 µg/g dw Level 3 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 22 µg/g dw Level 2 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 15 µg/g dw Level 1 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 27 µg/g dw Level 3 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 20 µg/g dw Level 2 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 13 µg/g dw Level 1 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 26 µg/g dw Level 3 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 18 µg/g dw Level 2 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 11 µg/g dw Level 1 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 8.74 µg/g dw 97.5th percentile reference concentration (i.e., the upper boundary of the normal range) used to identify a difference from reference (Minnow 2020).

Notes: % = percent; µg/g dw = micrograms per gram dry weight; < = less than; EVWQP = Elk Valley Water Quality Plan.

[a] This sample is a single-taxa sample containing annelids (LUM) only; all other creek samples are composite-taxa samples.

Table H.2: Comparisons Among Areas for Selenium Concentrations in Composite-taxa Benthic Invertebrate Tissue Samples from Greenhills and Gardine Creeks, September 2018 to 2021

ANOVA Model				Spatial Post-hoc Comparisons					
Transformation	Station	Year	Station:Year	Area 1	Area 2	MOD [a]			
						2018	2019	2020	2021
$\log_{10}$	<0.001	0.045	<0.001	RG_GHBP	RG_GHUT	-72	-80	-68	-70
					RG_GHNF	ns	-63	-46	-60
					RG_GHFF	-69	-77	-69	-61
					RG_GAUT	-	-90	-76	-84
					RG_GANF	-	-84	-80	-83
				RG_GHUT	RG_GHNF	150	81	ns	ns
					RG_GHFF	ns	ns	ns	ns
					RG_GAUT	-	-53	ns	-45
					RG_GANF	-	ns	-37	-42
				RG_GHNF	RG_GHFF	-56	-38	ns	ns
					RG_GAUT	-	-74	-55	-59
					RG_GANF	-	-56	-63	-56
				RG_GHFF	RG_GAUT	-	-58	ns	-57
					RG_GANF	-	ns	-37	-55
				RG_GAUT	RG_GANF	-	69	ns	ns

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 marginal estimated means).

[a] MOD = $(MCT_{Area\ 2} - MCT_{Area\ 1})/MCT_{Area\ 1} * 100$.

Table H.3: Comparisons Among Years for Selenium Concentrations in Composite-taxa Benthic Invertebrate Tissue Samples from Greenhills and Gardine Creeks, September 2018 to 2021

ANOVA Model				Area	Temporal Post-hoc Comparisons to 2018 (or base year) MOD [a]		
Transformation	Station	Year	Station:Year		2019	2020	2021
$\log_{10}$	<0.001	0.045	<0.001	RG_GHBP	ns	ns	ns
				RG_GHUT	ns	ns	ns
				RG_GHNF	-33	ns	-43
				RG_GHFF	ns	ns	ns
				RG_GAUT	Base Year	54	ns
				RG_GANF	Base Year	ns	ns

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; MCT = Measure of Central Tendency (back-transformed marginal estimated means).
[a] MOD = $(MCT_{\text{Examined Year}} - MCT_{\text{Base Year}})/MCT_{\text{Base Year}} * 100$.

Table H.4: Comparison of Selenium Concentrations in Composite-taxa Benthic Invertebrate Tissue Samples Collected from Greenhills and Gardine Creeks in February Versus September, 2019 to 2021

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
<0.001	0.155	0.058	0.409	0.004	0.131	0.011	RG_GHUT	ns	ns	ns
							RG_GHFF	-35	ns	-
							RG_GHBP	ns	145	ns
							RG_GANF	-	ns	-

(grey) P-value <0.05.
(blue) Concentration in February is significantly higher relative to September within a given year.
(green) 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 marginal estimated 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 H.5: Mean Observed and Predicted Benthic Invertebrate Tissue Selenium Concentrations for Lotic Sampling Areas, Greenhills and Gardine Creeks, 2018 to 2021 [a]

Watercourse	Biological Monitoring Area	Year	Month	Tissue Selenium (µg/g dw)	Prediction Interval (ug/g dw)		
					Lower	Mean	Upper
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			
	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			
	RG_GHFF	2018	September	8.8	3.9	7.6	15
				8.8			
				6.3			

Mean selenium concentration exceeds the upper predicted limit.
Mean selenium concentration is less than the lower predicted limit.

Notes: µg/g dw = micrograms per gram dry weight.

[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 September 2020 samples from RG_GHBP (i.e., the samples with selenium concentrations of 17, 24, and 21 µg/g dw).

Table H.5: Mean Observed and Predicted Benthic Invertebrate Tissue Selenium Concentrations for Lotic Sampling Areas, Greenhills and Gardine Creeks, 2018 to 2021 [a]

Watercourse	Biological Monitoring Area	Year	Month	Tissue Selenium (µg/g dw)	Prediction Interval (ug/g dw)		
					Lower	Mean	Upper
Upper Greenhills Creek	RG_GHFF	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]			
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			

Mean selenium concentration exceeds the upper predicted limit.

Mean selenium concentration is less than the lower predicted limit.

Notes: µg/g dw = micrograms per gram dry weight.

[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 September 2020 samples from RG_GHBP (i.e., the samples with selenium concentrations of 17, 24, and 21 µg/g dw).

Table H.5: Mean Observed and Predicted Benthic Invertebrate Tissue Selenium Concentrations for Lotic Sampling Areas, Greenhills and Gardine Creeks, 2018 to 2021 [a]

Watercourse	Biological Monitoring Area	Year	Month	Tissue Selenium (µg/g dw)	Prediction Interval (ug/g 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			
	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			

Mean selenium concentration exceeds the upper predicted limit.
Mean selenium concentration is less than the lower predicted limit.
Notes: µg/g dw = micrograms per gram dry weight.
[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 September 2020 samples from RG_GHBP (i.e., the samples with selenium concentrations of 17, 24, and 21 µg/g dw).

Table H.6: Comparison of Selenium Concentrations Measured in Benthic Invertebrate Tissues and Concentrations Predicted Using the Selenium Species Bioaccumulation Tool[a], 2021

Watercourse/ Waterbody	Biological Monitoring Area	B-tool Prediction		Field Measurements	
		Water Sample Date	Predicted selenium concentration in benthic invertebrate tissues (µg/g dw)	Tissue Sample Date	Mean selenium concentrations in benthic invertebrate tissues [b] (µg/g dw)
Upper Greenhills Creek	RG_GHUT	17-Feb-21	7.1	17-Feb-21	7.0
		13-Sep-21	6.3	13-Sep-21	7.8
	RG_GHNF	10-Sep-21	8.6	10-Sep-21	10
	RG_GHFF	9-Sep-21	9.5	9-Sep-21	10
Greenhills Creek Sedimentation Pond	RG_GHP	23-Sep-21	35	23-Sep-21	16
Lower Greenhills Creek	RG_GHBP	18-Feb-21	15	17-Feb-21	33
		13-Sep-21	38	14-Sep-21	26
Gardine Creek	RG_GAUT	16-Sep-21	4.0	16-Sep-21	4.3
	RG_GANF	15-Sep-21	3.6	15-Sep-21	4.5

Mean benthic invertebrate tissue selenium concentration is higher than predicted.

Notes: B-tool = Selenium Speciation Bioaccumulation Tool, µg/g dw = micrograms per gram 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 2021) (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_GHFF and RG_GHP, respectively, in September 2021 are not included).

Table H.7: Chemistry Data for Benthic Invertebrate Tissue Samples Collected from Greenhills Creek Sedimentation Pond, September 2021

Analyte	Unite	Greenhills Creek Sedimentation Pond				
		RG_GHP				
		RG_GHP-1 [a]	RG_GHP-3	RG_GHP_BIV-3 [a]	RG_GHP-5	RG_GHP_BIV-5 [a]
		22-Sep-21	22-Sep-21	22-Sep-21	23-Sep-21	23-Sep-21
% Moisture	%	67.9	80.1	48.0	82.9	41.5
Aluminum (Al)	µg/g dw	5,711	10,651	5,872	12,090	13,669
Antimony (Sb)	µg/g dw	0.244	0.345	0.220	0.263	0.405
Arsenic (As)	µg/g dw	0.951	3.7	1.5	3.1	2.0
Barium (Ba)	µg/g dw	169	335	338	270	255
Boron (B)	µg/g dw	5.2	9.7	5.4	11	11
Cadmium (Cd)	µg/g dw	0.517	0.720	0.751	1.2	1.5
Calcium (Ca)	µg/g dw	215,780	134,919	319,525	96,029	500,159
Chromium (Cr)	µg/g dw	77	19	163	29	437
Cobalt (Co)	µg/g dw	4.2	1.8	7.3	2.9	21
Copper (Cu)	µg/g dw	9.6	77	36	71	61
Iron (Fe)	µg/g dw	3,218	2,807	4,342	3530	10,575
Lead (Pb)	µg/g dw	1.4	2.0	1.2	2.5	2.3
Lithium (Li)	µg/g dw	1.9	6.5	2.9	5.3	5.3
Magnesium (Mg)	µg/g dw	1,267	5,038	1,742	3,794	2,363
Manganese (Mn)	µg/g dw	38	86	91	84	207
Mercury (Hg)	µg/g dw	0.052	0.074	0.052	0.078	0.052
Molybdenum (Mo)	µg/g dw	0.406	1.0	0.638	0.638	2.6
Nickel (Ni)	µg/g dw	138	52	315	62	740
Phosphorus (P)	µg/g dw	1,187	12,801	4,839	10,876	5,461
Potassium (K)	µg/g dw	1,942	13,876	7,596	11,851	9,996
Selenium (Se)	µg/g dw	12	17	9.4	20	11
Silver (Ag)	µg/g dw	0.218	1.4	0.916	1.10	0.983
Sodium (Na)	µg/g dw	924	5,863	3,827	5,544	5,967
Strontium (Sr)	µg/g dw	181	125	669	90	176
Thallium (Tl)	µg/g dw	0.084	0.263	0.100	0.305	0.199
Tin (Sn)	µg/g dw	0.642	0.886	0.670	1.0	1.3
Titanium (Ti)	µg/g dw	475	1,036	439	878	998
Uranium (U)	µg/g dw	0.385	0.390	0.402	0.357	0.448
Vanadium (V)	µg/g dw	11	18	14	18	31
Zinc (Zn)	µg/g dw	26	65	49	82	68

Selenium concentration exceeds the 45 µg/g dw preliminary Level 1 Benchmark for maternal amphibian diet (Massé et al. 2015).
Selenium concentration exceeds the 41 µg/g dw Level 3 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 22 µg/g dw Level 2 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 15 µg/g dw Level 1 Benchmark for dietary effects to juvenile birds (EVWQP; Golder 2014).
Selenium concentration exceeds the 27 µg/g dw Level 3 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 20 µg/g dw Level 2 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 13 µg/g dw Level 1 Benchmark for growth, reproduction, and survival of benthic invertebrates (EVWQP; Golder 2014).
Selenium concentration exceeds the 26 µg/g dw Level 3 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 18 µg/g dw Level 2 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 11 µg/g dw Level 1 Benchmark for dietary effects to juvenile fish (EVWQP; Golder 2014).
Selenium concentration exceeds the 11 µg/g dw 97.5th percentile lentic reference concentration (i.e., the upper boundary of the normal range) used to identify a difference from reference (Minnow 2020).

Notes: % = percent; µg/g dw = micrograms per gram dry weight; < = less than; EVWQP = Elk Valley Water Quality Plan.

[a] These samples are single-taxa samples containing bivalves (BIV) only. No other taxa were found in the grab from RG_GHP-1. Due to the high proportions of bivalves in the composite-taxa samples collected from RG_GHP-3 and RG_GHP-5, each sample was divided into aliquots containing bivalves-only and "other" taxa prior to analysis.

APPENDIX I
WESTSLOPE CUTTHROAT TROUT

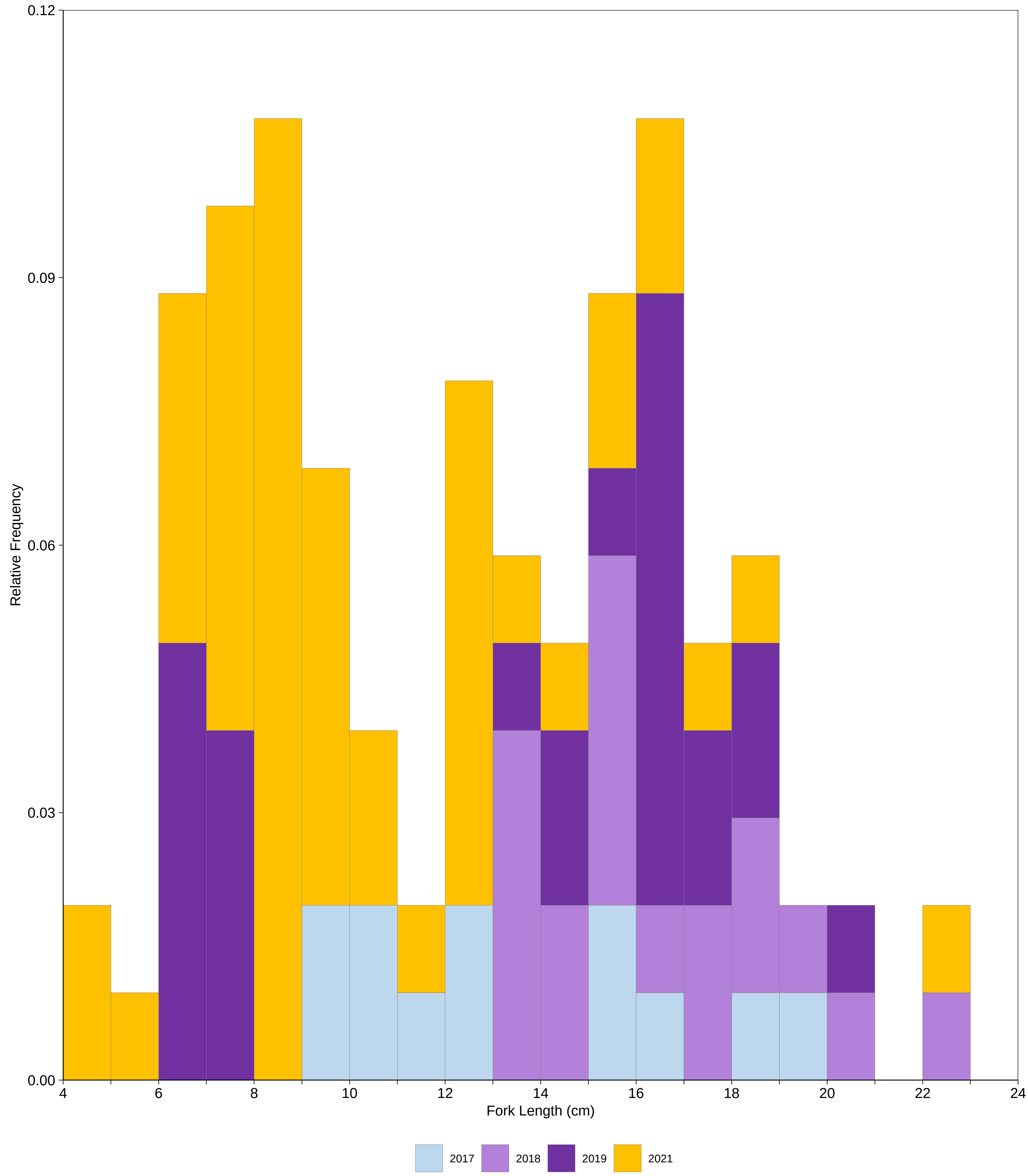


Figure I.1: Length-frequency Distribution for Westslope Cutthroat Trout Captured from Upper Greenhills and Gardine Creeks, 2017 to 2021

Table I.1: Catch, Abundance, Density, and Biomass Data for Westslope Cutthroat Trout Captured by Closed-station Electrofishing in Upper Greenhills Creek, September 2021

Area		Station ID	Upstream UTM Coordinates (NAD 83, Zone 11U)		Downstream UTM Coordinates (NAD 83, Zone 11U)		Date	Length of Run (m)	Mean Width (m)	Pass	Effort (seconds)	Number of Fish Caught	Fish Biomass Caught (g wet weight)	Abundance Estimate by Station [a]				Estimated Fish Density (no./100 m²) by Station			Estimated Fish Biomass (g/100 m²) by Station [b]		
			Easting	Northing	Easting	Northing								N	SE	LCI	UCI	N	LCI	UCI	N	LCI	UCI
Upper Greenhills Creek	RG_GHUT	RG_GHUT-EF1	654149	5549772	654161	5549749	13-Sep-21	35	3.0	1	451	0	0	0	0	0	0	0	0	0	0	0	0
										2	454	0	0										
										3	458	0	0										
										Total	1,363	0	0										
		RG_GHUT-EF2	654146	5549870	654151	5549829	13-Sep-21	40	2.8	1	353	0	0	0	0	0	0	0	0	0	0	0	0
										2	347	0	0										
										3	330	0	0										
										Total	**1,030**	**0**	**0**										
		RG_GHUT-EF3	654142	5549891	654125	5549917	16-Sep-21	30	2.5	1	248	0	0	0	0	0	0	0	0	0	0	0	0
										2	241	0	0										
										3	261	0	0										
										Total	**750**	**0**	**0**										
	RG_GHNF	RG_GHNF-EF1	654382	5548964	654384	5549006	17-Sep-21	40	2.5	1	284	0	0	1.0	1.2	0	3.3	1.0	0	3.3	100	0	329
										2	282	0	0										
										3	280	1	100										
										4	285	0	0										
										Total	**1,131**	**1**	**100**										
		RG_GHNF-EF2	654380	5549011	654372	5548937	21-Sep-21	30	3.0	1	269	1	36	2.0	0.38	1.2	2.8	2.2	1.4	3.1	103	64	142
										2	251	1	57										
										3	250	0	0										
										Total	**770**	**2**	**93**										
		RG_GHNF-EF3	654363	5549042	654374	5549073	22-Sep-21	35	2.5	1	305	0	0	2.0	2.3	0	6.6	2.3	0	7.5	92	0	302
										2	297	0	0										
										3	296	1	45										
										4	310	1	35										
										Total	**1,208**	**2**	**81**										
	RG_GHFF	RG_GHFF-EF1	654059	5547078	654020	5547046	15-Sep-21	50	2.8	1	276	1	5.1	3.0	1.5	0.029	6.0	2.1	0.021	4.3	11	0.10	21
										2	316	0	0										
										3	300	1	5.1										
										4	300	1	4.6										
										Total	**1,192**	**3**	**15**										
		RG_GHFF-EF2	654128	5547156	654111	5547113	15-Sep-21	40	3.0	1	354	0	0	2.0	2.3	0	6.6	1.7	0	5.5	8.6	0	28
										2	319	0	0										
										3	308	1	5.2										
										4	342	1	5.1										
										Total	**1,323**	**2**	**10**										
		RG_GHFF-EF3	654165	5547204	654135	5547177	20-Sep-21	43	3.0	1	355	1	5.7	2.0	0.38	1.2	2.8	1.6	0.97	2.1	28	17	38
										2	349	1	30										
										3	363	0	0										
										Total	**1,067**	**2**	**36**										

Notes: ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; m = metres; g = grams; N = number; SE = standard error; LCI = lower limit of the 95% confidence interval; UCI = upper limit of the 95% confidence interval; no./100 m_2 = number of fish per 100 square meters; g/100 m_2 = grams of fish biomass per 100 square metres; % = percent. Negative LCIs were truncated at 0.

[a] Mean abundance and 95% confidence intervals were estimated using multiple-pass depletion estimation (Carle and Strub 1978) as implemented in the FSA R package (Ogle et al. 2020). Each station was approximately 100 m^2.

[b] Biomass estimates were derived by multiplying population abundance by mean biomass of all captured fish.

Table I.2: Catch, Abundance, Density, and Biomass Data for Westslope Cutthroat Trout Captured by Closed-station and Spot Electrofishing in Gardine Creek, September 2021

Area		Station ID	Upstream UTM Coordinates (NAD 83, Zone 11U)		Downstream UTM Coordinates (NAD 83, Zone 11U)		Date	Length of Run (m)	Mean Width (m)	Pass	Effort (seconds)	Number of Fish Caught	Fish Biomass Caught (g wet weight)	Abundance Estimate by Station [a]				Estimated Fish Density (no./100 m^2) by Station			Estimated Fish Biomass (g/100 m^2) by Station [b]		
			Easting	Northing	Easting	Northing								N	SE	LCI	UCI	N	LCI	UCI	N	LCI	UCI
Upper Gardine Creek	RG_GAUT [c]	RG_GAUT-EF1	653551	5548836	653551	5548836	9-Sep-21	3.6	3.3	1	28	11	141	-	-	-	-	-	-	-	-	-	-
										2	27	17	142										
										Total	**55**	**28**	**282**										
		RG_GAUT-EF2	653538	5548845	653538	5548845	10-Sep-21	1.1	1.4	1	81	4	11	-	-	-	-	-	-	-	-	-	-
										Total	**81**	**4**	**11**										
		RG_GAUT-EF3	653576	5543797	653576	5548797	10-Sep-21	1.2	1.8	1	120	2	21	-	-	-	-	-	-	-	-	-	-
										Total	**120**	**2**	**21**										
Lower Gardine Creek	RG_GANF	RG_GANF-EF1	654261	5547781	654193	5547820	10-Sep-21	90	1.3	1	733	22	257	26	0.27	25	27	23	23	24	282	276	288
										2	537	4	61										
										3	676	0	0										
										Total	**1,946**	**26**	**317**										
		RG_GANF-EF2	654191	5547843	654109	5547834	29-Sep-21	80	1.0	1	894	0	0	2.0	0.56	0.91	3.1	2.5	1.1	3.9	28	13	43
										2	900	2	22										
										3	934	0	0										
										4	726	0	0										
										Total	**3,454**	**2**	**22**										
		RG_GANF-EF3	654038	5547848	654103	5547841	30-Sep-21	76	1.4	1	934	7	124	30	8.9	13	47	28	12	45	448	188	708
										2	800	7	115										
										3	755	5	62										
										4	803	4	65										
										Total	**3,292**	**23**	**365**										

Notes: ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; m = metres; g = grams; N = number; SE = standard error; LCI = lower limit of the 95% confidence interval; UCI = upper limit of the 95% confidence interval; no./100 m^2 = number of fish per 100 square meters; g/100 m^2 = grams of fish biomass per 100 square metres; - = no data/not calculated; % = percent. Negative LCIs were truncated at 0.

[a] Mean abundance and 95% confidence intervals were estimated using multiple-pass depletion estimation (Carle and Strub 1978) as implemented in the FSA R package (Ogle et al. 2020). Each station was approximately 100 m^2 unless otherwise indicated.

[b] Biomass estimates were derived by multiplying population abundance by mean biomass of all captured fish.

[c] Due to limited passes, population, density, and biomass estimations could not be calculated. The sampling locations were small pools.

Table I.3: Catch, Abundance, Density, and Biomass Data for Westslope Cutthroat Trout Captured by Closed-station Electrofishing in Lower Greenhills Creek, September 2021

Area		Station ID	UTM Coordinates (NAD 83, Zone 11U)		Date	Length of Run (m)	Mean Width (m)	Pass	Effort (seconds)	Number of Fish Caught	Fish Biomass Caught (g wet weight)	Abundance Estimate by Station[a]				Estimated Fish Density (no./100 m²) by Station			Estimated Fish Biomass (g/100 m²) by Station[b]		
			Easting	Northing								N	SE	LCI	UCI	N	LCI	UCI	N	LCI	UCI
Lower Greenhills Creek	Reach 1	GRE1_2	653530	5545618	9/15/2021	20	2.5	1	194	1	5.2	1.0	0	1.0	1.0	2.0	2.0	2.0	10	10	10
								2	171	0	0.0										
								Total	**365**	**1**	**5.2**										
		GRE1_3	653535	5545627	9/15/2021	18	2.5	1	178	1	14	1.0	0	1.0	1.0	2.2	2.2	2.2	31	31	31
								2	149	0	0										
								Total	**327**	**1**	**14**										
		GRE1_4	653515	5545587	9/15/2021	50	2	1	195	1	4.8	2.0	1	0.040	3.96	2.0	0	4.0	31	0.63	62
								2	170	1	27										
								Total	**365**	**2**	**31**										

Notes: ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; m = metres; g = grams; N = number; SE = standard error; LCI = lower limit of the 95% confidence interval; UCI = upper limit of the 95% confidence interval; no./100 m^2 = number of fish per 100 square meters; g/100 m^2 = grams of fish biomass per 100 square metres; - = no data/not calculated; % = percent. Negative LCIs were truncated at 0.

[a] Mean abundance and 95% confidence intervals were estimated using multiple-pass depletion estimation (Carle and Strub 1978) as implemented in the FSA R package (Ogle et al. 2020). Each station was approximately 100 m^2 unless otherwise indicated.

[b] Biomass estimates were derived by multiplying population abundance by mean biomass of all captured fish.

Table I.4: Catch, Abundance, Density, and Biomass Data for Westslope Cutthroat Trout Captured by Electrofishing in Upper and Lower Greenhills Creek, September 2017

Area		Station ID	Upstream UTM Coordinates (NAD 83, Zone 11U)		Downstream UTM Coordinates (NAD 83, Zone 11U)		Date	Length of Run (m)	Mean Width (m)	Pass	Effort (seconds)	Number of Fish Caught	Fish Biomass Caught (g wet weight)	Abundance Estimate by Station [a]				Estimated Fish Density (no./100 m^2) by Station			Estimated Fish Biomass (g/100 m^2) by Station [b]		
			Easting	Northing	Easting	Northing								N	SE	LCI	UCI	N	LCI	UCI	N	LCI	UCI
Upper Greenhills Creek	RG_GHUT	GHUT-EF1	654131	5549959	654157	5549944	14-Sep-17	12	1.6	1	320	0	0	0	-	-	-	0	-	-	-	-	-
										2	261	0	0										
										3	283	0	0										
										Total	**864**	**0**	**0**										
		GHUT-EF2	654145	5549859	654147	5549844	14-Sep-17	14	1.9	1	198	1	98	1.0	0	1.0	1.0	3.8	3.8	3.8	377	377	377
										2	223	0	0										
										3	340	0	0										
										Total	**761**	**1**	**98**										
		GHUT-EF3	654149	5549762	654154	5549752	14-Sep-17	12	2.6	1	229	0	0	0	-	-	-	0	-	-	-	-	-
										2	219	0	0										
										3	250	0	0										
										Total	**698**	**0**	**0**										
	RG_GHNF	GHNF-EF1	654385	5548986	654385	5548972	16-Sep-17	16	2.7	1	259	1	23	1.0	0	1.0	1.0	2.3	2.3	2.3	53	53	53
										2	273	0	0										
										3	553	0	0										
										Total	**1,085**	**1**	**23**										
		GHNF-EF2	654383	5549010	654383	5548996	16-Sep-17	16	2.5	1	274	1	10	1.0	0	1.0	1.0	2.5	2.5	2.5	24	24	24
										2	214	0	0										
										3	273	0	0										
										Total	**761**	**1**	**10**										
		GHNF-EF3	654372	5549057	654363	5549043	16-Sep-17	17	2.5	1	280	0	0	1.0	2.0	0	5.0	2.4	0	12	222	0	1105
										2	291	0	0										
										3	299	1	94										
										Total	**870**	**1**	**94**										
	RG_GHFF	GHFF-EF1	654050	5547067	654036	5547058	17-Sep-17	18	3.7	1	343	1	37	1.0	0	1.0	1.0	1.6	1.6	1.6	58	58	58
										2	290	0	0										
										3	281	0	0										
										Total	**914**	**1**	**37**										
		GHFF-EF2	654108	5547129	654111	5547122	17-Sep-17	18	2.8	1	218	2	37	4.0	0.54	2.9	5.1	8.1	5.9	10	127	93	161
										2	350	2	26										
										3	450	0	0										
										Total	**1,018**	**4**	**63**										
		GHFF-EF3	654130	5547168	654131	5547154	17-Sep-17	17	2.6	1	281	2	85	3.0	0.27	2.5	3.5	6.9	5.7	8.1	317	262	372
										2	274	1	52										
										3	356	0	0										
										Total	**911**	**3**	**138**										
Lower Greenhills Creek	RG_GHBP	GHBP-EF1	653509	5545588	653499	5545589	13-Sep-17	11	2.2	1	281	14	164	46	8.4	30	62	197	127	268	1,547	994	2,100
										2	342	9	40										
										3	478	10	34										
										4	232	4	52										
										Total	**1,333**	**37**	**290**										
		GHBP-EF2	653552	5545676	653544	5545663	13-Sep-17	15	3.2	1	652	26	244	54	6.1	42	66	115	90	140	1,012	789	1,235
										2	526	12	129										
										3	640	9	42										
										Total	**1,818**	**47**	**414**										
		GHBP-EF3	653542	5545683	653552	5545676	13-Sep-17	13	2.6	1	585	17	94	26	0.96	24	28	78	73	84	372	345	399
										2	613	8	27										
										3	625	1	2										
										Total	**1,823**	**26**	**123**										

Notes: ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; m = metres; g = grams; g ww = grams wet weight N = number; SE = standard error; LCI = lower limit of the 95% confidence interval; UCI = upper limit of the 95% confidence interval; no./100 m^2 = number of fish per 100 square meters; g/100 m^2 = grams of fish biomass per 100 square metres; - = no data/not calculated; % = percent. Negative LCIs were truncated at 0.

[a] Mean abundance and 95% confidence intervals were estimated using multiple-pass depletion estimation (Carle and Strub 1978) as implemented in the FSA R package (Ogle et al. 2020).

[b] Biomass estimates were derived by multiplying population abundance by mean biomass of all captured fish.

Table I.5: Catch, Abundance, Density, and Biomass Data for Westslope Cutthroat Trout Captured by Electrofishing in Upper and Lower Greenhills Creek, September 2018

Area		Station ID	Upstream UTM Coordinates (NAD 83, Zone 11U)		Downstream UTM Coordinates (NAD 83, Zone 11U)		Date	Length of Run (m)	Mean Width (m)	Pass	Effort (seconds)	Number of Fish Caught	Fish Biomass Caught (g wet weight)	Abundance Estimate by Station [a]				Estimated Fish Density (no./100 m^2) by Station			Estimated Fish Biomass (g/100 m^2) by Station [b]		
			Easting	Northing	Easting	Northing								N	SE	LCI	UCI	N	LCI	UCI	N	LCI	UCI
Upper Greenhills Creek	RG_GHUT	RG_GHUT-EF1	654143	5549873	654129	5549906	12-Sep-18	27	1.7	1	522	0	0	0	-	-	-	0	-	-	-	-	-
										2	555	0	0										
										3	382	0	0										
										Total	**1,459**	**0**	**0**										
		RG_GHUT-EF2	654143	5549873	654146	5549851	12-Sep-18	21	1.8	1	301	0	0	0	-	-	-	0	-	-	-	-	-
										2	305	0	0										
										3	287	0	0										
										Total	**893**	**0**	**0**										
		RG_GHUT-EF3	654156	5549784	654151	5549756	12-Sep-18	27	1.8	1	585	0	0	0	-	-	-	0	-	-	-	-	-
										2	445	0	0										
										3	507	0	0										
										Total	**1,537**	**0**	**0**										
	RG_GHNF	RG_GHNF-EF1	654384	5548993	654385	5548972	11-Sep-18	22	1.8	1	664	2	108	2.0	0	2.0	2.0	5.1	5.1	5.1	272	272	272
										2	510	0	0										
										3	539	0	0										
										Total	**1,713**	**2**	**108**										
		RG_GHNF-EF2	654383	5549010	654379	5548998	12-Sep-18	10	1.9	1	338	1	33	1.0	0	1.0	1.0	5.3	5.3	5.3	175	175	175
										2	301	0	0										
										3	312	0	0										
										Total	**951**	**1**	**33**										
		RG_GHNF-EF3	654373	5549057	654377	5549027	12-Sep-18	32	2.3	1	655	2	67	3.0	0.27	2.5	3.5	4.1	3.4	4.8	152	126	179
										2	645	1	45										
										3	667	0	0										
										Total	**1,967**	**3**	**112**										
	RG_GHFF	RG_GHFF-EF1	654063	5547075	654036	5547058	11-Sep-18	35	2.2	1	488	0	0	0	-	-	-	0	-	-	-	-	-
										2	431	0	0										
										3	443	0	0										
										Total	**1,362**	**0**	**0**										
		RG_GHFF-EF2	654122	5547150	654110	5547116	11-Sep-18	40	2.6	1	661	4	281	6.0	0.32	5.4	6.6	5.8	5.2	6.4	327	293	361
										2	509	1	32										
										3	509	1	28										
										4	441	0	0										
										Total	**2,120**	**6**	**340**										
		RG_GHFF-EF3	654145	5547100	654132	5547159	11-Sep-18	34	2.6	1	589	3	183	4.0	0.26	3.5	4.5	4.5	3.9	5.1	291	253	328
										2	524	0	0										
										3	518	1	74										
										4	547	0	0										
										Total	**2,178**	**4**	**257**										
Lower Greenhills Creek	RG_GHBP	RG_GHBP-EF1	653519	5545621	653503	5545599	10-Sep-18	34	1.8	1	336	11	194	15	0.35	14	16	25	24	26	430	410	450
										2	340	2	37										
										3	292	2	24										
										4	296	0	0										
										Total	**1,264**	**15**	**15**										
		RG_GHBP-EF2	653567	5545610	653528	5545610	10-Sep-18	45	1.8	1	467	20	308	28	0.54	27	29	36	34	37	472	454	490
										2	414	4	26										
										3	310	4	38										
										4	392	0	0										
										Total	**1,583**	**28**	**28**										
		RG_GHBP-EF3	653536	5545691	653544	5545661	10-Sep-18	27	2.0	1	863	47	437	70	2.1	66	74	130	122	137	1,199	1,129	1,269
										2	649	16	162										
										3	651	5	29										
										Total	**2,163**	**68**	**68**										

Notes: ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; m = metres; g = grams; N = number; SE = standard error; LCI = lower limit of the 95% confidence interval; UCI = upper limit of the 95% confidence interval; no./100 m^2 = number of fish per 100 square meters; g/100 m^2 = grams of fish biomass per 100 square metres; - = no data/not calculated; % = percent. Negative LCIs were truncated at 0.

[a] Mean abundance and 95% confidence intervals were estimated using multiple-pass depletion estimation (Carle and Strub 1978) as implemented in the FSA R package (Ogle et al. 2020).

[b] Biomass estimates were derived by multiplying population abundance by mean biomass of all captured fish.

Table I.6: Catch, Abundance, Density, and Biomass Data for Westslope Cutthroat Trout Captured by Electrofishing in Upper and Lower Greenhills Creek, September 2019

Area		Station ID	Upstream UTM Coordinates (NAD 83, Zone 11U)		Downstream UTM Coordinates (NAD 83, Zone 11U)		Date	Length of Run (m)	Mean Width (m)	Pass	Effort (seconds)	Number of Fish Caught	Fish Biomass Caught (g wet weight)	Abundance Estimate by Station [a]				Estimated Fish Density (no./100 m²) by Station			Estimated Fish Biomass (g/100 m²) by Station [b]		
			Easting	Northing	Easting	Northing								N	SE	LCI	UCI	N	LCI	UCI	N	LCI	UCI
Upper Greenhills Creek	RG_GHUT	RG_GHUT-EF1	654156	5549784	654151	5549756	17-Sep-19	30	1.2	1	519	0	0	0	-	-	-	0	-	-	-	-	-
										2	408	0	0										
										3	481	0	0										
										Total	**1,408**	**0**	**0**										
		RG_GHUT-EF2	654141	5550035	654142	5549889	17-Sep-19	42	1.0	1	408	0	0	0	-	-	-	0	-	-	-	-	-
										2	417	0	0										
										3	448	0	0										
										Total	**1,273**	**0**	**0**										
		RG_GHUT-EF3	654129	5550073	654141	5550035	17-Sep-19	43	1.0	1	467	0	0	0	-	-	-	0	-	-	-	-	-
										2	455	0	0										
										3	417	0	0										
										Total	**1,339**	**0**	**0**										
	RG_GHNF	RG_GHNF-EF1	654383	5549001	654382	5548971	18-Sep-19	32	2.0	1	593	0	0	1.0	0.73	0	2.4	1.6	0	3.8	100	0	244
										2	588	1	64										
										3	549	0	0										
										Total	**1,730**	**1**	**64**										
		RG_GHNF-EF2	654379	5549026	654383	5549007	18-Sep-19	30	1.8	1	481	1	52	1.0	0	1.0	1.0	1.9	1.9	1.9	96	96	96
										2	375	0	0										
										3	425	0	0										
										Total	**1,281**	**1**	**52**										
		RG_GHNF-EF3	654370	5549057	654379	5549026	18-Sep-19	40	2.0	1	880	2	99	3.0	0.27	2.5	3.5	3.8	3.1	4.4	205	170	241
										2	862	1	65										
										3	775	0	0										
										Total	**2,517**	**3**	**164**										
	RG_GHFF	RG_GHFF-EF1	654058	5547083	654037	5547059	16-Sep-19	44	2.7	1	359	0	0	7.0	3.5	0.17	14	5.9	0.14	12	87	2.1	172
										2	645	4	79										
										3	501	1	5.1										
										4	424	1	4.8										
										Total	**1,929**	**6**	**89**										
		RG_GHFF-EF2	654127	5547144	654109	5547116	16-Sep-19	46	2.8	1	577	1	49	1.0	0.0	1.0	1.0	0.78	0.78	0.78	38	38	38
										2	592	0	0										
										3	583	0	0										
										Total	**1,752**	**1**	**49**										
		RG_GHFF-EF3	654130	5547150	645144	5547196	16-Sep-19	42	3.0	1	788	4	95	4.0	0.0	4.0	4.0	3.2	3.2	3.2	75	75	75
										2	632	0	0										
										3	522	0	0										
										Total	**1,942**	**4**	**95**										
Lower Greenhills Creek	RG_GHBP	RG_GHBP-EF1	653521	5545619	653500	5545598	13-Sep-19	42	1.2	1	525	5	154	8.0	0.77	6.5	10	16	13	19	452	367	538
										2	633	2	50										
										3	554	1	24										
										Total	**1,712**	**8**	**228**										
		RG_GHBP-EF2	653500	5545598	653521	5545619	13-Sep-19	65	1.7	1	778	8	373	14	1.2	12	16	13	10	15	449	372	526
										2	686	4	49										
										3	678	2	74										
										Total	**2,142**	**14**	**496**										
		RG_GHBP-EF3	653539	5545171	653555	5545666	13-Sep-19	52	2.2	1	717	10	213	21	3.4	14	28	18	13	24	309	212	406
										2	615	5	68										
										3	593	4	39										
										Total	**1,925**	**19**	**320**										

Notes: ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; m = metres; g = grams; N = number; SE = standard error; LCI = lower limit of the 95% confidence interval; UCI = upper limit of the 95% confidence interval; no./100 m² = number of fish per 100 square meters; g/100 m² = grams of fish biomass per 100 square metres; - = no data/not calculated; % = percent. Negative LCIs were truncated at 0.

[a] Mean abundance and 95% confidence intervals were estimated using multiple-pass depletion estimation (Carle and Strub 1978) as implemented in the FSA R package (Ogle et al. 2020).

[b] Biomass estimates were derived by multiplying population abundance by mean biomass of all captured fish.

Table I.7: Supporting Measures Associated with Electrofishing on Upper Greenhills and Gardine Creeks, September 2021

Watercourse	**Greenhills Creek**									
Biological Area Code	**RG_GHUT**									
Station ID	**RG_GHUT-EF1**					**RG_GHUT-EF2**				
Date sampled	13-Sep-21					13-Sep-21				
Time (24 hrs)	10:15					13:40				
Start UTMs (NAD83, Zone 11U) - Easting, Northing	654125			5549917		654146			5549870	
End UTMs (NAD83, Zone 11U) - Easting, Northing	654142			5549891		654151			5549829	
Physical Characteristics										
Temperature (°C)	6.26					6.58				
pH	8.44					8.24				
DO (% sat)	93.4					95.2				
DO (mg/L)						11.57				
Conductance (µS/cm)	1,432					1,487				
Specific Conductance (µS/cm)	2,308					2,294				
ORP	79.1					277.3				
Habitat Characteristics										
Station Length (m)	40					40				
Station Width (m)	3					2.8				
Mean Depth (cm)	20					25				
Max Depth (cm)	50					60				
Water Appearance	Slightly turbid					Clear				
General Morphology (%)	**Pool/Pond**		**Riffle**		**Run**	**Pool/Pond**		**Riffle**		**Run**
	40		10		50	30		10		60
Bank Condition	Stable - no Bank Erosion					Stable - no Bank Erosion				
Substrate (%)	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**
	Calcite - no discernable substrate.					Calcite - no discernable substrate.				
Instream Cover (% of total surface)	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**
	0	0	10	20	0	0	0	5	10	0
	Other		Calcite = 10; OHV = 50			**Other**		Calcite = 50; OHV = 10		
Overhead Canopy (%)	**Dense**		**Partially Open**		**Open**	**Dense**		**Partially Open**		**Open**
	10		70		20	0		30		70
Aquatic Vegetation (% aerial coverage and dominant species)	**Emergent**	**Submergent**		**Floating**	**Attached Algae**	**Emergent**	**Submergent**		**Floating**	**Attached Algae**
	0	0		5, green	15, green filamentous	0	0		15, green filamentous	10, green filamentous
Stream Features	Calcite terraces					Calcite terraces				
Anthropogenic Disturbances	Calcite; logged a long time ago					Calcite; Logged a long time ago				
Surrounding Land Use	Forest					Forest				
Weather	Clear, frosty, cool					Clear, cold, frosty, sunny				
Riparian Vegetation types (descending dominance)	Shrubs, grasses					Shrubs, grasses				
Transect Number	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Wetted width (m)	3.5	2.8	4.6	2.7	2.5	1.9	2.2	3.1	2.7	3.1
Bankfull width (m)	7.8	10.2	13.2	6.4	11.3	4.5	5.4	7.8	10.0	10.0
Water Depth (cm) - Across Channel	13.0 10.0 20.0	27.0 32.0 20.0	16.5 41.0 5.0	10.0 20.0 21.5	23.0 28.0 24.0	15.0 20.0 13.0	22.0 29.0 13.0	20.0 19.0 15.0	12.0 36.0 18.0	85.0 23.0 32.0
Water Depth (cm) - Average	20.7					24.8				
Water Velocity (m/s) - Across Channel	0.011	0.039	0.060	0.430	0.084	0.035	0.293	0.229	0.092	0.149
Water Velocity (m/s) Average	0.12					0.16				

Notes: ID = identifier; hrs = hours; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; °C = degrees Celsius; - = no data/not applicable; DO = dissolved oxygen; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; ORP = oxidation-reduction potential; m = metres; cm = centimetres; ~ = approximately; % = percent; < = less than; OHV = overhanging vegetation; m/s = metres per second.

[a] Very overgrown with shrubs and difficult to access.

[b] All three electrofishing stations at RG_GAUT were isolated pools. Therefore, no flow measurements were taken at these stations.

[c] Side-channel was not measured.

[d] Back-eddy noted at this measurement location.

Table I.7: Supporting Measures Associated with Electrofishing on Upper Greenhills and Gardine Creeks, September 2021

Watercourse	**Greenhills Creek**		**Greenhills Creek**	
Biological Area Code	**RG_GHUT**		**RG_GHNF**	
Station ID	**RG_GHUT-EF3**		**RG_GHNF-EF1**	
Date sampled	14-Sep-21		13-Sep-21	
Time (24 hrs)	08:56		15:20	
Start UTMs (NAD83, Zone 11U) - Easting, Northing	654161	5549749	654382	5543964
End UTMs (NAD83, Zone 11U) - Easting, Northing	654149	5549772	654384	5549006
Physical Characteristics				
Temperature (°C)	5.42		5	
pH	8.54		7.78	
DO (% sat)	81.9		98.7	
DO (mg/L)	10.27		10.13	
Conductance (µS/cm)	1,426		1,355	
Specific Conductance (µS/cm)	2,278		2,194	
ORP	-		147.2	
Habitat Characteristics				
Station Length (m)	30		40	
Station Width (m)	2.5		2.5	
Mean Depth (cm)	20		-	
Max Depth (cm)	50		-	
Water Appearance	Clear, some hydrocarbon film		Clear	

General Morphology (%)	**Pool/Pond**	**Riffle**	**Run**	**Pool/Pond**	**Riffle**	**Run**
	60	15	25	85	10	5

Bank Condition	Stable - no Bank Erosion	Stable - no Bank Erosion

Substrate (%)	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**
	Calcite - no discernable substrate.					Calcite - no discernable substrate.				

Instream Cover (% of total surface)	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**
	0	0	0	30	0	10	5	5	60	5
	Other		Calcite = 5; OHV = 50			**Other**		Calcite = 10		

Overhead Canopy (%)	**Dense**	**Partially Open**	**Open**	**Dense**	**Partially Open**	**Open**
	50	50	0	0	100	0

Aquatic Vegetation (% aerial coverage and dominant species)	**Emergent**	**Submergent**	**Floating**	**Attached Algae**	**Emergent**	**Submergent**	**Floating**	**Attached Algae**
	0	0	0	25, green filamentous	0	0	0	10

Stream Features	Calcite terraces, step pools	Calcite terraces
Anthropogenic Disturbances	Calcite	Calcite
Surrounding Land Use	Forest	Forest
Weather	Cold, frosty, clear	Clear, sunny
Riparian Vegetation types (descending dominance)	Shrubs, grasses, deciduous trees	Shrubs, grasses

Transect Number	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Wetted width (m)	2.7	2.6	2.2	2.9	2.5	2.2	3.3	3.3	2.4	3.4
Bankfull width (m)	4.5	6.0	5.6	9.2	5.9	7.5	8.0	9.0	6.3	6.5
Water Depth (cm) - Across Channel	20.0, 24.0, 27.0	24.0, 16.0, 12.0	7.0, 33.0, 23.0	15.5, 25.0, 13.0	15.0, 42.0, 21.0	21.0, 31.0, 21.0	34.0, 10.0, 10.0	57.0, 30.5, 33.5	22.0, 28.0, 15.0	16.0, 15.0, 14.0
Water Depth (cm) - Average	21.2					23.9				
Water Velocity (m/s) - Across Channel	0.271	0.366	0.203	0.024	0.060	0.715	0.118	0.151	0.064	0.183
Water Velocity (m/s) Average	0.18					0.25				

Notes: ID = identifier; hrs = hours; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; °C = degrees Celsius; - = no data/not applicable; DO = dissolved oxygen; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; ORP = oxidation-reduction potential; m = metres; cm = centimetres; ~ = approximately; % = percent; < = less than; OHV = overhanging vegetation; m/s = metres per second.

[a] Very overgrown with shrubs and difficult to access.

[b] All three electrofishing stations at RG_GAUT were isolated pools. Therefore, no flow measurements were taken at these stations.

[c] Side-channel was not measured.

[d] Back-eddy noted at this measurement location.

Table I.7: Supporting Measures Associated with Electrofishing on Upper Greenhills and Gardine Creeks, September 2021

Watercourse	Greenhills Creek									
Biological Area Code	RG_GHNF									
Station ID	RG_GHNF-EF2 [a]					RG_GHNF-EF3 [a]				
Date sampled	16-Sep-21					16-Sep-21				
Time (24 hrs)	09:15					10:30				
Start UTMs (NAD83, Zone 11U) - Easting, Northing	654380		5549011			654363		5549042		
End UTMs (NAD83, Zone 11U) - Easting, Northing	654372		5549037			654374		5549073		
Physical Characteristics										
Temperature (°C)	-					5.42				
pH	-					8.54				
DO (% sat)	-					81.9				
DO (mg/L)	-					10.27				
Conductance (µS/cm)	-					1,426				
Specific Conductance (µS/cm)	-					2,278				
ORP	-					-				
Habitat Characteristics										
Station Length (m)	30					35				
Station Width (m)	-					-				
Mean Depth (cm)	15					15				
Max Depth (cm)	~100					50				
Water Appearance	Clear					Clear				
General Morphology (%)	**Pool/Pond**	**Riffle**	**Run**			**Pool/Pond**	**Riffle**	**Run**		
	70	5	25			70	5	25		
Bank Condition	Stable - no Bank Erosion					Moderate				
Substrate (%)	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**
	Calcite - no discernable substrate.					Calcite - no discernable substrate.				
Instream Cover (% of total surface)	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**
	<5	0	<5	20	0	<5	0	5	15	0
	Other	OHV = 90				**Other**	OHV = 90			
Overhead Canopy (%)	**Dense**	**Partially Open**	**Open**			**Dense**	**Partially Open**	**Open**		
	100	0	0			100	0	0		
Aquatic Vegetation (% aerial coverage and dominant species)	**Emergent**	**Submergent**	**Floating**	**Attached Algae**		**Emergent**	**Submergent**	**Floating**	**Attached Algae**	
	0	0	0	20, green filamentous		0	0	0	20, filamentous	
Stream Features	Step pools, calcite terraces					Step pools formed by calcite, calcite terraces				
Anthropogenic Disturbances	Calcite					Calcite				
Surrounding Land Use	Forest					Forest				
Weather	Sunny, below freezing, frosty					Clear, sunny, cold/frosty				
Riparian Vegetation types (descending dominance)	Shrubs (very dominant), horsetails, grasses					Shrubs, grasses, deciduous trees, horsetails				
Transect Number	1	2	3	4	5	1	2	3	4	5
Wetted width (m)	3.5	2.3	2.6	4.5	3.0	3.0	3.8	5.7	2.8	3.4
Bankfull width (m)	6.1	6.0	8.8	6.7	5.1	7.4	7.0	5.4	5.7	10.8
Water Depth (cm) - Across Channel	9.0, 26.5, 15.0	19.5, 13.5, 26.0	16.0, 11.0, 7.5	24.0, 44.0, 6.5	17.5, 9.0, 20.0	18.0, 17.0, 11.5	25.5, 19.0, 11.5	9.0, 13.0, 22.5	51.5, 17.0, 5.5	17.0, 15.0, 11.0
Water Depth (cm) - Average	17.7					17.6				
Water Velocity (m/s) - Across Channel	0.009	0.269	0.139	0.045	0.065 [d]	0.094	0.191	0.068	0.074	0.019
Water Velocity (m/s) Average	0.12					0.09				

Notes: ID = identifier; hrs = hours; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; °C = degrees Celsius; - = no data/not applicable; DO = dissolved oxygen; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; ORP = oxidation-reduction potential; m = metres; cm = centimetres; ~ = approximately; % = percent; < = less than; OHV = overhanging vegetation; m/s = metres per second.

[a] Very overgrown with shrubs and difficult to access.

[b] All three electrofishing stations at RG_GAUT were isolated pools. Therefore, no flow measurements were taken at these stations.

[c] Side-channel was not measured.

[d] Back-eddy noted at this measurement location.

Table I.7: Supporting Measures Associated with Electrofishing on Upper Greenhills and Gardine Creeks, September 2021

Watercourse	**Greenhills Creek**			
Biological Area Code	**RG_GHFF**			
Station ID	**RG_GHFF-EF1**		**RG_GHFF-EF2**	
Date sampled	13-Sep-21		13-Sep-21	
Time (24 hrs)	10:50		11:34	
Start UTMs (NAD83, Zone 11U) - Easting, Northing	654059	5547078	654128	5547156
End UTMs (NAD83, Zone 11U) - Easting, Northing	654020	5547046	654111	5547113
Physical Characteristics				
Temperature (°C)	5.88		6.6	
pH	8.76		8.66	
DO (% sat)	99.1		101.2	
DO (mg/L)	12.3		12.35	
Conductance (µS/cm)	1,089		1,111	
Specific Conductance (µS/cm)	1,716		1,714	
ORP	216.7		245.3	
Habitat Characteristics				
Station Length (m)	50		45	
Station Width (m)	-		-	
Mean Depth (cm)	15		15	
Max Depth (cm)	65		71	
Water Appearance	Clear		Clear	

General Morphology (%)	**Pool/Pond**	**Riffle**	**Run**	**Pool/Pond**	**Riffle**	**Run**
	20	70	10	30	50	20
Bank Condition	Moderate			Moderate		

Substrate (%)	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**
	0	10	60	10	20	0	5	60	10	25
Instream Cover (% of total surface)	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**
	5	5	15	5	0	5	5	20	5	0
	Other		-			**Other**		-		

Overhead Canopy (%)	**Dense**	**Partially Open**	**Open**	**Dense**	**Partially Open**	**Open**
	0	100	0	0	85	15

Aquatic Vegetation (% aerial coverage and dominant species)	**Emergent**	**Submergent**	**Floating**	**Attached Algae**	**Emergent**	**Submergent**	**Floating**	**Attached Algae**
	0	0	0	10, filamentous	0	0	0	5, filamentous

	RG_GHFF-EF1	RG_GHFF-EF2
Stream Features	Falls (short)	Log jams
Anthropogenic Disturbances	Calcified	Calcified
Surrounding Land Use	Forest	Forest
Weather	Clear, cool	Clean, sunny, warming up
Riparian Vegetation types (descending dominance)	Horsetail, grasses, forbs, moss, shrubs (very mixed)	Grasses, forbs, horsetails, shrubs

Transect Number	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Wetted width (m)	2.3	4.2	2.6	3.1	3.3	5.2	2.2	3.9	3.3	3.1
Bankfull width (m)	5.2	7.4	5.2	4.3	5.6	12.6	4.0 [c]	8.9	9.7	9.4
Water Velocity (m/s) - Across Channel	0.786	0.161	0.068	0.197	0.818	0.275	0.389	0.413	0.248	0.135
Water Velocity (m/s) Average	0.41					0.29				

Transect Number	1			2			3			4			5			1			2			3			4			5		
Water Depth (cm) - Across Channel	7.5	12.5	17.0	6.5	16.5	5.5	14.0	28.0	25.5	21.0	9.0	17.5	16.0	14.0	12.0	7.0	16.0	5.0	11.5	10.0	8.5	13.5	8.0	6.5	5.0	13.0	8.5	21.0	18.5	10.0
Water Depth (cm) - Average	14.8															10.8														

Notes: ID = identifier; hrs = hours; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; °C = degrees Celsius; - = no data/not applicable; DO = dissolved oxygen; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; ORP = oxidation-reduction potential; m = metres; cm = centimetres; ~ = approximately; % = percent; < = less than; OHV = overhanging vegetation; m/s = metres per second.

[a] Very overgrown with shrubs and difficult to access.

[b] All three electrofishing stations at RG_GAUT were isolated pools. Therefore, no flow measurements were taken at these stations.

[c] Side-channel was not measured.

[d] Back-eddy noted at this measurement location.

Table I.7: Supporting Measures Associated with Electrofishing on Upper Greenhills and Gardine Creeks, September 2021

Watercourse	**Greenhills Creek**		**Gardine Creek**	
Biological Area Code	**RG_GHFF**		**RG_GAUT [b]**	
Station ID	**RG_GHFF-EF3**		**RG_GAUT-EF1**	
Date sampled	13-Sep-21		9-Sep-21	
Time (24 hrs)	12:15		13:15	
Start UTMs (NAD83, Zone 11U) - Easting, Northing	654165	5547204	653551	5548836
End UTMs (NAD83, Zone 11U) - Easting, Northing	654135	5547177	-	-
Physical Characteristics				
Temperature (°C)	5.7		6.36	
pH	8.12		8.47	
DO (% sat)	91.2		82	
DO (mg/L)	9.5		10.09	
Conductance (µS/cm)	1,123		299	
Specific Conductance (µS/cm)	1,780		464	
ORP	151.1		260.8	
Habitat Characteristics				
Station Length (m)	43		4	
Station Width (m)	-		3.3	
Mean Depth (cm)	15		- (too turbid)	
Max Depth (cm)	25		40	
Water Appearance	Clear		Clear	

General Morphology (%)	**Pool/Pond**	**Riffle**	**Run**	**Pool/Pond**	**Riffle**	**Run**
	20	70	10	100	-	-
Bank Condition	Moderate			Moderate		

Substrate (%)	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**
	0	10	60	10	20	0	0	0	5	95
Instream Cover (% of total surface)	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**
	0	5	15	0	0	5	0	5	0	0
	Other		-			**Other**		OHV = 20		

Overhead Canopy (%)	**Dense**	**Partially Open**	**Open**	**Dense**	**Partially Open**	**Open**
	0	100	0	0	100	0

Aquatic Vegetation (% aerial coverage and dominant species)	**Emergent**	**Submergent**	**Floating**	**Attached Algae**	**Emergent**	**Submergent**	**Floating**	**Attached Algae**
	0	0	0	5, filamentous	0	0	0	0

	Greenhills Creek	Gardine Creek
Stream Features	Log jams	Culvert
Anthropogenic Disturbances	Calcified	Road Crossing
Surrounding Land Use	Forest	Forest, mining
Weather	Clear, Sunny	Clear
Riparian Vegetation types (descending dominance)	Grasses, Forbs, Shrubs, Deciduous trees, less horsetail	Shrubs, grasses, forbs

Transect Number	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Wetted width (m)	2.7	3.4	3.1	3.2	3.3	3.3				
Bankfull width (m)	4.0	5.2	7.1	9.8	5.6	4.0				
Water Depth (cm) - Average	14.6					-				
Water Velocity (m/s) - Across Channel	0.268	0.106	0.332	0.426	0.290	-	-	-	-	-
Water Velocity (m/s) Average	0.28					-				

Water Depth (cm) - Across Channel	Greenhills Creek	Gardine Creek
Transect 1	25.0, 26.5, 11.5	-, -, -
Transect 2	16.5, 20.0, 14.0	-, -, -
Transect 3	12.0, 12.0, 4.5	-, -, -
Transect 4	8.0, 13.0, 12.0	-, -, -
Transect 5	15.0, 17.5, 12.0	-, -, -

Notes: ID = identifier; hrs = hours; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; °C = degrees Celsius; - = no data/not applicable; DO = dissolved oxygen; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; ORP = oxidation-reduction potential; m = metres; cm = centimetres; ~ = approximately; % = percent; < = less than; OHV = overhanging vegetation; m/s = metres per second.

[a] Very overgrown with shrubs and difficult to access.

[b] All three electrofishing stations at RG_GAUT were isolated pools. Therefore, no flow measurements were taken at these stations.

[c] Side-channel was not measured.

[d] Back-eddy noted at this measurement location.

Table I.7: Supporting Measures Associated with Electrofishing on Upper Greenhills and Gardine Creeks, September 2021

Watercourse	Gardine Creek									
Biological Area Code	RG_GAUT [b]									
Station ID	RG_GAUT-EF2					RG_GAUT-EF3				
Date sampled	10-Sep-21					10-Sep-21				
Time (24 hrs)	08:38					10:25				
Start UTMs (NAD83, Zone 11U) - Easting, Northing	653538		5548845			653576		5543797		
End UTMs (NAD83, Zone 11U) - Easting, Northing	-		-			-		-		
Physical Characteristics										
Temperature (°C)	10.2					6.18				
pH	7.16					8.42				
DO (% sat)	101.4					87.7				
DO (mg/L)	11.43					10.66				
Conductance (µS/cm)	-					303				
Specific Conductance (µS/cm)	329					464				
ORP	271.2					255.1				
Habitat Characteristics										
Station Length (m)	1.1					1.15				
Station Width (m)	1.4					1.8				
Mean Depth (cm)	-					17				
Max Depth (cm)	16					23.5				
Water Appearance	Clear					Clear				
General Morphology (%)	**Pool/Pond**		**Riffle**		**Run**	**Pool/Pond**		**Riffle**		**Run**
	100		0		0	100		0		0
Bank Condition	Moderate					Moderate				
Substrate (%)	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**
	0	0	10	15	75	0	0	0	20	80
Instream Cover (% of total surface)	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**
	5	0	30	0	0	5	0	10	0	0
	Other		-			**Other**		-		
Overhead Canopy (%)	**Dense**		**Partially Open**		**Open**	**Dense**		**Partially Open**		**Open**
	0		0		100	0		100		0
Aquatic Vegetation (% aerial coverage and dominant species)	**Emergent**	**Submergent**		**Floating**	**Attached Algae**	**Emergent**	**Submergent**		**Floating**	**Attached Algae**
	0	0		0	0	0	0		0	0
Stream Features	Pool					Pool				
Anthropogenic Disturbances	Culvert, staff gauge upstream of road					None				
Surrounding Land Use	Forest, mining					Forest				
Weather	Clear					Clear, some haze				
Riparian Vegetation types (descending dominance)	Grasses, shrubs, forbs					Moss, horsetails, shrubs, forbs				
Transect Number	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Wetted width (m)	1.5					1.8				
Bankfull width (m)	2.0					2.0				
Water Depth (cm) - Across Channel	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Water Depth (cm) - Average	-					-				
Water Velocity (m/s) - Across Channel	-	-	-	-	-	-	-	-	-	-
Water Velocity (m/s) Average	-					-				

Notes: ID = identifier; hrs = hours; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; °C = degrees Celsius; - = no data/not applicable; DO = dissolved oxygen; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; ORP = oxidation-reduction potential; m = metres; cm = centimetres; ~ = approximately; % = percent; < = less than; OHV = overhanging vegetation; m/s = metres per second.

[a] Very overgrown with shrubs and difficult to access.

[b] All three electrofishing stations at RG_GAUT were isolated pools. Therefore, no flow measurements were taken at these stations.

[c] Side-channel was not measured.

[d] Back-eddy noted at this measurement location.

Table I.7: Supporting Measures Associated with Electrofishing on Upper Greenhills and Gardine Creeks, September 2021

Watercourse	Gardine Creek									
Biological Area Code	RG_GANF									
Station ID	RG_GANF-EF1					RG_GANF-EF2				
Date sampled	10-Sep-21					16-Sep-21				
Time (24 hrs)	12:36					15:20				
Start UTMs (NAD83, Zone 11U) - Easting, Northing	654261		5547781			654103		5547841		
End UTMs (NAD83, Zone 11U) - Easting, Northing	6541923		5547820			654038		5547848		
Physical Characteristics										
Temperature (°C)	7.45					5				
pH	8.67					7.14				
DO (% sat)	88.6					88.1				
DO (mg/L)	10.59					9.19				
Conductance (µS/cm)	771					2,209				
Specific Conductance (µS/cm)	1,159					3,595				
ORP	268.9					-				
Habitat Characteristics										
Station Length (m)	90					50				
Station Width (m)	1.25					-				
Mean Depth (cm)	10					6				
Max Depth (cm)	40					40				
Water Appearance	Clear					Clear				
General Morphology (%)	**Pool/Pond**		**Riffle**		**Run**	**Pool/Pond**		**Riffle**		**Run**
	60		10		40	50		10		40
Bank Condition	Moderate					Moderate				
Substrate (%)	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**	**Bedrock**	**Boulder**	**Cobble**	**Gravel**	**Sand/Fines**
	0	25	25	25	25	0	20	30	15	35
Instream Cover (% of total surface)	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**	**Undercut Banks**	**Boulder**	**Woody Debris**	**Deep Pool**	**Macrophytes**
	10	15	25	15	0	5	15	20	10	0
	Other		-			**Other**		-		
Overhead Canopy (%)	**Dense**		**Partially Open**		**Open**	**Dense**		**Partially Open**		**Open**
	30		60		0	30		60		0
Aquatic Vegetation (% aerial coverage and dominant species)	**Emergent**	**Submergent**		**Floating**	**Attached Algae**	**Emergent**	**Submergent**		**Floating**	**Attached Algae**
	0	0		0	0	0	0		0	0
Stream Features	A number of impassable upstream log falls					A few log jams/falls				
Anthropogenic Disturbances	None, other than calcite					None, other than calcite				
Surrounding Land Use	Forest					Forest				
Weather	Rain in morning, cool, clear in afternoon					-				
Riparian Vegetation types (descending dominance)	Moss, shrubs, forbs, deciduous trees					Shrubs, moss, forbs				
Transect Number	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Wetted width (m)	1.3	1.5	1.2	0.6	2.0	1.4	2.4	1.9	0.6	2.0
Bankfull width (m)	2.1	3.1	2.7	2.0	3.9	2.1	2.4	5.1	3.9	3.9
Water Depth (cm) - Across Channel	10.0 11.0 5.0	5.0 9.0 11.0	6.5 7.0 15.0	5.0 8.0 4.0	10.0 18.5 9.0	6.5 8.5 8.0	4.5 4.5 6.0	2.5 7.0 4.5	6.0 3.5 3.5	5.0 2.0 3.0
Water Depth (cm) - Average	8.9					5.0				
Water Velocity (m/s) - Across Channel	0.130	0.080	0.130	0.190	0.020	0.208	0.325	0.187	0.371	0.357
Water Velocity (m/s) Average	0.11					0.29				

Notes: ID = identifier; hrs = hours; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; °C = degrees Celsius; - = no data/not applicable; DO = dissolved oxygen; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; ORP = oxidation-reduction potential; m = metres; cm = centimetres; ~ = approximately; % = percent; < = less than; OHV = overhanging vegetation; m/s = metres per second.

[a] Very overgrown with shrubs and difficult to access.

[b] All three electrofishing stations at RG_GAUT were isolated pools. Therefore, no flow measurements were taken at these stations.

[c] Side-channel was not measured.

[d] Back-eddy noted at this measurement location.

Table I.7: Supporting Measures Associated with Electrofishing on Upper Greenhills and Gardine Creeks, September 2021

<table>
<tr><td>**Watercourse**</td><td colspan="15">**Gardine Creek**</td></tr>
<tr><td>**Biological Area Code**</td><td colspan="15">**RG_GANF**</td></tr>
<tr><td>**Station ID**</td><td colspan="15">**RG_GANF-EF3**</td></tr>
<tr><td>Date sampled</td><td colspan="15">11-Sep-21</td></tr>
<tr><td>Time (24 hrs)</td><td colspan="15">14:52</td></tr>
<tr><td>Start UTMs (NAD83, Zone 11U) - Easting, Northing</td><td colspan="7">654109</td><td colspan="8">5547834</td></tr>
<tr><td>End UTMs (NAD83, Zone 11U) - Easting, Northing</td><td colspan="7">654191</td><td colspan="8">5547843</td></tr>
<tr><td>**Physical Characteristics**</td><td colspan="15"></td></tr>
<tr><td>Temperature (°C)</td><td colspan="15">5.9</td></tr>
<tr><td>pH</td><td colspan="15">7.54</td></tr>
<tr><td>DO (% sat)</td><td colspan="15">90.2</td></tr>
<tr><td>DO (mg/L)</td><td colspan="15">9.17</td></tr>
<tr><td>Conductance (µS/cm)</td><td colspan="15">2,300</td></tr>
<tr><td>Specific Conductance (µS/cm)</td><td colspan="15">3,635</td></tr>
<tr><td>ORP</td><td colspan="15">-</td></tr>
<tr><td>**Habitat Characteristics**</td><td colspan="15"></td></tr>
<tr><td>Station Length (m)</td><td colspan="15">76</td></tr>
<tr><td>Station Width (m)</td><td colspan="15">1.4</td></tr>
<tr><td>Mean Depth (cm)</td><td colspan="15">10</td></tr>
<tr><td>Max Depth (cm)</td><td colspan="15">25</td></tr>
<tr><td>Water Appearance</td><td colspan="15">Clear</td></tr>
<tr><td rowspan="2">General Morphology (%)</td><td colspan="6">**Pool/Pond**</td><td colspan="5">**Riffle**</td><td colspan="4">**Run**</td></tr>
<tr><td colspan="6">20</td><td colspan="5">40</td><td colspan="4">40</td></tr>
<tr><td>Bank Condition</td><td colspan="15">Moderate</td></tr>
<tr><td rowspan="2">Substrate (%)</td><td colspan="3">**Bedrock**</td><td colspan="3">**Boulder**</td><td colspan="3">**Cobble**</td><td colspan="3">**Gravel**</td><td colspan="3">**Sand/Fines**</td></tr>
<tr><td colspan="3">0</td><td colspan="3">25</td><td colspan="3">25</td><td colspan="3">25</td><td colspan="3">25</td></tr>
<tr><td rowspan="3">Instream Cover (% of total surface)</td><td colspan="3">**Undercut Banks**</td><td colspan="3">**Boulder**</td><td colspan="3">**Woody Debris**</td><td colspan="3">**Deep Pool**</td><td colspan="3">**Macrophytes**</td></tr>
<tr><td colspan="3">-</td><td colspan="3">-</td><td colspan="3">-</td><td colspan="3">0</td><td colspan="3">0</td></tr>
<tr><td colspan="6">**Other**</td><td colspan="9">-</td></tr>
<tr><td rowspan="2">Overhead Canopy (%)</td><td colspan="5">**Dense**</td><td colspan="6">**Partially Open**</td><td colspan="4">**Open**</td></tr>
<tr><td colspan="5">30</td><td colspan="6">60</td><td colspan="4">0</td></tr>
<tr><td rowspan="2">Aquatic Vegetation (% aerial coverage and dominant species)</td><td colspan="4">**Emergent**</td><td colspan="4">**Submergent**</td><td colspan="3">**Floating**</td><td colspan="4">**Attached Algae**</td></tr>
<tr><td colspan="4">0</td><td colspan="4">0</td><td colspan="3">0</td><td colspan="4">0</td></tr>
<tr><td>Stream Features</td><td colspan="15">Cascades/falls/step pools</td></tr>
<tr><td>Anthropogenic Disturbances</td><td colspan="15">None, other than calcite</td></tr>
<tr><td>Surrounding Land Use</td><td colspan="15">Forest</td></tr>
<tr><td>Weather</td><td colspan="15">Clear, cool</td></tr>
<tr><td>Riparian Vegetation types (descending dominance)</td><td colspan="15">Moss, horsetails, shrubs, forbs, grass</td></tr>
<tr><td>**Transect Number**</td><td colspan="3">**1**</td><td colspan="3">**2**</td><td colspan="3">**3**</td><td colspan="3">**4**</td><td colspan="3">**5**</td></tr>
<tr><td>Wetted width (m)</td><td colspan="3">1.5</td><td colspan="3">2.1</td><td colspan="3">1.7</td><td colspan="3">1.7</td><td colspan="3">0.8</td></tr>
<tr><td>Bankfull width (m)</td><td colspan="3">2.4</td><td colspan="3">2.6</td><td colspan="3">2.4</td><td colspan="3">5.0</td><td colspan="3">6.2</td></tr>
<tr><td>Water Depth (cm) - Across Channel</td><td>3.5</td><td>9.0</td><td>11.5</td><td>13.0</td><td>11.5</td><td>4.0</td><td>30.0</td><td>10.0</td><td>11.5</td><td>6.5</td><td>18.5</td><td>9.0</td><td>6.5</td><td>3.5</td><td>3.0</td></tr>
<tr><td>Water Depth (cm) - Average</td><td colspan="15">10.1</td></tr>
<tr><td>Water Velocity (m/s) - Across Channel</td><td colspan="3">0.030</td><td colspan="3">0.230</td><td colspan="3">0.210</td><td colspan="3">Pool</td><td colspan="3">0.300</td></tr>
<tr><td>Water Velocity (m/s) Average</td><td colspan="15">0.19</td></tr>
</table>

Notes: ID = identifier; hrs = hours; UTMs = Universal Transverse Mercator Coordinates; NAD = North American Datum; °C = degrees Celsius; - = no data/not applicable; DO = dissolved oxygen; % sat = percent saturation; mg/L = milligrams per litre; µS/cm = microSiemens per centimetre; ORP = oxidation-reduction potential; m = metres; cm = centimetres; ~ = approximately; % = percent; < = less than; OHV = overhanging vegetation; m/s = metres per second.

[a] Very overgrown with shrubs and difficult to access.

[b] All three electrofishing stations at RG_GAUT were isolated pools. Therefore, no flow measurements were taken at these stations.

[c] Side-channel was not measured.

[d] Back-eddy noted at this measurement location.

Table I.8: Measurements and External Health Data for Individual Westslope Cutthroat Trout Captured from Upper Greenhills Creek, 2021

Processing Date	Biological Monitoring Area	Station ID	Pass No.	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Severity of External Anomalies (0 to 3)				Caudal Fin Length (mm)	Relative Caudal Fin Length (%)	Comments
								0	1	2	3			
17-Sep-21	RG_GHNF	EF1 [a]	3	GHNF1-66	19.9	18.8	100.2	X	-	-	-	25	13	-
21-Sep-21		EF2	1	GHNF2-69	17.4	16.6	36.5	X	-	-	-	23.23	13	-
			1	GHNF2-70	23.6	22.8	71.3	-	X	-	-	26.10	11	Lip/jaw nodule
			2	GHNF2-71	18.5	17.5	56.5	X	-	-	-	21.67	12	-
21-Sep-21		EF3	3	GHNF3-72	17.4	16.5	45.2	X	-	-	-	22.19	13	-
			4	GHNF3-73	16.0	15.0	35.4	X	-	-	-	20.10	13	-
15-Sep-21	RG_GHFF	EF1 [a]	1	GHFF1-61	8.5	8.2	5.1	X	-	-	-	12	14	-
			3	GHFF1-62	8.6	8.2	5.1	X	-	-	-	12	14	-
			4	GHFF1-63	8.4	8.1	4.6	X	-	-	-	12	14	-
15-Sep-21		EF2 [a]	3	GHFF2-64	8.6	8.1	5.2	X	-	-	-	12	14	-
			4	GHFF2-65	8.6	8.2	5.1	-	X	-	-	13	15	Minor/light active erosion on dorsal and caudal fins
20-Sep-21		EF3 [a]	1	GHFF3-67	8.7	8.3	5.7	X	-	-	-	12	14	-
			2	GHFF3-68	16.1	15.1	30.3	X	-	-	-	23	14	Body appeared "pinched" with wounds on both sides (suspected predation-related injury)
All Fish				**Sample Size**	**13**	**13**	**13**	**-**	**-**	**-**	**-**	**13**	**13**	**-**
				Average	**14**	**13**	**31**	**-**	**-**	**-**	**-**	**18**	**13**	**-**
				Median	**16**	**15**	**30**	**-**	**-**	**-**	**-**	**20**	**14**	**-**
				Standard Deviation	**5.4**	**5.2**	**31**	**-**	**-**	**-**	**-**	**5.8**	**1.2**	**-**
				Standard Error	**1.5**	**1.4**	**8.5**	**-**	**-**	**-**	**-**	**1.6**	**0.32**	**-**
				Minimum	**8.4**	**8.1**	**4.6**	**-**	**-**	**-**	**-**	**12**	**11**	**-**
				Maximum	**24**	**23**	**100**	**-**	**-**	**-**	**-**	**26**	**15**	**-**

Notes: ID = identifier; No. = number; cm = centimetres; g = grams; mm = millimetres; % = percent; X = severity of external anomaly (0 = no anomalies, 1 = minor, 2 = moderate; 3 = severe anomaly); = no data/not applicable.

[a] Due to an equipment malfunction, caudal fin measurements were read manually (i.e., the calipers did not have a functioning digital read-out).

Table I.9: Measurements and External Health Data for Individual Westslope Cutthroat Trout Captured from Gardine Creek, 2021

Processing Date	Biological Monitoring Area	Station ID	Pass No.	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Severity of External Anomalies (0 to 3)				Caudal Fin Length (mm)	Relative Caudal Fin Length (%)	Comments
								0	1	2	3			
9-Sep-21	RG_GAUT	EF1 [a]	1	GAUT1-01	15.3	15.0	25.8	X	-	-	-	22	14	-
				GAUT1-02	12.1	11.0	15.7	X	-	-	-	18	15	-
				GAUT1-03	7.6	7.3	3.3	X	-	-	-	12	16	-
				GAUT1-04	13.0	12.4	20.5	X	-	-	-	18	14	-
				GAUT1-05	6.8	6.4	2.7	X	-	-	-	12	18	-
				GAUT1-06	6.0	5.6	2.0	X	-	-	-	8	13	-
				GAUT1-07	9.4	9.0	7.2	X	-	-	-	14	15	-
				GAUT1-08	10.1	9.5	7.4	X	-	-	-	15	15	-
				GAUT1-09	14.3	13.8	20.2	X	-	-	-	19	13	-
				GAUT1-10	13.3	12.7	17.7	X	-	-	-	19	14	-
				GAUT1-11	12.7	12.3	18.2	X	-	-	-	21	17	-
			2	GAUT1-12	13.3	12.7	19.2	X	-	-	-	20	15	-
				GAUT1-13	10.4	9.9	9.9	-	X	-	-	16	15	Minor/light active erosion on caudal fin
				GAUT1-14	6.5	6.2	2.4	See comment				11	17	Deformed caudal fin
				GAUT1-15	8.4	7.9	5.7	X	-	-	-	12	14	-
				GAUT1-16	9.0	8.5	6.0	X	-	-	-	13	14	-
				GAUT1-17	9.5	9.1	7.2	X	-	-	-	15	16	-
				GAUT1-18	7.4	7.1	3.2	X	-	-	-	11	15	-
				GAUT1-19	9.8	9.3	6.8	X	-	-	-	14	14	-
				GAUT1-20	9.3	8.7	6.3	X	-	-	-	14	15	Caudal fin partly bitten off
				GAUT1-21	13.1	12.7	19.8	X	-	-	-	19	15	-
				GAUT1-22	8.4	8.1	5.4	X	-	-	-	12	14	-
				GAUT1-23	13.3	12.6	19.1	X	-	-	-	19	14	-
				GAUT1-24	7.7	7.4	4.3	X	-	-	-	14	18	-
				GAUT1-25	8.1	7.7	4.1	X	-	-	-	13	16	-
				GAUT1-26	7.3	7.0	3.2	X	-	-	-	12	16	-
				GAUT1-27	11.9	11.1	12.1	X	-	-	-	17	14	-
				GAUT1-28	9.6	9.1	7.1	X	-	-	-	15	16	-
10-Sep-21		EF2 [a]	1	GAUT2-29	7.2	6.9	3.3	-	X	-	-	12	17	Minor/light active fin erosion
				GAUT2-30	8.3	7.9	6.0	X	-	-	-	13	16	-
				GAUT2-31	4.5	4.2	0.68	X	-	-	-	7	16	-
				GAUT2-32	4.1	4.0	0.66	X	-	-	-	6	15	Mortality
10-Sep-21		EF3 [a]	1	GAUT3-33	11.3	10.7	14.3	X	-	-	-	17	15	-
				GAUT3-34	8.7	8.4	6.7	See comment				12	14	Shortened lower lobe on caudal fin
All Fish				**Sample Size**	**34**	**34**	**34**	**-**	**-**	**-**	**-**	**34**	**34**	**-**
				Average	**9.6**	**9.2**	**9.2**	**-**	**-**	**-**	**-**	**14**	**15**	**-**
				Median	**9.4**	**8.9**	**6.8**	**-**	**-**	**-**	**-**	**14**	**15**	**-**
				Standard Deviation	**2.8**	**2.7**	**7.0**	**-**	**-**	**-**	**-**	**3.9**	**1.2**	**-**
				Standard Error	**0.48**	**0.47**	**1.2**	**-**	**-**	**-**	**-**	**0.67**	**0.20**	**-**
				Minimum	**4.1**	**4.0**	**0.66**	**-**	**-**	**-**	**-**	**6.0**	**13**	**-**
				Maximum	**15**	**15**	**26**	**-**	**-**	**-**	**-**	**22**	**18**	**-**
10-Sep-21	RG_GANF [b]	EF1 [a]	1	GANF1-35	11.2	10.9	12.8	X	-	-	-	15	13	Mortality
				GANF1-36	11.8	11.3	15.6	X	-	-	-	18	15	Mortality
				GANF1-37	8.4	8.0	6.0	X	-	-	-	13	15	-
				GANF1-38	10.4	9.9	11.1	X	-	-	-	16	15	-
				GANF1-39	8.5	8.1	6.3	X	-	-	-	14	16	-
				GANF1-40	8.0	7.6	4.0	X	-	-	-	13	16	-
				GANF1-41	16.6	15.6	40.0	X	-	-	-	23	14	-
				GANF1-42	8.9	8.4	7.0	X	-	-	-	13	15	-

Notes: ID = identifier; No. = number; cm = centimetres; g = grams; mm = millimetres; % = percent; X = severity of external anomaly (0 = no anomalies, 1 = minor, 2 = moderate; 3 = severe anomaly); - = no data/not applicable.

[a] Due to an equipment malfunction, caudal fin measurements were read manually (i.e., the calipers did not have a functioning digital read-out).

[b] Fishing at stations RG_GANF-EF2 and RG_GANF-EF3 was postponed due to bear activity in the area. The upstream end of RG_GANF-1 and downstream end of RG_GANF-2 were separated by a barrier that was deemed impassible (i.e., movement of fish upstream into RG_GANF-EF2 between September 10 and 29, 2021 was considered unlikely).

Table I.9: Measurements and External Health Data for Individual Westslope Cutthroat Trout Captured from Gardine Creek, 2021

Processing Date	Biological Monitoring Area	Station ID	Pass No.	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	Severity of External Anomalies (0 to 3)				Caudal Fin Length (mm)	Relative Caudal Fin Length (%)	Comments
								0	1	2	3			
10-Sep-21	RG_GANF [b]	EF1 [a]	1	GANF1-43	8.1	7.6	4.2	X	-	-	-	13	16	-
				GANF1-44	12.9	12.3	16.3	X	-	-	-	16	12	-
				GANF1-45	12.1	11.6	16.2	X	-	-	-	17	14	-
				GANF1-46	9.1	8.7	7.5	X	-	-	-	13	14	-
				GANF1-47	13.4	12.9	14.5	X	-	-	-	19	14	-
				GANF1-48	8.0	7.6	4.0	-	X	-	-	13	16	Split in caudal fin
				GANF1-49	8.7	8.3	6.0	X	-	-	-	14	16	-
				GANF1-50	7.6	7.2	4.3	X	-	-	-	11	14	-
				GANF1-51	11.8	11.1	13.5	X	-	-	-	17	14	-
				GANF1-52	8.3	7.8	4.9	X	-	-	-	12	14	-
				GANF1-53	8.5	8.2	5.3	X	-	-	-	13	15	-
				GANF1-54	13.2	12.6	18.9	X	-	-	-	19	14	-
				GANF1-55	11.7	11.4	13.8	-	-	-	X	17	15	Severely shortened operculum
				GANF1-56	14.3	13.7	24.5	X	-	-	-	21	15	-
11-Sep-21			2	GANF1-57	7.5	7.1	3.6	X	-	-	-	12	16	-
				GANF1-58	10.9	9.9	10.5	X	-	-	-	15	14	-
				GANF1-59	13.4	12.8	22.9	X	-	-	-	18	13	-
				GANF1-60	12.6	12.0	23.6	X	-	-	-	18	14	-
29-Sep-21		EF2	2	GANF2-01	12.6	12.1	17.6	X	-	-	-	18.08	14	-
				GANF2-02	8.0	7.6	4.7	X	-	-	-	11.31	14	-
30-Sep-21		EF3	1	GANF3-01	13.8	13.0	23.4	X	-	-	-	17.22	12	-
				GANF3-02	12.8	12.1	13.8	X	-	-	-	16.25	13	-
				GANF3-03	11.6	10.9	13.6	-	X	-	-	13.43	12	Parasite - bulge between fins
				GANF3-04	10.7	10.0	10.1	X	-	-	-	15.31	14	-
				GANF3-05	12.7	12.0	18.6	X	-	-	-	17.75	14	-
				GANF3-06	14.8	14.2	26.5	X	-	-	-	18.86	13	-
				GANF3-07	12.9	12.3	17.7	X	-	-	-	16.49	13	-
			2	GANF3-08	14.7	13.9	24.2	X	-	-	-	17.47	12	-
				GANF3-09	11.8	11.0	15.4	X	-	-	-	16.03	14	-
				GANF3-10	14.1	13.4	25.1	X	-	-	-	19.50	14	-
				GANF3-11	8.3	7.8	4.2	X	-	-	-	9.55	12	-
				GANF3-12	13.4	12.6	21.1	X	-	-	-	17.37	13	-
				GANF3-13	10.4	9.8	8.7	X	-	-	-	13.57	13	-
				GANF3-14	12.6	12.0	16.3	X	-	-	-	13.34	11	-
			3	GANF3-15	13.5	12.7	21.8	X	-	-	-	18.51	14	-
				GANF3-16	13.8	13.0	22.3	X	-	-	-	18.18	13	-
				GANF3-17	8.8	8.4	5.6	X	-	-	-	11.05	13	-
				GANF3-18	9.2	8.7	5.8	X	-	-	-	11.67	13	-
				GANF3-19	9.5	9.0	6.4	X	-	-	-	11.58	12	-
			4 [a]	GANF3-20	12.5	11.9	16.6	X	-	-	-	17	14	-
				GANF3-21	12.4	11.8	16.6	X	-	-	-	19	15	-
				GANF3-22	14.6	13.9	26.4	X	-	-	-	20	14	-
				GANF3-23	8.6	8.2	5.3	X	-	-	-	13	15	-
All Fish				**Sample Size**	**51**	**51**	**51**	**-**	**-**	**-**	**-**	**51**	**51**	**-**
				Average	**11**	**11**	**14**	**-**	**-**	**-**	**-**	**16**	**14**	**-**
				Median	**12**	**11**	**14**	**-**	**-**	**-**	**-**	**16**	**14**	**-**
				Standard Deviation	**2.4**	**2.3**	**8.2**	**-**	**-**	**-**	**-**	**3.0**	**1.3**	**-**
				Standard Error	**0.34**	**0.32**	**1.1**	**-**	**-**	**-**	**-**	**0.42**	**0.19**	**-**
				Minimum	**7.5**	**7.1**	**3.6**	**-**	**-**	**-**	**-**	**9.6**	**11**	**-**
				Maximum	**17**	**16**	**40**	**-**	**-**	**-**	**-**	**23**	**16**	**-**

Notes: ID = identifier; No. = number; cm = centimetres; g = grams; mm = millimetres; % = percent; X = severity of external anomaly (0 = no anomalies, 1 = minor, 2 = moderate; 3 = severe anomaly); - = no data/not applicable.

[a] Due to an equipment malfunction, caudal fin measurements were read manually (i.e., the calipers did not have a functioning digital read-out).

[b] Fishing at stations RG_GANF-EF2 and RG_GANF-EF3 was postponed due to bear activity in the area. The upstream end of RG_GANF-1 and downstream end of RG_GANF-2 were separated by a barrier that was deemed impassible (i.e., movement of fish upstream into RG_GANF-EF2 between September 10 and 29, 2021 was considered unlikely).

Table I.10: **Measurements and External Health Data for Individual Westslope Cutthroat Trout Captured from Upper Greenhills Creek, 2017 to 2019**

	Processing Date	Station ID	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	DELT (Severe [S]; Minor [M]; Absent [A])				Caudal Length (mm)	Relative Caudal Fin Length (%)	Tag ID	Other Information (aging structure, fate)
							D	E	L	T				
2017	14-Sep-17	RG_GHUT-EF2	GHUT-WCT-01	20.3	19.4	98.2	A	A	A	A	37.8	19	3DD.003C022686	Scales, released
	16-Sep-17	RG_GHNF-EF1	GHNF-WCT-01	12.8	12.2	23.2	A	A	A	A	27.9	22	3DD.003C022690	Scales, released
		RG_GHNF-EF2	GHNF-WCT-02	9.9	9.4	9.7	A	A	A	A	21.4	22	3DD.003C02266C	Scales, released
		RG_GHNF-EF3	GHNF-WCT-03	19.7	18.7	94.1	A	A	A	A	40.2	20	3DD.003C02267E	Scales, released
	17-Sep-17	RG_GHFF-EF1	GHFF-WCT-01	15.8	15.1	37.5	A	A	A	A	29.9	19	3DD.003C022640	Scales, released
		RG_GHFF-EF2	GHFF-WCT-02	10.3	9.6	11.6	A	A	A	A	22.2	22	3DD.003C022679	Scales, released
			GHFF-WCT-03	13.7	12.9	25.0	A	A	A	A	27.6	20	3DD.003C02267F	Scales, released
			GHFF-WCT-04	11.1	10.4	12.0	A	A	A	A	21.7	20	3DD.003C02266B	Scales, released
			GHFF-WCT-05	11.3	10.6	14.4	A	A	A	A	22.2	20	3DD.003C02264D	Scales, released
		RG_GHFF-EF3	GHFF-WCT-06	17.4	16.5	65.1	A	A	A	A	34.0	20	3DD.003C022671	Scales, released
		RG_GHFF-EF3	GHFF-WCT-07	12.3	11.6	20.2	A	A	A	A	23.5	19	3DD.003C02265D	Scales, released
		RG_GHFF-EF3	GHFF-WCT-08	16.4	15.6	52.2	A	A	A	A	32.0	19	3DD.003C022645	Scales, released
	All Fish		**Sample Size**	**12**	**12**	**12**	**-**	**-**	**-**	**-**	**12**	**12**	**-**	**-**
			Average	**14**	**14**	**39**	**-**	**-**	**-**	**-**	**28**	**20**	**-**	**-**
			Median	**13**	**13**	**24**	**-**	**-**	**-**	**-**	**28**	**20**	**-**	**-**
			Standard Deviation	**3.6**	**3.5**	**32**	**-**	**-**	**-**	**-**	**6.5**	**1.1**	**-**	**-**
			Standard Error	**1.0**	**1.0**	**9.2**	**-**	**-**	**-**	**-**	**1.9**	**0.32**	**-**	**-**
			Minimum	**9.9**	**9.4**	**9.7**	**-**	**-**	**-**	**-**	**21**	**19**	**-**	**-**
			Maximum	**20**	**19**	**98**	**-**	**-**	**-**	**-**	**40**	**22**	**-**	**-**
2018	11-Sep-18	RG_GHNF-EF1	GHNF-EF1-01	16.4	15.7	53.4	A	A	A	A	-	-	3DD.003BF666EB	-
			GHNF-EF1-02	16.5	15.8	54.2	A	A	A	A	-	-	3DD.003BF666E1	-
			GHNF-EF1-03	23.2	22.4	141.2	A	A	A	A	-	-	3DD.003BF666DA	-
	12-Sep-18	RG_GHNF-EF2	GHNF-EF2-01	15.5	14.8	33.2	A	A	A	A	-	-	3DD.003BF66703	-
		RG_GHNF-EF3	GHNF-EF3-01	14.7	13.9	31.9	A	A	A	A	-	-	3DD.003BF66706	-
			GHNF-EF3-02	14.7	13.9	34.7	A	A	A	A	-	-	3DD.003BF666FB	-
			GHNF-EF3-03	15.9	15.3	45.3	A	A	A	A	-	-	3DD.003BF66700	-
	11-Sep-18	RG_GHFF-EF2	GHFF-EF2-01	18.4	17.4	72.4	A	A	A	A	-	-	3DD.003BF66705	-
			GHFF-EF2-02	20.7	19.8	101.4	A	A	A	A	-	-	3DD.003BF666FC	-
			GHFF-EF2-03	17.3	16.4	60.7	A	A	A	A	-	-	3DD.003BF666C6	-
			GHFF-EF2-04	16.7	16.0	46.1	A	A	A	A	-	-	3DD.003C02267F	Recap
			GHFF-EF2-05	14.2	13.5	31.9	A	A	A	A	-	-	3DD.003BF666EO	-
			GHFF-EF2-06	13.8	13.2	27.6	A	A	A	A	-	-	3DD.003BF666DC	-
		RG_GHFF-EF3	GHFF-EF3-01	18.7	18.1	67.6	A	A	A	A	-	-	3DD.003BF66701	-
			GHFF-EF3-02	21.3	20.1	103.5	A	A	A	A	-	-	3DD.003BF666F6	-
			GHFF-EF3-03	19.4	18.5	80.8	A	A	A	A	-	-	3DD.003BF6670D	-
			GHFF-EF3-04	14.9	14.6	34.5	A	A	A	A	-	-	3DD.003BF666E3	-
			GHFF-EF3-05	18.0	17.4	74.0	A	A	A	A	-	-	3DD.003BF666F7	-
	All Fish		**Sample Size**	**18**	**18**	**18**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Average	**17**	**16**	**61**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Median	**17**	**16**	**54**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Standard Deviation	**2.4**	**2.3**	**26**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Standard Error	**0.57**	**0.54**	**6.1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Minimum	**14**	**13**	**28**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Maximum	**23**	**22**	**141**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Notes: ID = identifier; cm = centimetres; g = grams; D = Deformity, E = Erosion, L =Lesion, T = Tumor; mm = millimetres; % = percent; - = no data/not applicable; recap = recaptured fish.

Table I.10: Measurements and External Health Data for Individual Westslope Cutthroat Trout Captured from Upper Greenhills Creek, 2017 to 2019

Processing Date		Station ID	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	DELT (Severe [S]; Minor [M]; Absent [A])				Caudal Length (mm)	Relative Caudal Fin Length (%)	Tag ID	Other Information (aging structure, fate)
							D	E	L	T				
2019	18-Sep-19	RG_GHNF-EF1	GHNF-EF1-01	17.0	16.3	64.3	A	A	A	A	2.3	14	3DD.003C022655	-
		RG_GHNF-EF2	GHNF-EF2-01	17.1	16.4	52.4	A	A	A	A	2.1	12	3DD.003C02263F	-
		RG_GHNF-EF3	GHNF-EF3-01	21.4	20.4	124.0	A	A	A	A	2.9	14	3DD.003C02267E	-
			GHNF-EF3-02	17.5	16.9	35.0	A	M	A	A	2.1	12	3DD.003BF66706	Minor erosion on upper lobe of caudal fin
			GHNF-EF3-03	18.0	17.2	64.2	A	A	A	A	2.0	11	3DD.003C022664	-
			GHNF-EF3-04	17.5	16.7	65.1	A	A	A	A	2.3	13	3DD.003C02264A	-
	16-Sep-19	RG_GHFF-EF1	GHFF-EF1-01	17.5	16.9	65.8	M	A	A	A	2.0	11	3DD.003BF666E3	Lower caudal fin deformed; caught with tag
			GHFF-EF1-02	7.7	7.5	5.4	A	A	A	A	1.1	14	-	-
			GHFF-EF1-03	6.5	6.2	3.4	A	A	A	A	1.0	15	-	-
			GHFF-EF1-04	7.0	6.7	4.4	M	A	A	A	1.0	14	-	Very minor operculum deformity
			GHFF-EF1-05	7.6	7.3	5.1	A	A	A	A	1.0	13	-	-
			GHFF-EF1-06	7.2	6.9	4.8	A	A	A	A	1.1	15	-	-
		RG_GHFF-EF2	GHFF-EF2-01	16.6	15.8	48.9	A	A	A	A	2.2	13	3DD.003BF666E0	Caught with tag
		RG_GHFF-EF3	GHFF-EF3-01	19.5	18.6	80.2	A	A	A	A	2.3	12	3DD.003C022639	-
			GHFF-EF3-02	7.6	7.2	5.1	A	A	A	A	1.1	14	-	-
			GHFF-EF3-03	7.3	7.0	4.6	A	A	A	A	1.0	14	-	-
			GHFF-EF3-04	7.7	7.4	5.2	A	A	A	A	1.1	14	-	-
	All Fish		**Sample Size**	**11**	**11**	**11**	**-**	**-**	**-**	**-**	**11**	**11**	**-**	**-**
			Average	**10**	**10**	**21**	**-**	**-**	**-**	**-**	**1.4**	**14**	**-**	**-**
			Median	**8**	**7**	**5**	**-**	**-**	**-**	**-**	**1.1**	**14**	**-**	**-**
			Standard Deviation	**5.0**	**4.8**	**29**	**-**	**-**	**-**	**-**	**0.53**	**1.3**	**-**	**-**
			Standard Error	**1.5**	**1.4**	**8.7**	**-**	**-**	**-**	**-**	**0.16**	**0.38**	**-**	**-**
			Minimum	**6.5**	**6.2**	**3.4**	**-**	**-**	**-**	**-**	**1.0**	**11**	**-**	**-**
			Maximum	**20**	**19**	**80**	**-**	**-**	**-**	**-**	**2.3**	**15**	**-**	**-**

Notes: ID = identifier; cm = centimetres; g = grams; D = Deformity, E = Erosion, L =Lesion, T = Tumor; mm = millimetres; % = percent; - = no data/not applicable; recap = recaptured fish.

Table I.11: Measurements and External Health Data for Individual Westslope Cutthroat Trout Captured from Gardine Creek, 2019

Processing Date		Station ID	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	DELT (Severe [S]; Minor [M]; Absent [A])				Caudal Length (cm)	Relative Caudal Fin Length (%)	Tag ID	Other Information (aging structure, fate)
							D	E	L	T				
2019	20-Sep-19	RG_GAUT	GAUT-EF1-01	18.4	17.4	49.7	A	M	A	A	2.4	13	3DD.003C02263E	Minor erosion on upper caudal fin
			GAUT-EF1-02	17.5	16.6	43.8	A	A	A	A	2.1	12	3DD.003C022637	-
			GAUT-EF1-03	19.1	18.3	68.7	A	A	A	A	2.3	12	3DD.003C022670	-
			GAUT-EF1-04	15.8	15	40.1	A	A	A	A	2.0	13	3DD.003C022654	-
			GAUT-EF1-05	17.1	16.3	41.3	A	A	A	A	2.1	12	3DD.003C022631	-
			GAUT-EF1-06	14.6	14	26.1	A	M	A	A	1.1	7.5	3DD.003C022634	Moderate erosion on anal and dorsal fins
			GAUT-EF1-07	15.3	14.6	31.5	A	M	A	A	1.9	12	3DD.003C02262E	Minor erosion on anal and dorsal fins
			GAUT-EF1-08	7.2	6.7	3.9	A	A	A	A	1.1	15	-	-
	19-Sep-19	GANF-EF1	GANF-EF1-01	14.3	13.5	24.6	A	A	A	A	1.8	13	3DD.003C022641	-
			GANF-EF1-02	13.1	12.4	18.0	A	A	A	A	1.6	12	3DD.003C02263B	-
			GANF-EF1-03	7.9	7.5	4.6	A	A	A	A	1.3	16	-	-
			GANF-EF1-04	7.1	6.8	3.4	A	A	A	A	1.0	14	-	-
			GANF-EF1-05	11.3	10.5	12.4	A	A	A	A	1.6	14	-	-
			GANF-EF1-06	7.6	7.3	4.5	A	A	A	A	1.2	16	-	-
			GANF-EF1-07	6.4	6.1	2.4	M	M	A	A	1.0	16	-	Small head, minor dorsal erosion
			GANF-EF1-08	10.5	10.0	10.2	A	M	A	A	1.5	14	-	Top lobe of caudal fin 1.0 cm shorter than bottom lobe
			GANF-EF1-09	12.9	12.3	18.3	A	A	A	A	1.7	13	3DD.003C022657	-
			GANF-EF1-10	7.4	7.0	4.2	A	A	A	A	1.1	15	-	-
			GANF-EF1-11	13.0	12.3	20.7	A	A	A	A	1.8	14	3DD.003C022642	-
			GANF-EF1-12	12	11.3	15.1	A	M	A	A	1.8	15	-	Minor erosion on lower caudal fin
			GANF-EF1-13	7.2	6.7	3.7	A	A	A	A	1.2	17	-	-
			GANF-EF1-14	7.1	6.8	3.3	A	A	A	A	1.1	15	-	-
			GANF-EF1-15	12.6	12.0	18.5	A	A	A	A	1.7	13	-	-
		GANF-EF2	GANF-EF2-01	7.5	7.0	3.9	A	A	A	A	1.0	13	-	-
			GANF-EF2-02	7.7	7.4	4.7	A	A	A	A	1.1	14	-	-
			GANF-EF2-03	9.8	9.5	9.7	A	A	A	A	1.4	14	-	-
			GANF-EF2-04	12.3	11.8	16.2	A	A	A	A	1.3	11	-	-
			GANF-EF2-05	15.3	14.5	29.9	A	A	A	A	2.0	13	3DD.003C0226SE	-
			GANF-EF2-06	11.4	10.7	11.9	A	A	A	A	1.5	13	-	-
			GANF-EF2-07	6.5	6.2	3.2	A	A	A	A	1.0	15	-	-
			GANF-EF2-08	13.3	12.6	20.6	A	A	A	A	1.8	14	3DD.003C022649	-
	20-Sep-19	GANF-EF3	GANF-EF3-01	16.9	15.8	41.8	A	A	A	A	2.1	12	3DD.003C02264F	-
			GANF-EF3-02	17.3	16.4	49.3	A	A	A	A	2.1	12	3DD.003C02266F	-
			GANF-EF3-03	17.0	16.1	43.1	A	M	A	A	2.0	12	3DD.003C02266D	Minor erosion on dorsal fin
			GANF-EF3-04	12.5	11.9	18.0	A	A	A	A	1.8	14	-	-
			GANF-EF3-05	7.8	7.5	4.3	A	A	A	A	1.1	14	-	-
			GANF-EF3-06	7.9	7.5	5.0	A	A	A	A	1.2	15	-	-
			GANF-EF3-07	7.6	7.2	4.3	A	A	A	A	1.1	14	-	-
			GANF-EF3-08	11.0	10.4	12.2	A	A	A	A	1.2	11	-	-
			GANF-EF3-09	11.0	10.5	12.6	A	A	A	A	1.8	16	-	-
			GANF-EF3-10	8.2	7.7	5.9	A	A	A	A	1.3	16	-	-
			GANF-EF3-11	13.1	12.4	19.3	A	A	A	A	1.9	15	3DD.003C0226BD	-
All Fish			**Sample Size**	**34**	**34**	**34**	-	-	-	-	-	**34**	-	-
			Average	**11**	**10**	**14**	-	-	-	-	-	**14**	-	-
			Median	**11**	**10**	**12**	-	-	-	-	-	**14**	-	-
			Standard Deviation	**3.3**	**3.2**	**13**	-	-	-	-	-	**1.5**	-	-
			Standard Error	**0.57**	**0.54**	**2.2**	-	-	-	-	-	**0.26**	-	-
			Minimum	**6.4**	**6.1**	**2.4**	-	-	-	-	-	**11**	-	-
			Maximum	**17**	**16**	**49**	-	-	-	-	-	**17**	-	-

Notes: ID = identifier; cm = centimetres; g = grams; D = Deformity, E = Erosion, L =Lesion, T = Tumor; % = percent; - = not data/not applicable

Table I.12: Measurements for Individual Westslope Cutthroat Trout Captured from Lower Greenhills Creek, 2021[a]

Processing Date	Biological Monitoring Area	Station ID	Pass No.	Fish ID	Fork Length (cm)	Weight (g)	Severity of External Anomalies (0 to 3)				Comments
							0	1	2	3	
15-Sep-21	Reach 1	2	1	-	7.2	5.2	X	-	-	-	-
		3	1	-	10.9	14.1	X	-	-	-	-
		4	1	-	7.7	4.8	X	-	-	-	-
			2	-	12.6	26.6	X	-	-	-	-
All Fish				**Sample Size**	**4**	**4**	**-**	**-**	**-**	**-**	**-**
				Average	**9.6**	**13**	**-**	**-**	**-**	**-**	**-**
				Median	**9.3**	**9.6**	**-**	**-**	**-**	**-**	**-**
				Standard Deviation	**2.6**	**10**	**-**	**-**	**-**	**-**	**-**
				Standard Error	**1.3**	**5.1**	**-**	**-**	**-**	**-**	**-**
				Minimum	**7.2**	**4.8**	**-**	**-**	**-**	**-**	**-**
				Maximum	**13**	**27**	**-**	**-**	**-**	**-**	**-**

Notes: ID = identifier; No. = number; cm = centimetres; g = grams; X = severity of external anomaly (0 = no anomalies, 1 = minor, 2 = moderate; 3 = severe anomaly); - = no data/not applicable.
[a] Fishing was completed by consultants other than Minnow and under a separate scope from the Greenhills and Gardine Creeks Aquatic Monitoring Program.

Table I.13: Measurements and External Health Data for Individual Westslope Cutthroat Trout Captured from Lower Greenhills Creek, 2017 to 2019

Year	Station ID	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	DELT (Severe [S]; Minor [M]; Absent [A])				Caudal Length (cm)	Relative Caudal Fin Length (%)	Tag ID	Other Information (aging structure, fate)
						D	E	L	T				
		GHBP-WCT-01	12.7	11.8	18.60	M	A	A	A	27.9	22	-	Shortened operculum
		GHBP-WCT-02	12.1	11.2	14.43	A	A	A	A	24.7	20	-	-
		GHBP-WCT-03	14.1	13.2	25.11	A	A	A	A	29.3	21	-	-
		GHBP-WCT-04	5.3	5.1	1.06	A	A	A	A	11.5	22	-	-
		GHBP-WCT-05	11.9	11.2	17.88	A	A	A	A	24.7	21	-	-
		GHBP-WCT-06	15.4	14.6	36.29	A	A	A	A	32.6	21	C02263C	-
		GHBP-WCT-07	9.5	8.9	6.83	A	A	A	A	19.4	20	-	-
		GHBP-WCT-08	7.1	6.6	3.33	A	A	A	A	14.3	20	-	No parr marks
		GHBP-WCT-09	10.3	9.5	9.41	A	A	A	A	21.2	21	-	-
		GHBP-WCT-10	6.9	6.3	2.33	A	A	A	A	11.9	17	-	-
		GHBP-WCT-11	5.4	5.1	1.49	A	A	A	A	11.7	22	-	-
		GHBP-WCT-12	5.7	5.3	1.71	A	A	A	A	12.8	22	-	-
		GHBP-WCT-13	9.1	8.4	7.43	A	A	A	A	20.1	22	-	-
		GHBP-WCT-14	12.2	11.4	18.13	A	A	A	A	28.2	23	-	-
		GHBP-WCT-15	5.5	5.2	1.43	A	A	A	A	11.2	20	-	-
		GHBP-WCT-16	4.6	4.3	0.94	A	A	A	A	9.4	20	-	-
		GHBP-WCT-17	6.6	6.2	2.42	A	A	A	A	11.3	17	-	-
		GHBP-WCT-18	9.8	9.1	7.82	A	A	A	A	20.3	21	-	-
	RG_GHBP_EF1	GHBP-WCT-19	11.2	10.5	13.08	A	A	A	A	24.4	22	-	-
		GHBP-WCT-20	4.2	4.0	0.79	A	A	A	A	7.9	19	-	-
		GHBP-WCT-21	7.1	6.7	3.10	A	A	A	A	15.0	21	-	-
		GHBP-WCT-22	10.9	9.4	9.02	A	A	A	A	20.9	19	-	-
		GHBP-WCT-23	4.9	4.6	1.10	A	A	A	A	10.0	20	-	-
		GHBP-WCT-24	6.2	5.8	2.00	A	A	A	A	11.7	19	-	Whole fish taken
		GHBP-WCT-25	5.6	5.3	1.73	A	A	A	A	10.5	19	-	-
		GHBP-WCT-26	10.6	10.0	9.81	A	A	A	A	21.1	20	-	-
2017		GHBP-WCT-27	10.1	9.5	10.20	A	A	A	A	21.7	22	-	-
		GHBP-WCT-28	6.1	5.7	2.23	A	A	A	A	12.4	20	-	Drowned in stop net
		GHBP-WCT-29	6.0	5.5	1.97	A	A	A	A	11.9	20	-	-
		GHBP-WCT-30	5.7	5.3	1.64	A	A	A	A	12.2	21	-	-
		GHBP-WCT-31	4.7	4.4	1.02	A	A	A	A	10.0	21	-	-
		GHBP-WCT-32	5.6	5.2	1.58	A	A	A	A	12.5	22	-	-
		GHBP-WCT-33	6.5	6.1	2.28	A	A	A	A	12.8	20	-	-
		GHBP-WCT-34	8.6	7.9	6.55	A	A	A	A	17.6	20	-	-
		GHBP-WCT-35	9.0	8.5	6.09	A	A	A	A	19.8	22	-	-
		GHBP-WCT-36	12.9	12.1	20.99	A	A	A	A	28.6	22	-	-
		GHBP-WCT-37	12.9	12.1	18.41	A	A	A	A	26.6	21	-	-
		GHBP-WCT-38	20.2	19.1	79.50	A	A	A	A	41.0	20	C02268D	-
		GHBP-WCT-39	11.2	10.5	12.78	A	A	A	A	23.2	21	-	-
		GHBP-WCT-40	7.1	6.8	3.22	A	A	A	A	15.1	21	-	-
		GHBP-WCT-41	6.0	5.6	1.98	A	A	A	A	12.2	20	-	-
		GHBP-WCT-42	6.5	6.0	2.54	A	A	A	A	14.6	22	-	-
		GHBP-WCT-43	12.3	11.5	16.79	A	A	A	A	27.4	22	-	-
		GHBP-WCT-44	10.2	9.4	9.57	A	A	A	A	23.8	23	-	-
	RG_GHBP_EF2	GHBP-WCT-45	4.4	4.1	0.82	A	A	A	A	9.5	22	-	-
		GHBP-WCT-46	5.9	5.7	1.93	A	A	A	A	12.4	21	-	-
		GHBP-WCT-47	12.8	12.0	19.88	A	A	A	A	27.5	21	-	-
		GHBP-WCT-48	5.6	5.3	1.50	M	A	A	M	12.4	22	-	Shortened operculum
		GHBP-WCT-49	6.5	6.2	2.53	A	A	A	A	13.0	20	-	-
		GHBP-WCT-50	6.4	6.0	2.50	M	A	A	A	13.2	21	-	Slightly shortened operculum
		GHBP-WCT-51	4.8	4.5	1.22	M	A	A	A	9.0	19	-	Curvature of spine from top
		GHBP-WCT-52	6.0	5.6	1.93	A	A	A	A	11.1	19	-	-

Notes: ID = identifier; cm = centimetres; g = grams; D = Deformity, E = Erosion, L =Lesion, T = Tumor; % = percent; - = not data/not applicable

Table I.13: Measurements and External Health Data for Individual Westslope Cutthroat Trout Captured from Lower Greenhills Creek, 2017 to 2019

Year	Station ID	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	DELT (Severe [S]; Minor [M]; Absent [A])				Caudal Length (cm)	Relative Caudal Fin Length (%)	Tag ID	Other Information (aging structure, fate)
						D	E	L	T				
2017	RG_GHBP_EF2	GHBP-WCT-53	12.0	11.3	16.89	A	A	A	A	25.7	21	-	-
		GHBP-WCT-54	5.8	5.4	1.88	A	A	A	A	13.5	23	-	-
		GHBP-WCT-55	5.9	5.6	1.99	A	A	A	A	11.8	20	-	-
		GHBP-WCT-56	5.6	5.3	1.50	A	A	A	A	11.3	20	-	-
		GHBP-WCT-57	11.0	10.3	11.31	A	A	A	A	22.2	20	-	-
		GHBP-WCT-58	9.4	8.8	7.36	A	A	A	A	22.3	24	-	-
		GHBP-WCT-59	10.7	10.0	12.51	A	A	A	A	23.3	22	-	-
		GHBP-WCT-60	11.1	10.3	11.49	A	A	A	A	21.9	20	-	-
		GHBP-WCT-61	10.2	9.6	9.11	A	A	A	A	19.8	19	-	-
		GHBP-WCT-62	9.3	8.7	7.01	A	A	A	A	19.2	21	-	-
		GHBP-WCT-63	7.2	6.8	3.83	A	A	A	A	15.3	21	-	-
		GHBP-WCT-64	5.6	5.3	1.75	A	A	A	A	11.4	20	-	-
		GHBP-WCT-65	5.3	5.0	1.41	M	A	A	A	10.7	20	-	Slightly shortened operculum on left side
		GHBP-WCT-66	6.3	5.9	2.38	M	A	A	A	12.7	20	-	Shortened operculum
		GHBP-WCT-67	13.2	12.3	20.62	A	A	A	A	26.0	20	-	-
		GHBP-WCT-68	6.7	6.4	3.02	A	A	A	A	13.6	20	-	-
		GHBP-WCT-69	5.9	5.6	2.22	A	A	A	A	11.1	19	-	-
		GHBP-WCT-70	5.1	4.8	1.28	A	A	A	A	9.8	19	-	-
		GHBP-WCT-71	10.6	9.9	9.71	A	A	A	A	21.6	20	-	-
		GHBP-WCT-72	16.1	15.1	41.79	A	A	A	A	33.4	21	C02268F	-
		GHBP-WCT-73	5.2	4.9	1.51	A	A	A	A	11.7	22	-	-
		GHBP-WCT-74	15.7	14.7	40.26	A	A	A	A	32.0	20	C022673	-
		GHBP-WCT-75	6.4	6.0	2.82	A	A	A	A	12.7	20	-	-
		GHBP-WCT-76	10.6	9.8	10.58	M	A	A	A	21.2	20	-	Shortened operculum on left side
		GHBP-WCT-77	5.5	5.2	1.49	A	A	A	A	12.3	22	-	-
		GHBP-WCT-78	5.6	5.3	1.67	A	A	A	A	12.9	23	-	-
		GHBP-WCT-79	7.0	6.6	3.22	A	A	A	A	14.4	21	-	-
		GHBP-WCT-80	6.9	6.6	3.10	A	A	A	A	15.2	22	-	-
		GHBP-WCT-81	6.1	5.8	1.98	A	A	A	A	11.7	19	-	-
		GHBP-WCT-82	5.5	5.2	1.56	A	A	A	A	11.3	21	-	-
		GHBP-WCT-83	11.9	11.1	15.09	A	A	A	A	25.0	21	-	-
		GHBP-WCT-84	7.0	6.6	2.95	M	A	A	A	14.8	21	-	Slightly shortened operculum
	RG_GHBP_EF3	GHBP-WCT-85	6.1	5.8	2.04	M	A	A	A	13.5	22	-	Slightly shortened operculum left side
		GHBP-WCT-86	10.8	10.1	11.38	A	A	A	A	23.8	22	-	-
		GHBP-WCT-87	7.1	6.7	2.93	A	A	A	A	13.5	19	-	-
		GHBP-WCT-88	6.7	6.3	2.72	A	A	A	A	13.9	21	-	No parr marks, but dots on dorsal
		GHBP-WCT-89	6.2	5.8	2.35	A	A	A	A	14.2	23	-	-
		GHBP-WCT-90	11.9	11.2	16.97	A	A	A	A	25.9	22	-	-
		GHBP-WCT-91	6.6	6.1	2.69	A	A	A	A	13.1	20	-	-
		GHBP-WCT-92	5.2	5.0	1.41	M	A	A	A	10.7	21	-	Shortened operculum on left side
		GHBP-WCT-93	10.4	9.7	9.29	M	A	A	A	21.7	21	-	-
		GHBP-WCT-94	4.9	4.6	1.18	A	A	A	A	11.6	24	-	-
		GHBP-WCT-95	11.2	10.4	12.35	A	A	A	A	24.9	22	-	-
		GHBP-WCT-96	7.0	6.6	2.94	A	A	A	A	14.8	21	-	-
		GHBP-WCT-97	9.4	8.8	8.14	A	A	A	A	20.7	22	-	-
		GHBP-WCT-98	6.5	6.0	2.30	M	A	A	A	13.7	21	-	Shortened operculum
		GHBP-WCT-99	5.6	5.3	1.67	A	A	A	A	12.5	22	-	-
		GHBP-WCT-100	11.3	10.6	12.05	A	A	A	A	23.9	21	-	-
		GHBP-WCT-101	6.1	5.7	1.99	A	A	A	A	11.6	19	-	-
		GHBP-WCT-102	7.5	7.1	4.17	A	A	A	A	18.5	25	-	-

Notes: ID = identifier; cm = centimetres; g = grams; D = Deformity, E = Erosion, L =Lesion, T = Tumor; % = percent; - = not data/not applicable

Table I.13: Measurements and External Health Data for Individual Westslope Cutthroat Trout Captured from Lower Greenhills Creek, 2017 to 2019

Year	Station ID	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	DELT (Severe [S]; Minor [M]; Absent [A])				Caudal Length (cm)	Relative Caudal Fin Length (%)	Tag ID	Other Information (aging structure, fate)
						D	E	L	T				
2017	RG_GHBP_EF3	GHBP-WCT-103	9.2	8.6	7.10	A	A	A	A	22.6	25	-	Top caudal split
		GHBP-WCT-104	6.8	6.4	3.11	A	A	A	A	17.5	26	-	No parr marks
		GHBP-WCT-105	7.2	6.8	3.57	A	A	A	A	16.2	23	-	-
		GHBP-WCT-106	6.7	6.3	3.04	A	A	A	A	16.1	24	-	-
		GHBP-WCT-107	6.6	6.2	2.83	M	A	A	A	13.2	20	-	Shortened operculum
		GHBP-WCT-108	5.0	4.6	1.30	A	A	A	A	11.9	24	-	-
		GHBP-WCT-109	6.2	5.8	2.25	A	A	A	A	15.4	25	-	-
		GHBP-WCT-110	5.4	5.1	1.65	A	A	A	A	11.5	21	-	-
		Sample Size	**110**	**110**	**110**	**-**	**-**	**-**	**-**	**110**	**110**	**-**	**-**
		Average	**8.2**	**7.7**	**7.5**	**-**	**-**	**-**	**-**	**17**	**21**	**-**	**-**
		Median	**6.9**	**6.4**	**2.9**	**-**	**-**	**-**	**-**	**15**	**21**	**-**	**-**
		Standard Deviation	**3.1**	**2.9**	**11**	**-**	**-**	**-**	**-**	**6.6**	**1.5**	**-**	**-**
		Standard Error	**0.30**	**0.28**	**1.0**	**-**	**-**	**-**	**-**	**0.63**	**0.15**	**-**	**-**
		Minimum	**4.2**	**4.0**	**0.79**	**-**	**-**	**-**	**-**	**7.9**	**17**	**-**	**-**
		Maximum	**20**	**19**	**80**	**-**	**-**	**-**	**-**	**41**	**26**	**-**	**-**
2018	RG_GHBP-EF1	GHBP-EF1-01	13.4	12.7	25.78	A	A	A	A	-	-	3DD.003BF666E6	-
		GHBP-EF1-02	12.0	11.5	16.62	A	A	A	A	-	-	3DD.003BF666F5	-
		GHBP-EF1-03	12.9	12.1	20.32	A	A	A	A	-	-	3DD.003BF66716	-
		GHBP-EF1-04	11.3	10.8	16.41	A	A	A	A	-	-	3DD.003BF666B9	-
		GHBP-EF1-05	9.0	8.8	8.71	A	A	A	A	-	-	-	-
		GHBP-EF1-06	10.3	9.6	9.62	A	A	A	A	-	-	-	-
		GHBP-EF1-07	10.9	10.2	10.15	A	A	A	A	-	-	3DD.003BF666B6	-
		GHBP-EF1-08	14.8	13.9	36.29	A	A	A	A	-	-	3DD.003BF666CC	-
		GHBP-EF1-09	15.8	15.1	38.94	A	A	A	A	-	-	3D6.00187AA3C2	Recapture
		GHBP-EF1-10	10.0	9.4	9.02	A	A	A	A	-	-	-	-
		GHBP-EF1-11	6.3	6.0	2.43	A	A	A	A	-	-	-	-
		GHBP-EF1-12	13.8	13.0	21.78	A	A	A	A	-	-	3DD.003BF666D1	-
		GHBP-EF1-13	12.0	11.6	15.66	A	A	A	A	-	-	3DD.003BF6670E	-
		GHBP-EF1-14	10.9	10.2	13.37	A	A	A	A	-	-	3DD.003BF666F3	-
		GHBP-EF1-15	10.8	10.3	10.56	A	A	A	A	-	-	3DD.003BF666CA	Skinny
	RG_GHBP-EF2	GHBP-EF2-01	17.8	16.8	62.14	A	A	A	A	-	-	3DD.003BF6670B	Light abrasion on flank
		GHBP-EF2-02	16.8	15.9	42.75	A	A	A	A	-	-	3DD.003BF666C4	-
		GHBP-EF2-03	10.8	10.0	12.07	A	A	A	A	-	-	3DD.003BF666C4	-
		GHBP-EF2-04	14.1	13.3	24.52	A	A	A	A	-	-	3DD.003BF666B7	-
		GHBP-EF2-05	11.6	11.0	14.07	A	A	A	A	-	-	3DD.003BF666DD	-
		GHBP-EF2-06	13.9	13.0	22.71	A	A	A	A	-	-	3DD.003BF666E5	-
		GHBP-EF2-07	15.4	14.8	33.98	A	A	A	A	-	-	3DD.003BF666F1	-
		GHBP-EF2-08	6.8	6.5	2.62	A	A	A	A	-	-	-	-
		GHBP-EF2-09	12.3	11.7	17.75	A	A	A	A	-	-	3DD.003BF666EE	-
		GHBP-EF2-10	6.3	5.9	2.21	A	A	A	A	-	-	-	-
		GHBP-EF2-11	11.9	11.4	15.63	A	A	A	A	-	-	3DD.003BF666D3	-
		GHBP-EF2-12	9.2	8.7	6.50	A	A	A	A	-	-	-	-
		GHBP-EF2-13	6.8	6.6	3.16	A	A	A	A	-	-	-	-
		GHBP-EF2-14	11.3	10.6	11.12	A	A	A	A	-	-	3DD.003BF666C7	-
		GHBP-EF2-15	6.8	6.5	2.63	A	A	A	A	-	-	-	-
		GHBP-EF2-16	10.2	9.7	9.94	A	A	A	A	-	-	3DD.003BF666BC	-
		GHBP-EF2-17	9.9	9.5	8.53	A	A	A	A	-	-	-	-
		GHBP-EF2-18	7.2	6.8	2.91	A	A	A	A	-	-	-	-
		GHBP-EF2-19	7.0	6.7	2.92	A	A	A	A	-	-	-	-
		GHBP-EF2-20	10.6	10.0	9.67	A	A	A	A	-	-	3DD.003BF666CF	-
		GHBP-EF2-21	11.1	10.6	12.54	A	A	A	A	-	-	3DD.003BF666BA	-
		GHBP-EF2-22	6.5	6.2	2.42	A	A	A	A	-	-	-	-
		GHBP-EF2-23	6.8	6.5	2.88	A	A	A	A	-	-	-	-
		GHBP-EF2-24	9.8	8.9	8.23	A	A	A	A	-	-	-	-

Notes: ID = identifier; cm = centimetres; g = grams; D = Deformity, E = Erosion, L =Lesion, T = Tumor; % = percent; - = not data/not applicable

Table I.13: Measurements and External Health Data for Individual Westslope Cutthroat Trout Captured from Lower Greenhills Creek, 2017 to 2019

Year	Station ID	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	DELT (Severe [S]; Minor [M]; Absent [A])				Caudal Length (cm)	Relative Caudal Fin Length (%)	Tag ID	Other Information (aging structure, fate)
						D	E	L	T				
2018	RG_GHBP-EF2	GHBP-EF2-25	12.8	12.1	19.85	A	A	A	A	-	-	3DD.003BF666BB	-
		GHBP-EF2-26	9.7	9.3	8.20	A	A	A	A	-	-	-	-
		GHBP-EF2-27	9.6	9.1	7.14	A	A	A	A	-	-	-	-
		GHBP-EF2-28	6.8	6.5	2.84	A	A	A	A	-	-	-	-
	RG_GHBP-EF3	GHBP-EF3-01	6.4	6.2	2.47	A	A	A	A	-	-	-	-
		GHBP-EF3-02	6.2	5.9	2.17	A	A	A	A	-	-	-	-
		GHBP-EF3-03	6.4	6.1	2.63	A	A	A	A	-	-	-	-
		GHBP-EF3-04	12.8	12.2	18.88	A	A	A	A	-	-	3DD.003BF666C5	-
		GHBP-EF3-05	9.8	9.2	7.75	A	A	A	A	-	-	-	-
		GHBP-EF3-06	16.0	15.3	40.52	A	A	A	A	-	-	3DD.003BF666CE	Dark mark on flank
		GHBP-EF3-07	12.2	11.4	15.12	A	A	A	A	-	-	3DD.003BF666DB	-
		GHBP-EF3-08	7.1	6.7	3.05	A	A	A	A	-	-	-	-
		GHBP-EF3-09	15.0	14.3	33.88	A	A	A	A	-	-	3DD.003BF666C9	-
		GHBP-EF3-10	6.9	6.7	3.15	A	A	A	A	-	-	-	-
		GHBP-EF3-11	14.4	13.6	26.43	A	A	A	A	-	-	3DD.003BF666C8	-
		GHBP-EF3-12	9.6	9.1	8.47	A	A	A	A	-	-	-	-
		GHBP-EF3-13	6.7	6.4	2.43	A	A	A	A	-	-	-	-
		GHBP-EF3-14	10.9	10.4	12.92	A	A	A	A	-	-	3DD.003BF666D4	-
		GHBP-EF3-15	5.8	5.6	1.99	A	A	A	A	-	-	-	-
		GHBP-EF3-16	12.5	11.8	16.70	A	A	A	A	-	-	3DD.003BF666CB	-
		GHBP-EF3-17	6.4	6.1	2.21	A	A	A	A	-	-	-	-
		GHBP-EF3-18	12.8	12.2	19.84	A	A	A	A	-	-	3DD.003BF666DE	-
		GHBP-EF3-19	12.2	11.4	16.24	A	A	A	A	-	-	3DD.003BF666BD	-
		GHBP-EF3-20	11.8	11.2	14.47	A	A	A	A	-	-	3DD.003BF666D7	-
		GHBP-EF3-21	6.7	6.3	2.82	A	A	A	A	-	-	-	-
		GHBP-EF3-22	11.8	11.2	13.47	A	A	A	A	-	-	3DD.003BF666D5	-
		GHBP-EF3-23	10.2	9.7	9.12	A	A	A	A	-	-	3DD.003BF666C2	-
		GHBP-EF3-24	11.3	10.8	13.97	A	A	A	A	-	-	3DD.003BF666E9	-
		GHBP-EF3-25	7.1	6.9	3.08	A	A	A	A	-	-	-	-
		GHBP-EF3-26	5.9	5.7	1.97	A	A	A	A	-	-	-	-
		GHBP-EF3-27	6.6	6.3	3.27	A	A	A	A	-	-	-	-
		GHBP-EF3-28	6.0	5.8	2.22	A	A	A	A	-	-	-	-
		GHBP-EF3-29	10.1	9.6	9.72	A	A	A	A	-	-	3DD.003BF666DF	-
		GHBP-EF3-30	11.1	10.4	12.02	A	A	A	A	-	-	3DD.003BF666D8	-
		GHBP-EF3-31	5.4	5.2	1.50	A	A	A	A	-	-	-	-
		GHBP-EF3-32	6.3	6.0	2.21	A	A	A	A	-	-	-	-
		GHBP-EF3-33	5.9	5.6	2.28	A	A	A	A	-	-	-	-
	RG_GHBP-EF3	GHBP-EF3-34	11.7	11.0	12.95	A	A	A	A	-	-	3DD.003BF666D6	-
		GHBP-EF3-35	6.7	6.5	2.96	A	A	A	A	-	-	-	-
		GHBP-EF3-36	6.2	6.0	2.23	A	A	A	A	-	-	-	-
		GHBP-EF3-37	14.2	13.7	26.96	A	A	A	A	-	-	3DD.003BF666B5	Dark mark on flank
		GHBP-EF3-38	12.0	11.6	14.45	A	A	A	A	-	-	3DD.003BF666F0	-
		GHBP-EF3-39	5.9	5.7	1.92	A	A	A	A	-	-	-	-
		GHBP-EF3-40	11.2	10.9	11.88	A	A	A	A	-	-	3DD.003BF666D0	-
		GHBP-EF3-41	5.9	5.6	2.03	A	A	A	A	-	-	-	-
		GHBP-EF3-42	5.6	5.4	1.75	A	A	A	A	-	-	-	-
		GHBP-EF3-43	6.7	6.5	2.94	A	A	A	A	-	-	-	-
		GHBP-EF3-44	8.9	8.5	5.99	A	A	A	A	-	-	-	-
		GHBP-EF3-45	5.7	5.6	1.98	A	A	A	A	-	-	-	-
		GHBP-EF3-46	9.2	8.8	6.46	A	A	A	A	-	-	-	-
		GHBP-EF3-47	12.0	11.4	14.00	A	A	A	A	-	-	3DD.003BF666D2	-
		GHBP-EF3-48	13.4	12.6	22.50	A	A	A	A	-	-	3DD.003BF666E4	-
		GHBP-EF3-49	12.0	11.4	15.24	A	A	A	A	-	-	3DD.003BF666EC	-
		GHBP-EF3-50	5.9	5.6	1.98	A	A	A	A	-	-	-	-

Notes: ID = identifier; cm = centimetres; g = grams; D = Deformity, E = Erosion, L =Lesion, T = Tumor; % = percent; - = not data/not applicable

Table I.13: Measurements and External Health Data for Individual Westslope Cutthroat Trout Captured from Lower Greenhills Creek, 2017 to 2019

Year	Station ID	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	DELT (Severe [S]; Minor [M]; Absent [A])				Caudal Length (cm)	Relative Caudal Fin Length (%)	Tag ID	Other Information (aging structure, fate)
						D	E	L	T				
2018	RG_GHBP-EF3	GHBP-EF3-51	5.6	5.3	1.87	A	A	A	A	-	-	-	-
		GHBP-EF3-52	10.5	10.1	11.33	A	A	A	A	-	-	3DD.003BF666E2	-
		GHBP-EF3-53	5.4	5.2	1.62	A	A	A	A	-	-	-	-
		GHBP-EF3-54	6.0	5.8	2.00	A	A	A	A	-	-	-	-
		GHBP-EF3-55	13.5	12.9	25.68	A	A	A	A	-	-	3DD.003BF666FF	-
		GHBP-EF3-56	6.3	6.1	2.38	A	A	A	A	-	-	-	-
		GHBP-EF3-57	10.7	10.3	15.27	A	A	A	A	-	-	3DD.003BF666CD	-
		GHBP-EF3-58	7.3	7.2	3.45	A	A	A	A	-	-	-	-
		GHBP-EF3-59	5.9	5.7	2.14	A	A	A	A	-	-	-	-
		GHBP-EF3-60	10.8	10.2	13.26	A	A	A	A	-	-	-	-
		GHBP-EF3-61	6.5	6.3	2.66	A	A	A	A	-	-	3DD.003BF66709	-
		GHBP-EF3-62	13.4	12.6	22.72	A	A	A	A	-	-	3DD.003BF666D9	-
		GHBP-EF3-63	11.6	11.0	17.97	A	A	A	A	-	-	3DD.003BF66707	-
		GHBP-EF3-64	10.6	10.0	10.54	A	A	A	A	-	-	3DD.003BF66710	-
		GHBP-EF3-65	10.7	10.3	12.17	A	A	A	A	-	-	3DD.003BF666F2	-
		GHBP-EF3-66	5.7	5.5	1.98	A	A	A	A	-	-	-	-
		GHBP-EF3-67	6.5	6.3	2.30	A	A	A	A	-	-	-	Mortality
		GHBP-EF3-68	6.0	5.7	2.22	A	A	A	A	-	-	-	Mortality
	Sample Size		**111**	**111**	**111**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Average		**9.7**	**9.2**	**11**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Median		**10**	**9.6**	**9.1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Standard Deviation		**3.1**	**3.0**	**11**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Standard Error		**0.30**	**0.28**	**1.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Minimum		**5.4**	**5.2**	**1.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Maximum		**18**	**17**	**62**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
2019	GHBP-EF1	GHBP-EF1-01	15.6	14.5	38.0	A	A	A	A	2.0	12.82	3D6.1D596DCEA5	Caught with tag; released alive
		GHBP-EF1-02	17.3	16.5	61.0	A	A	A	A	2.3	13.29	3D6.1D596DCEA6	Caught with tag; released alive
		GHBP-EF1-03	12.4	11.9	32.0	A	A	A	A	2.0	16.13	3D6.1D596DCEE6	Caught with tag; released alive
		GHBP-EF1-04	12.0	11.3	19.0	A	A	A	A	1.9	15.83	3D6.1D596DCEDA	Caught with tag; released alive
		GHBP-EF1-05	6.9	6.5	3.6	A	A	A	A	1.1	15.94	-	Released alive
		GHBP-EF1-06	12.5	12.0	13.0	S	A	A	A	1.7	13.60	3DD.003C0225E7	Missing gill plate; released alive
		GHBP-EF1-07	15.0	14.5	37.0	M	A	A	A	2.2	14.67	3DD.003C0225CC	Deformed upper caudal; released alive
		GHBP-EF1-08	13.0	12.2	24.0	A	A	A	A	1.8	13.85	3DD.003C02261C	Released alive
	GHBP-EF2	GHBP-EF2-01	17.6	16.6	52.0	A	A	A	A	2.0	11.36	3DD.003C022623	Released alive
		GHBF-EF2-02	12.6	11.9	31.0	A	A	A	A	1.8	14.29	3DD.003C022619	Released alive
		GHBF-EF2-03	21.7	20.6	82.0	A	M	A	A	1.2	5.53	3DD.003C022624	Released alive
		GHBF-EF2-04	17.6	16.6	50.0	A	A	A	A	2.1	11.93	3DD.003C02262B	Released alive
		GHBF-EF2-05	19.6	18.9	78.0	M	A	A	A	2.1	10.71	3DD.003C0225DA	Deformed gill plate
		GHBF-EF2-06	12.0	11.4	11.0	A	A	A	A	1.6	13.33	3DD.003C0225F8	Released alive
		GHBF-EF2-07	16.6	15.7	45.0	A	A	A	A	1.8	10.84	3DD.003C0225E0	Released alive
		GHBF-EF2-08	13.8	12.9	24.0	A	A	A	A	1.9	13.77	3DD.003C022626	Released alive
		GHBF-EF2-09	13.5	12.9	26.0	A	A	A	A	2.0	14.81	3DD.003C022648	Released alive
		GHBF-EF2-10	10.7	10.1	15.0	A	A	A	A	1.6	14.95	-	Released alive
		GHBF-EF2-11	9.7	9.1	8.0	A	A	A	A	1.3	13.40	-	Released alive
		GHBF-EF2-12	18.0	17.1	55.0	A	A	A	A	2.3	12.78	3DD.003BF666DD	Caught with tag; released alive
		GHBF-EF2-13	14.4	13.6	22.0	A	A	A	A	2.1	14.58	3D6.1D596DCEC7	Caught with tag; released alive
		GHBF-EF2-14	18.2	13.6	52.0	M	A	A	A	2.3	12.64	3D6.1D596DCEDF	Deformed operculum; caught with tag; released
	GHBP-EF3	GHBP-EF3-01	19.0	18.1	61.0	M	A	A	A	2.8	14.74	3DD.003C02268B	Deformed operculum; released alive
		GHBP-EF3-02	17.1	16.4	35.0	A	A	A	A	2.7	15.79	3DD.003C02265C	Released alive
		GHBP-EF3-03	12.5	11.8	9.0	A	A	A	A	1.7	13.60	3DD.003C02263A	Released alive
		GHBP-EF3-04	14.1	15.1	19.0	A	A	A	A	2.1	14.89	3DD.003C02261B	Released alive
		GHBP-EF3-05	15.3	14.6	22.0	A	A	A	A	2.1	13.73	3DD.003C02260E	Released alive
		GHBP-EF3-06	13.6	12.9	13.0	A	A	A	A	2.0	14.71	3DD.003C02261A	Released alive

Notes: ID = identifier; cm = centimetres; g = grams; D = Deformity, E = Erosion, L =Lesion, T = Tumor; % = percent; - = not data/not applicable

Table I.13: Measurements and External Health Data for Individual Westslope Cutthroat Trout Captured from Lower Greenhills Creek, 2017 to 2019

Year	Station ID	Fish ID	Total Length (cm)	Fork Length (cm)	Weight (g)	DELT (Severe [S]; Minor [M]; Absent [A])				Caudal Length (cm)	Relative Caudal Fin Length (%)	Tag ID	Other Information (aging structure, fate)
						D	E	L	T				
2019	GHBP-EF3	GHBP-EF3-07	14.9	14.3	22.0	A	A	A	A	1.8	12.08	3DD.003C022615	Released alive
		GHBP-EF3-08	12.3	11.8	8.0	A	A	A	A	1.7	13.82	3DD.003C022609	Released alive
		GHBP-EF3-09	6.8	6.4	3.2	A	A	A	A	1.1	16.18	-	Released alive
		GHBP-EF3-10	12.8	12.1	20.9	A	A	A	A	1.9	14.84	3DD.003C02260B	Released alive
		GHBP-EF3-11	10.7	10.4	12.8	M	A	A	A	1.5	14.02	-	Deformed caudal
		GHBP-EF3-12	9.4	9.0	8.5	A	A	A	A	1.1	11.70	-	Released alive
		GHBP-EF3-13	11.6	10.9	16.1	A	A	A	A	1.7	14.66	-	Released alive
		GHBP-EF3-14	12.6	12.0	21.3	A	A	A	A	2.0	15.87	3DD.003C022638	Released alive
		GHBP-EF3-15	9.2	8.7	9.8	A	A	A	A	1.6	17.39	-	Released alive
		GHBP-EF3-16	9.5	9.2	8.4	A	A	A	A	1.4	14.74	-	Released alive
		GHBP-EF3-17	9.9	9.4	9.6	A	A	A	A	1.6	16.16	-	Released alive
		GHBP-EF3-18	10.1	9.7	11.5	A	A	A	A	1.5	14.85	-	Released alive
		GHBP-EF3-19	9.5	9.0	9.4	A	A	A	A	1.4	14.74	-	Released alive
	Sample Size		**41**	**41**	**41**	**-**	**-**	**-**	**-**	**-**	**41**	**-**	**-**
	Average		**13**	**13**	**27**	**-**	**-**	**-**	**-**		**14**		
	Median		**13**	**12**	**21**	**-**	**-**	**-**	**-**		**14**		
	Standard Deviation		**3.5**	**3.3**	**20**	**-**	**-**	**-**	**-**		**2.0**		
	Standard Error		**0.54**	**0.51**	**3.2**	**-**	**-**	**-**	**-**		**0.32**		
	Minimum		**6.8**	**6.4**	**3.2**	**-**	**-**	**-**	**-**		**5.5**		
	Maximum		**22**	**21**	**82**	**-**	**-**	**-**	**-**		**17**		

Notes: ID = identifier; cm = centimetres; g = grams; D = Deformity, E = Erosion, L =Lesion, T = Tumor; % = percent; - = not data/not applicable

Table I.14: Statistical Comparisons of Westslope Cutthroat Trout Health Endpoints, Upper Greenhills Creek, 2017 to 2021

Indicator	Endpoint	Variables		Sample Size				Test	ANCOVA Model Statistics			Summary Statistics [b]					Test P-value (Year)	2017 vs. 2018		2017 vs. 2019		2017 vs. 2021	
		Response	Covariate	2017	2018	2019	2021		Interaction Model Interaction P-value	Parallel Slope Model Covariate P-value	Covariate Value for Comparisons [a]	Statistic	2017	2018	2019	2021		P-Value	MOD (%) [c]	P-Value	MOD (%) [c]	P-Value	MOD (%) [c]
Body Size	Fork Length	Fork Length (cm)	-	12	18	17	13	K-W	-	-	-	Median	12.6	15.9	15.8	15.1	0.16	ns	ns	ns	ns	ns	ns
Body Size	Body Weight	Body Weight (g)	-	12	18	17	13	K-W	-	-	-	Median	24.1	53.8	35.0	30.3	0.047	0.095	123	0.65	45	0.51	26
Energy Storage	Condition	$\log_{10}$[Body Weight (g)]	$\log_{10}$[Fork Length (cm)]	12	18	17	13	ANCOVA	0.33	<0.001	13	Adjusted Mean	29.2	29.3	29.9	21.5	<0.001	1.0	0.33	0.98	2.4	<0.001	-26
Energy Storage	Condition (Outliers Removed)	$\log_{10}$[Body Weight (g)]	$\log_{10}$[Fork Length (cm)]	12	18	16 [d]	11 [e]	ANCOVA	0.11	<0.001	13	Adjusted Mean	27.5	27.3	29.4	20.2	<0.001	1.0	-0.74	0.20	7.0	<0.001	-26

Area p-value <0.1 or interaction p-value <0.05.

MOD >25% for (or >10% for condition).

Covariate P-value >0.05.

Notes: ANCOVA = Analysis of Covariance; vs. = versus; MOD = Magnitude of Difference; % = percent; cm = centimetres; - = no data/not applicable; K-W = Kruskal-Wallis; ns = not significant; g = grams; < = less than; > = greater than; MCT = Measure of Central Tendency. Fish with fork lengths <6.5 cm were excluded from the analyses.

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[b] The median and adjusted mean are reported for K-W and ANCOVA, respectively, and the predicted means of the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction (i.e., different slopes) occurs.

[c] Calculated as the difference in the MCT between years (expressed as a percentage of the MCT for 2017).

[d] One outlier (GHNF-EF3-02, Studentized residual = -4.7) was removed from analysis.

[e] Two outliers (GHNF-EF1-P3-WCT-66, Studentized residual = 4.4; GHNF-EF2-P1-WCT-70, Studentized residual = -4.1) were removed from analysis.

Table I.15: Statistical Comparisons of Westslope Cutthroat Trout Health Endpoints, Upper Gardine Creek, 2019 and 2021

Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics [b]			Test P-value (Year)	MOD (%) [c]
							Interaction Model	Parallel Slope Model	Covariate Value for Comparisons [a]					
		Response	Covariate	2019	2021		Interaction P-value	Covariate P-value		Statistic	2019	2021		
Body Size	Fork Length	Fork Length (cm)	-	8	29	tequal	-	-	-	Mean	14.9	9.86	<0.001	-34
	Body Weight	Body Weight (g)	-	8	29	tunequal	-	-	-	Geometric Mean	30.7	8.57	0.004	-72
Energy Storage	Condition	$\log_{10}$[Body Weight (g)]	$\log_{10}$[Fork Length (cm)]	8	29	ANCOVA	0.55	<0.001	11	Adjusted Mean	12.7	10.9	0.01	-14

Area p-value <0.1 or interaction p-value <0.05.

MOD >25% for (or >10% for condition).

Covariate P-value >0.05.

Notes: ANCOVA = Analysis of Covariance; MOD = Magnitude of Difference; % = percent; cm = centimetres; - = no data/not applicable; tequal = equal variances t-test; < = less than; g = grams; > = greater than; MCT = Measure of Central Tendency. Fish with fork lengths <6.5 cm were excluded from the analyses.

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[b] The mean (geometric mean for $\log_{10}$-transformed variables) and adjusted mean are reported for tequal and ANCOVA, respectively, and the predicted means of the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction (i.e., different slopes) occurs.

[c] Calculated as the difference in the MCT between years (expressed as a percentage of the MCT for 2019).

Table I.16: Statistical Comparisons of Westslope Cutthroat Trout Health Endpoints, Lower Gardine Creek, 2019 and 2021

Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics [b]			Test P-value (Year)	MOD (%) [c]
		Response	Covariate	2019	2021		Interaction Model: Interaction P-value	Parallel Slope Model: Covariate P-value	Covariate Value for Comparisons [a]	Statistic	2019	2021		
Body Size	Fork Length	Fork Length (cm)	-	32	51	M-W	-	-	-	Median	10.5	11.1	0.29	5.7
Body Size	Body Weight	Body Weight (g)	-	32	51	M-W	-	-	-	Median	12.3	13.8	0.59	12
Energy Storage	Condition	$\log_{10}$[Body Weight (g)]	$\log_{10}$[Fork Length (cm)]	32	51	ANCOVA	0.27	<0.001	10	Adjusted Mean	11.6	10.9	0.0030	-6.7
Energy Storage	Condition (Outliers Removed)	$\log_{10}$[Body Weight (g)]	$\log_{10}$[Fork Length (cm)]	32	50 [d]	ANCOVA	0.10	<0.001	10	Adjusted Mean	11.6	10.9	0.0030	-6.1

Area p-value <0.1 or interaction p-value <0.05.

MOD >25% for (or >10% for condition).

Covariate P-value >0.05.

Notes: ANCOVA = Analysis of Covariance; MOD = Magnitude of Difference; % = percent; cm = centimetres; - = no data/not applicable; M-W = Mann-Whitney; g = grams; < = less than; > = greater than; MCT = Measure of Central Tendency. Fish with fork lengths <6.5 cm were excluded from the analyses.

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[b] The median and adjusted mean are reported for M-W and ANCOVA, respectively, and the predicted means of the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction (i.e., different slopes) occurs.

[c] Calculated as the difference in the MCT between years (expressed as a percentage of the MCT for 2019).

[d] One outlier (GANF-EF1-P1-WCT-47, Studentized residual = -4.4) was removed from analysis.

Table I.17: Catch, Abundance, Density, and Biomass Data for Westslope Cutthroat Trout Captured by Electrofishing in Gardine Creek, September 2019

Area		Station ID	Upstream UTM Coordinates (NAD 83, Zone 11U)		Downstream UTM Coordinates (NAD 83, Zone 11U)		Date	Length of Run (m)	Mean Width (m)	Pass	Effort (seconds)	Number of Fish Caught	Fish Biomass Caught (g wet weight)	Abundance Estimate by Station [a]				Estimated Fish Density (no./100 m^2) by Station			Estimated Fish Biomass (g/100 m^2) by Station [b]		
			Easting	Northing	Easting	Northing								N	SE	LCI	UCI	N	LCI	UCI	N	LCI	UCI
Upper Gardine Creek	RG_GAUT [c]	RG_GAUT-EF1	653553	5548832	-	-	20-Sep-19	-	-	1	48	8	305	-	-	-	-	-	-	-	-	-	-
										Total	**48**	**8**	**305**										
		RG_GAUT-EF2	653490	5548896	-	-	20-Sep-19	-	-	1	-	3	[d]	-	-	-	-	-	-	-	-	-	-
										2	-	2											
										Total	-	**5**	**-**										
Lower Gardine Creek	RG_GANF	RG_GANF-EF1	654273	5547746	654284	5547717	19-Sep-19	40	1.5	1	599	7	70	17	3.6	10	24	28	16	40	310	180	439
										2	683	5	68										
										3	737	3	26										
										Total	**2,019**	**15**	**164**										
		RG_GANF-EF2	654192	5547828	654216	5547814	19-Sep-19	40	1.7	1	661	5	64	8.0	0.77	6.5	10	12	9.5	14	147	119	175
										2	579	2	15										
										3	582	1	21										
										Total	**1,822**	**8**	**100**										
		RG_GANF-EF3	653975	5547935	653983	5547921	20-Sep-19	40	2.0	1	782	11	216	11	0	11	11	14	14	14	270	270	270
										2	615	0	0										
										3	682	0	0										
										Total	**2,079**	**11**	**216**										

Notes: ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; m = metres; g = grams; N = number; SE = standard error; LCI = lower limit of the 95% confidence interval; UCI = upper limit of the 95% confidence interval; no./100 m^2 = number of fish per 100 square meters; g/100 m^2 = grams of fish biomass per 100 square metres; - = no data/not calculated; % = percent. Negative LCIs were truncated at 0.

[a] Mean abundance and 95% confidence intervals were estimated using multiple-pass depletion estimation (Carle and Strub 1978) as implemented in the FSA R package (Ogle et al. 2020).

[b] Biomass estimates were derived by multiplying population abundance by mean biomass of all captured fish.

[c] Due to limited passes, abundance, density, and biomass estimations could not be calculated. The sampling locations were small pools.

[d] Fish were not measured due to lack of time.

Table I.18: Catch, Abundance, Density, and Biomass Data for Westslope Cutthroat Trout Captured by Electrofishing in Reach 1 of Lower Greenhills Creek, 2015 to 2019 [a]

Year	Station	Upstream UTM Coordinates (NAD 83, Zone 11U)		Downstream UTM Coordinates (NAD 83, Zone 11U)		Date	Length of Run (m)	Mean Width (m)	Pass	Effort (seconds)	Number of Fish Caught	Fish Biomass Caught (g wet weight)	Abundance Estimate by Station [b]				Estimated Fish Density (no./100 m^2) by Station			Estimated Fish Biomass (g/100 m^2) by Station [c]		
		Easting	Northing	Easting	Northing								N	SE	LCI	UCI	N	LCI	UCI	N	LCI	UCI
2015	Reach 1-EF1	653495	5545585	-	-	28-Sep-15	33	2.2	1	645	2	11	3.0	0.27	2.5	3.5	4.1	3.4	4.9	17	14	20
									2	595	1	2										
									3	499	0	0										
									Total	**1,739**	**3**	**12**										
	Reach 1-EF2	653525	5545637	-	-	28-Sep-15	25	2.0	1	472	1	11	1.0	0	1.0	1.0	2.0	2.0	2.0	21	21	21
									2	325	0	0										
									3	-	-	-										
									Total	**797**	**1**	**11**										
	Reach 1-EF3	653440	5545653	-	-	28-Sep-15	30	2.3	1	437	3	52	3.0	0	3.0	3.0	4.3	4.3	4.3	75	75	75
									2	409	0	0										
									3	-	-	-										
									Total	**846**	**3**	**52**										
2017	Reach 1-EF1	653497	5545590	-	-	25-Aug-17	33	2.3	1	560	21	156	42	4.0	34	50	55	45	66	372	302	442
									2	634	12	74										
									3	537	5	26										
									Total	**1,731**	**38**	**255**										
	Reach 1-EF2	653528	5545624	-	-	25-Aug-17	25	2.3	1	623	16	82	51	13	26	76	89	46	131	369	191	547
									2 [d]	586	14	26										
									3 [d]	518	8	39										
									Total	**1,727**	**38**	**146**										
	Reach 1-EF3	653540	5545656	-	-	25-Aug-17	30	2.3	1	559	15	169	31	2.7	26	36	45	37	53	366	303	430
									2	485	12	64										
									3	480	2	3.5										
									Total	**1,524**	**29**	**236**										
2019	Reach 1-EF1	653500	5545599	-	-	28-Aug-19	33	2.3	1	974	6	76	6.0	0.0	6.0	6.0	7.9	7.9	7.9	100	100	100
									2	871	0	0										
									3	728	0	0										
									Total	**2,573**	**6**	**76**										
	Reach 1-EF2	653527	5545622	-	-	28-Aug-19	25	2.0	1	613	4	87	6.0	0.67	4.7	7.3	12	9.4	15	258	202	314
									2	630	1	25										
									3	570	1	18										
									Total	**1,813**	**6**	**129**										
	Reach 1-EF3	653540	5545609	-	-	28-Aug-19	30	2.3	1	782	3	24	6.0	1.0	4.0	8.0	8.7	5.8	12	74	50	98
									2	642	2	21										
									3	587	1	6.6										
									Total	**2,011**	**6**	**51**										

Notes: ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; m = metres; g = grams; N = number; SE = standard error; LCI = lower limit of the 95% confidence interval; UCI = upper limit of the 95% confidence interval; no./100 m^2 = number of fish per 100 square meters; g/100 m^2 = grams of fish biomass per 100 square metres; - = no data/not calculated; % = percent. Negative LCIs were truncated at 0.

[a] Fishing in Reach 1 of Lower Greenhills Creek was completed by Westslope Fisheries.

[b] Mean abundance and 95% confidence intervals were estimated using multiple-pass depletion estimation (Carle and Strub 1978) as implemented in the FSA R package (Ogle et al. 2020).

[c] Biomass estimates were derived by multiplying population abundance by mean biomass of all captured fish.

[d] Biomass estimates for pass 2 and pass 3 exclude data that were missing for two and one fish, respectively.

Table I.19: Chemistry Data for Muscle Tissue Collected from Westslope Cutthroat Trout (Incidental Mortality), September 2021

Analyte	Units	Lower Greenhills Creek
		RG_GHBP
		23-Sep-21
% Moisture	%	75.3
Wet Weight	g	0.097
Dry Weight	g	0.024
Aluminum (Al)	µg/g dw	12
Antimony (Sb)	µg/g dw	0.013
Arsenic (As)	µg/g dw	<0.439
Barium (Ba)	µg/g dw	0.569
Boron (B)	µg/g dw	0.300
Cadmium (Cd)	µg/g dw	<0.047
Calcium (Ca)	µg/g dw	1,763
Chromium (Cr)	µg/g dw	2.7
Cobalt (Co)	µg/g dw	0.217
Copper (Cu)	µg/g dw	2.6
Iron (Fe)	µg/g dw	53
Lead (Pb)	µg/g dw	0.049
Lithium (Li)	µg/g dw	1.7
Magnesium (Mg)	µg/g dw	1,341
Manganese (Mn)	µg/g dw	1.2
Mercury (Hg) [a]	µg/g dw	0.029
Molybdenum (Mo)	µg/g dw	0.097
Nickel (Ni)	µg/g dw	2.5
Phosphorus (P)	µg/g dw	8,056
Potassium (K)	µg/g dw	14,169
Selenium (Se) - Muscle	µg/g dw	29
Selenium (Se) - Ovary [b]	µg/g dw	46
Silver (Ag)	µg/g dw	0.005
Sodium (Na)	µg/g dw	1,202
Strontium (Sr)	µg/g dw	1.0
Thallium (Tl)	µg/g dw	0.023
Tin (Sn)	µg/g dw	0.850
Titanium (Ti)	µg/g dw	2.3
Uranium (U)	µg/g dw	0.003
Vanadium (V)	µg/g dw	0.059
Zinc (Zn)	µg/g dw	38

Muscle mercury concentration exceeds the British Columbia guideline (0.033 µg/g ww).

Muscle selenium concentration exceeds the estimated effects threshold (15.5 µg/g dw).

Estimated ovary selenium concentration exceeds the site-specific Level 1 Benchmark (25 µg/g dw; EC10 equivalent) for WCT ovaries (Teck 2014).

Estimated ovary selenium concentration exceeds the site-specific Level 2 Benchmark (27 µg/g dw; EC20 equivalent) for WCT ovaries (Teck 2014).

Estimated ovary selenium concentration exceeds the site-specific Level 3 Benchmark (33 µg/g dw; EC50 equivalent) for WCT ovaries (Teck 2014).

Notes: % = percent; g = grams; µg/g dw = micrograms per gram dry weight' ; < = less than; µg/g ww = micrograms per gram wet weight; EC = effective concentration; WCT = westslope cutthroat trout.

[a] The British Columbia guideline for methyl mercury was applied based on the assumption that all mercury in the fish tissue was methyl mercury. The wet-weight concentration was calculated by multiplying the dry weight concentration by % moisture.

[b] The ovary selenium concentration was estimated using an ovary:muscle ratio of 1.6:1.0 (Nautilus and Interior Reforestation 2011).

Ministry of Forests, Lands, Natural Resource Operations and Rural Development

BRITISH COLUMBIA

FISH COLLECTION PERMIT
Environmental Impact Assessment

File: 34770-20

Permit No.: CB21-631191

Permit Holder: Minnow Environmental Inc. – Amy Wiebe
110 – 2750 Faithful Avenue
Saskatoon SK S7K 6M6

Authorized Persons: Amy Wiebe, Jeremy Benson, Peter Schnurr, Chad Apol, Maddy Stokes, Brianna Barnhart, Dave Hasek, Tyler Mehler, Katharina Batchelar,, Patrick Shaefer, Alex McClymont, Jess Tester, Clare Nelligan, Marc Giorgini, Jennifer Ings

Pursuant to section 18 of the Angling and Scientific Collection Regulation, B.C. Reg. 125/90, the above-named persons are authorized to collect fish for scientific purposes (from non-tidal waters) subject to the terms set forth in this Permit:

Permitted Sampling Period: September 1, 2021 to October 31, 2021
Permitted Waterbodies:
Kootenay-Boundary Region - Greenhills Creek/Settling Pond (349-248100-48300-32200)
Kootenay-Boundary Region - Gardine Creek (349-248100-48300-32200-2720)
Permitted Sampling Techniques: EF (subject to permit terms)
Potential Species: WCT (subject to permit terms)

Provincial Terms: (Permit holder and authorized persons must be aware of all terms):
See Appendix A.
Region Specific Terms:
See Appendix A.

Authorized by:

Albert Chirico

Albert Chirico, Regional Information Specialist/Fisheries
As authorized by the Regional Manager
Recreational Fisheries & Wildlife Programs
Kootenay-Boundary Region

Date: August 20, 2021 Permit Fee $25

Appendix A: Fish Collection Permit Terms

Any Variation of the following terms will require explicit authorization by the appropriate regional Fish & Wildlife Section Head.

Provincial Terms

1. This collecting permit is **only** valid for species listed as threatened, endangered or extirpated under the *Species at Risk Act* (SARA) **in conjunction with a permit issued under Section 73 of SARA from Fisheries and Oceans Canada.**

   NOTE: Contact the Department of Fisheries and Oceans for fish collecting permits for salmon, eulachon or SARA listed species (see Appendix B).

2. Any specimen's surplus to scientific requirements and any species not authorized for collection in this permit must be immediately and carefully released at the point of capture.

3. Fish collected under authority of this permit must not be used for food or any purpose other than the objectives set out in this permit. Dead fish must be disposed of in a manner that will not constitute a health hazard, nuisance or a threat to wildlife.

4. No fish collected under authority of this permit must be transplanted unless separately authorized by the Federal/Provincial Introductions and Transfers Committee.

5. The permit holder must, within 90 days (120 days for the Kootenay/Boundary region and Peace region) of the expiry of this permit, submit a report of fish collection activities. Interim reports may also be required and must be submitted as required by the permit issuer. All submissions must be filed electronically to: https://www2.gov.bc.ca/fish-data-submission-process.

   Reporting specifications, information and templates are available from this website and outline the mandatory information requirements. Prior notification of submission or questions regarding data report standards can be made to: fishdatasub@gov.bc.ca

6. The permit holder must comply with all Workers' Compensation Board requirements and other regulatory requirements. The permit holder is responsible for ensuring authorized persons listed on the permit are properly certified for specific sampling methods or activities (e.g. electroshocking).

7. Any workers not listed on the permit must be supervised by the permit holder or one of the authorized persons named on the permit.

8. All sampling equipment that has been previously used outside of B.C. must be cleaned of mud and dirt and disinfected with 100mg/L chlorine bleach before using in any water course to prevent the spread of fish pathogens (e.g. whirling disease) and/or invasive plant species. Any washed off dirt or mud must be disposed of in a manner such that it cannot enter a watercourse untreated.

9. No electrofishing is to take place in waters having a temperature less than five degrees C.

10. No sampling of fish in waters having a temperature greater than twenty degrees C.

11. Electrofishing must not be conducted in the vicinity of spawning gravel, redds, or spawning fish, or around gravels which are capable of supporting eggs or developing embryos of any species of salmonid at a time of year when such eggs or embryos may be present.

Provincial Terms continued

When work requires de-watering or isolation of the worksite in the stream, a permit for the salvage of fish and wildlife (Scientific Fish Collection permit) must be obtained prior to commencing work. All required salvage permits must be obtained from FrontCounter BC: http://www.frontcounterbc.gov.bc.ca/

Any fish or wildlife salvage must be carried out by a qualified environmental professional registered with a professional association (such as an R.P.Bio.). The qualified professional conducting salvage work must adhere to the conditions below in addition to those required in the Scientific Fish Collection permit.

- Salvage activities must be conducted to the Provincial Resource Information Standards Committee (RISC) standards for capture, data collection, handling and release:

STREAM ISOLATION

- The QP must follow the standards and practices outlined in the Work Area Isolation Appendix found in the Standards and Best Practices for Instream Works. http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf
- A QP must ensure that the worksite has be substantively isolated to prevent any fishes from entering the work area and efforts must be made to exclude fish from entrapment during installation of isolation works. (See section 14.2 of the Standards and Best Practices for Instream Works (MWLAP 2004).
- Dewatering must not result in HADD to fish habitat or the death of fish unless authorized by Fisheries and Oceans Canada.
- While dewatering the work site and dewatering during fish capture, all pump intakes are required to meet the federal COP for fish intake screening guidelines https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html.

FISH CAPTURE

- Qualified professionals must determine appropriate sampling methods from the RISC standards based on water body type and habitat conditions https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/fishml04.pdf.
- Qualified professionals must use a risk hierarchy of passive to active and low risk to higher risk in collection methods (e.g., minnow traps, fyke nets, beach pole seines, electroshocking, angling).
- Qualified professional must conduct a **minimum of three** non-lethal collection methods in all fish salvages.
- For active collection methods a minimum of two consecutive passes of each method that produces a zero catch must be completed as per total population removal methodology (at a minimum 95% fish removal must be achieved). (https://www.wildsalmoncenter.org/resources/field-protocols-best-monitoring-practices/).
- Where work site isolation cannot be fully achieved (e.g., fast flowing streams, imperfect seal due to substrate) additional efforts are needed to prevent harm to fish. At the end of each workday, a passive form of fish capture (e.g., baited minnow traps) are to be placed in the isolation site. If fish are captured overnight, you must restart isolation procedures at the start of the workday.
- If species at risk are captured, work must stop until proper permits are obtained.

DATA COLLECTION

- Sampling/data collection is a requirement of the Scientific Collection Permit. Sample size requirements are listed in the table below.
- Scientific Fish Collection Permits require a Fish Data Submission Template to be completed. Step 4 (Stream Site Data) of the Fish Data Submission Template must be filled out for the location where fish are salvaged from. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/fish-and-fish-habitat-data-information/fish-data-submission/submit-fish-data

FISH RELEASE

- Fish must be released following RISC standards.
- All species are to be released in the same watercourse downstream of the work areas or a sufficient distance upstream (5 channel widths to a maximum of 100 meters) into waters of equivalent baseline quality and habitat type (pool, riffle, run).

Minimum Standards During Salvage for Fish Collection Sampling Effort*

Fish Species	Age Class	Size range	Minimum Sampling Size for lengths	Sample column required (from Individual Fish Data form)	Notes
Salmonids, including RB, CT(CCT), DV, BT, GR, LT, KO	fry	20 to 80 mm	up to 30 after 30 count	J (if possible), K	
	juvenile	81 mm-250 mm	Measure all fish caught	J, K, L	
	adult	greater than 250 mm	Measure all fish caught	J, K, L, M, N	
Coarse Fish (cyprinids, stickleback, dace, shiner, carp, pikeminnow)		under 200 mm	up to 30 after 30 count	J, K	
	Adult	over 200 mm	All	J, K, L, M	
Sport other (bass, perch, sunfish, walleye, northern pike)		all	up to 30 after 30 count	J, K, L	
Sculpin sp.		0-150mm (total length)	up to 30 after 30 count	J, K	
		Over 150mm	All	J, K, L	
Burbot, Lamprey		0-150 mm (total length)	All	J, K, L, N	
Listed Species (salish sucker, sturgeon, etc.)		All	All		Refer to SAR permit for conditions
All fishes not listed above		All	minimum 10 of each then count only	J, K, L	

Abbreviations for salmonids

RB-Rainbow
CT(CCT)-Cutthroat
DV-Dolly Varden
BT- Bull Trout
GR- Arctic Grayling
LT- Lake Trout
KO- Kokanee

Region Specific Terms

West Coast Region

- Within the boundaries of Management Units 1-1 through 1-13, there is no electrofishing in: (1) streams above 630 meters elevation, (2) in anadromous rivers from January 1 to June 30, (3) or any lake tributaries from January 1 to June 30.
- All sampling gear follow Association of Professional Biologists' advisory practice bulletin #5. Practice Advisory – Dydimo, see: http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469
- The permit holder must advise the West Coast Region of sampling activities 24 hrs. prior to field operations. Please complete the following notification form: http://www.env.gov.bc.ca/pasb/reports/fish/permit_notify1.html

South Coast Region

- The permit holder must notify Fish and Aquatic Habitat Branch of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development at SCFishandAquaticWildlife@gov.bc.ca with the following information at least 24 hours prior to undertaking work:
    - approved SFC permit number
    - company
    - contact
    - address
    - phone
    - water body
    - purpose of collection
    - start date
    - end date
- All streams sampled, for which a watershed code does not presently exist, will require a map showing the location of the stream and sampling location with the map scale identified at time of reporting.
- Electrofishing and minnow trapping can harm or kill non-target species of management concern such as the endangered Coastal Giant Salamander (within the Chilliwack River drainage system), Oregon Spotted Frog, and Pacific Water Shrew (within the lower Fraser River Valley). Any incidental captures (alive or dead) of any red-listed or blue-listed wildlife species must be reported to the Ministry of Forest, Lands, Natural Resources and Rural Development, South Coast Region. For further information on these species or to report incidental captures, please contact the Fish and Aquatic Habitat Branch by e-mail at SCFishandAquaticWildlife@gov.bc.ca.
- All non-native fish species captured under this permit are to be humanely euthanized and disposed of appropriately. Within 48 hours of capture, a record of the species, capture location, date, waterbody, number, size range (mm) and digital imagery must be submitted to the Fish and Aquatic Habitat Branch by email at SCFishandAquaticWildlife@gov.bc.ca. Non-native fish species include but are not limited to: American Shad; Black Catfish; Black Crappie; Brown Catfish; Carp; Goldfish; Largemouth or Smallmouth Bass; Pumpkinseed Sunfish; and Weather-fish.
- Please refer to the following website for the least risk in-stream work windows: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/regional-terms-conditions-timing-windows. Where possible, collection should be conducted during the least risk work windows identified. The exception is seasonal or ephemeral streams where sampling may not be possible during the prescribed window due to flow conditions.
- The permit holder must refer to the following when sampling Salish Sucker, Nooksack Dace and Stickleback species.
  Salish sucker sampling guidelines -
  http://www.frontcounterbc.gov.bc.ca/pdf/SalishSuckerCollectionGuidelines2015.pdf

  Nooksack dace sampling guidelines –
  http://www.frontcounterbc.gov.bc.ca/pdf/NooksackDaceCollectionGuidelines2015.pdf

  Stickleback species pairs sampling guidelines - http://www.dfo-mpo.gc.ca/species-especes/publications/sara-lep/stickleback-epinoches/index-eng.html

Thompson/Okanagan Region

- Please refer to information at: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/regional-terms-conditions-timing-windows for the appropriate in stream work windows.

Kootenay/Boundary Region

- No electrofishing is permitted between September 15 and June 15 in streams containing bull trout.
- The permit holder must contact the local zone Conservation Officer Service prior to initiating the field collections.
- All burbot traps must have a section in the top or sidewall that has been secured by a length of untreated, 100% cotton twine no greater than No. 30 (e.g. 30 thread count) or 3 mm diameter. When twine deteriorates, this must produce a square opening with a minimum size of 20 cm x 20 cm. This is intended to ensure that if the trap is lost, the section secured by the twine will rot, allowing captive fish to escape, and preventing the trap from continuing to fish.
- All sampling gear follow Association of Professional Biologist's advisory practice bulletin #5. Practice Advisory Dydimo, see: http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469
- All fishing gear (e.g. gill nets, minnow traps, etc.) that are left unattended must have the permit holders contact information (name and phone number).
- Within 120 days of expiry of this permit, the permit holder must submit a report that summarizes all field and any laboratory analysis data related to the sampling program (typically location of catch, species, individual fish tissue metals analysis, moisture content, fish length and weight, etc., and as applicable) and all associated raw laboratory data.

  The digital final written report (e.g. report, summary, memo, letter) is required and shall be submitted along with the standard format Excel data submission template.

Cariboo Region

- Cariboo Region requires seven days (7) written notice, complete with waterbody and watershed codes for the proposed areas prior to sampling in the Cariboo Region. Please submit written email notice to: Lee.Williston@gov.bc.ca or fax to 250 398 4214.
- Until such time as the permit holder has discussed specific activities with the Regional Manager and obtains written permission, fish collection, fish sampling or fish salvage may not be undertaken within the boundaries of Management Units 5-04 or 5-05.

Skeena Region

- For information related to Fish Collection Permit Activities in the Skeena Region, please contact Kristin Charleton at 250-876-7131 or Kristin.Charleton@gov.bc.ca.
- Accidental fish mortalities and or injuries that occur during salvage activities, related to this permit, must be reported to the Skeena Regional office within 48 hrs. Contact Troy Larden at Troy.Larden@gov.bc.ca or Kristin Charleton at Kristin.Charleton@gov.bc.ca to report.

Omineca Region

- The permit holder must advise Region 7A (Omineca) of sampling activities 48 hrs. prior to field operations by completion of the following form: http://www.env.gov.bc.ca/pasb/reports/fish/permit_notify7a.html
- No electrofishing is permitted between September 15 and June 15 in streams containing bull trout.
- Voucher specimens for all regionally significant red and blue-listed species (3 per species), with exception to SARA-listed white sturgeon (*Acipenser transmontanus*), must be submitted to the Regional Fish Information Specialist as per RISC standards.
- All sampling gear follow Association of Professional Biologist's advisory practice bulletin #5. Practice Advisory Dydimo, see: http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469.When lethal sampling has occurred for the purposes of environmental effects monitoring or impact

assessment, the permit holder must, within 90 days of the expiry of this permit, submit a report that summarizes all raw data related to the lethal program. This would typically include location of catch, species, fish tissue metals analysis, fish tissue moisture content, fish length and fish weight, at minimum. Interim reports may also be required and must be submitted as required by the permit issuer. All fish tissue analysis data related to the lethal program must be submitted ALONG with the standard sampling effort data submission template to https://www2.gov.bc.ca/fish-data-submission-process. Questions regarding submission requirements for lethal sampling may be directed to Susanne.Weber@gov.bc.ca.

Peace Region

- No electrofishing is permitted between September 15 and June 15 in streams containing bull trout.
- All sampling gear follow Association of Professional Biologists' advisory practice bulletin #5. Practice Advisory – Dydimo, see: http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469
- All fishing gear (e.g. gill nets, minnow traps, etc.) that are left unattended must have the permit holders contact information (name and phone number).
- Within 120 days of expiry of this permit, the permit holder must submit a report that summarizes all field and any laboratory analysis data related to the sampling program (typically location of catch, species, individual fish tissue metals analysis, moisture content, fish length and weight, etc., and as applicable) and all associated raw laboratory data.

  The digital final written report (e.g. report, summary, memo, letter) is required and shall be submitted along with the standard format Excel data submission template.

Appendix B: Table 1 - Species at Risk

The following are species at risk that have been listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as either endangered, threatened or a species of special concern. Species also listed under the Species at Risk Act (SARA) are identified with an asterisk and are subject to additional permitting requirements through the Federal Department of Fisheries and Oceans (DFO).

Common Name	Scientific Name
Benthic Paxton Lake Stickleback	**Gasterosteus sp.*
Benthic Vananda Creek Stickleback	**Gasterosteus sp.*
Limnetic Paxton Lake Stickleback	**Gasterosteus sp.*
Limnetic Vananda Creek Stickleback	**Gasterosteus sp.*
Nooksack Dace	**Rhinichthys sp.*
Morrison Creek Lamprey	**Lampetra richardsoni*
Vancouver Lamprey (Cowichan Lake Lamprey)	**Lampetra macrostoma*
Cultus Pygmy Sculpin	**Cottus sp.*
Shorthead Sculpin	**Cottus confusus*
Hotwater Physa	**Physella wrighti*
Limnetic Enos Lake Stickleback	*Gasterosteus sp.*
Benthic Enos Lake Stickleback	*Gasterosteus sp.*
Salish Sucker	*Catostomus sp.*
Speckled Dace	*Rhinichthys osculus*
Charlotte Unarmoured Stickleback	*Gasterosteus aculeatus*
Columbia Mottled Sculpin	*Cottus bairdi hubbsi*
Giant Stickleback	*Gasterosteus sp.*
Green Sturgeon	*Acipenser medirostris*
Umatilla Dace	*Rhinichthys umatilla*
West Slope Cutthroat Trout	**Oncorhynchus clarki lewisi*
White Sturgeon	*Acipenser transmontanus*

Applications for permits to specifically collect and retain listed species must be reviewed by the appropriate provincial expert, who will screen permits to ensure that any impacts on listed species are acceptable. For white sturgeon the contact is Steve McAdam (steve.mcadam@gov.bc.ca). For listed non-game freshwater fish the contact is Jordan Rosenfeld (jordan.rosenfeld@gov.bc.ca).

Appendix C: Advisory

GENERAL

- It is the permit holder's responsibility to be aware of all applicable laws and the limits of this permit.
  For example,
  - This permit **does not** authorize the collection of fish in national or provincial parks.
  - This permit does not authorize the collection of fish in tidal waters.
  - This permit does not authorize the collection of eulachon or for salmon, other than kokanee.
  - This permit is NOT authority to angle for fish without a valid angling licence.

  It is the responsibility of the permit holder to obtain proper authorization.
- The Province is not liable for any illness contracted through fish handling. It is the responsibility of the permit holder to inform themselves of possible health hazards, and to ensure that all reasonably necessary safety measures are undertaken.
- If applicable, the permit holder is responsible for renewing his or her own permit. The issuer is not obliged to send a reminder notice.

LEGISLATION

Below is a non-exhaustive list of provisions under the *Wildlife Act* and regulations that are relevant to this permit. It is the permit holder's responsibility to be aware of any provisions under the Act or regulations that may apply to this permit.

Wildlife Act

Suspension and cancellation of permits

25 (1) A regional manager, for any cause he or she considers sufficient, and after providing an opportunity for the person to be heard, may suspend or cancel a permit held by a person, may order that the person is ineligible to obtain or renew a permit for a period and, if he or she does make an order, must inform the person of the period of ineligibility.

(2) An officer may, without the necessity of holding a hearing, exercise the powers of a regional manager under this section to suspend a permit and, if a permit is suspended by an officer, the matter must be referred to the regional manager, who may confirm, reduce, extend or terminate the suspension.

Documents not transferable

81 Except as authorized by regulation or as otherwise provided under this Act, a licence, permit or limited entry hunting authorization is not transferable, and a person commits an offence if the person

(a) allows his or her licence, permit or limited entry hunting authorization to be used by another person, or

(b) uses another person's licence, permit or limited entry hunting authorization.

Failure to pay fine

85 (1) This section applies if a person

(a) fails to pay, within the time required by law, a fine imposed as a result of the person's conviction for an offence under this Act or the *Firearm Act*, and

(b) has been served with notice of this section.

(2) In the circumstances referred to in subsection (1),

(a) the person's right to apply for or obtain a licence, permit or limited entry hunting authorization under this Act is suspended immediately and automatically on the failure to pay the fine,

(b) all licences, permits and limited entry hunting authorizations issued to that person under this Act are cancelled immediately and automatically on the failure to pay the fine,

(b.1) the person must not apply for employment as an assistant guide,

(b.2) the person must not guide as an assistant guide, and

(c) the person commits an offence if, before that fine is paid, the person

(i) applies for, or in any way obtains, a licence, permit or limited entry hunting authorization under this Act,

(ii) does anything for which a licence, permit or limited entry hunting authorization under this Act is required,

(iii) applies for employment as an assistant guide, or

(iv) guides as an assistant guide.

Proof of identity and authorization

97 (1) In this section, **"authorization"** means a licence, permit or limited entry hunting authorization issued under this Act.

(2) Subject to subsection (5), a person who is required to hold an authorization must, on the request of an officer,

(a) state the person's name and address,

(b) produce prescribed photo identification, and

(c) demonstrate in accordance with subsection (3) that the person holds the authorization.

(3) A person may demonstrate that the person holds an authorization by

(a) producing the authorization, or

(b) unless the regulations require that the original authorization be produced,

(i) producing a legible copy of the authorization, or

(ii) if authorized by the regulations, stating a number assigned to the person by the director as an identification number for the person.

(4) Subject to subsection (5), a person who would be required to hold a licence or permit issued under this Act were the person not exempt under section 11 (9) or 12 (b) must, on the request of an officer,

(a) state the person's name and address, and

(b) produce prescribed photo identification.

(5) Subsections (2) (b) and (4) (b) do not apply to a person in a prescribed class of persons.

(6) A person who contravenes subsection (2) or (4) commits an offence.

<u>Wildlife Act General Regulation</u>

Proof of identity

21.01 (1) For the purposes of section 97 (2)(b) and (4)(b) of the Act, the following photo identification is prescribed:

(a) valid photo identification issued to a person by any of the following:

(i) the government of Canada;

(ii) the government of a province or territory, or an agent of the government of a province or territory, in which the person has a current address;

(iii) the Nisga'a Nation, if the person is a Nisga'a citizen;

(iv) a treaty first nation, if the person is a treaty first nation member of the treaty first nation;

(b) in the case of a person who is a non-resident alien,

(i) valid photo identification in the form of

(A) a passport, or

(B) a driver's licence issued to the person by a foreign jurisdiction in which the person has a current address, or

(ii) a copy of a photo identification referred to in subparagraph (i) that has been certified as a true copy by

(A) a lawyer, or

(B) a notary who is a member in good standing under the *Notaries Act*

(c) in any case, a valid NEXUS card.

(2) For the purposes of section 97 (5) of the Act, persons under 16 years of age are prescribed as exempt from the requirement to produce photo identification.

<u>Freshwater Fish Regulation</u>

Offences

2 A person commits an offence where the person

(a) has in possession,

(b) transports, or

(c) traffics in

live fish unless authorized by a permit or a licence.