Klohn Crippen Berger

Teck Highland Valley Copper Partnership

2022 Annual Facility Performance Report

Bethlehem No.1 Tailings Storage Facility

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March 2023

March 13, 2023

Teck Highland Valley Copper Partnership
PO Box 1500
Logan Lake, British Columbia
V0K 1W0

Mr. Bryan Bale, P.Eng.
Chief Engineer, Tailings

Dear Mr. Bale:

2022 Annual Facility Performance Report
Bethlehem No. 1 Tailings Storage Facility

We are pleased to submit the Bethlehem No. 1 Tailings Storage Facility 2002 Annual Facility Performance Report. The review period for this document is from October 2021 through September 2022.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Rick Friedel, P.Eng.
Engineer of Record, Representative
Senior Geotechnical Engineer, Principal

RF/NS:cd/jc

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Teck Highland Valley Copper Partnership

2022 Annual Facility Performance Report

Bethlehem No.1 Tailings Storage Facility

EXECUTIVE SUMMARY

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (HVC) to complete the 2022 Annual Facility Performance Report (AFPR) of the Bethlehem No. 1 Tailings Storage Facility (Bethlehem TSF). The review period of this AFPR is from October 2021 through September 2022.

The Bethlehem TSF is located on the Highland Valley Copper Mine Site (HVC Mine Site) 4 km north of the operating Highland Mill. This facility was operated from 1964 to 1989 and subsequently reclaimed. The Bethlehem TSF is maintained by HVC and is considered to be in the Closure – Active Care Phase, based on the Canadian Dam Association definition[1].

The Bethlehem Tailings Storage Facility Structures

This review covers the following structures, that comprise the Bethlehem TSF:

- Dam No. 1 – comprises a glacial till starter dam, which was raised using a modified centreline method with rockfill placed to form a downstream shell and spigotted or cycloned tailings hydraulically placed on the upstream beach. A downstream rockfill toe buttress was later added in the valley section.
- Bose Lake Dam – constructed of compacted glacial till with rockfill over the downstream slope for erosion protection, and a rockfill toe berm that includes a filter blanket and seepage collection system.
- R3 Seepage Pond – located downstream from Dam No. 1 and collects seepage from the Dam No. 1 underdrains and local surface runoff.

The Bethlehem TSF has been inactive for more than 30 years. The surface of the dam has been reclaimed, and the pond level has been lowered. No significant dam safety incidents occurred at the facility during operations or since reclamation. In the current configuration, the piezometric levels and gradients through the tailings and dam fill are lower than during operations, which increases the factor of safety against slope failure and internal erosion.

During the review period, the following key roles, according to the definitions in the Health Safety and Reclamation Code for Mines in B.C. (HSRC[2]), were filled as follows:

- Mr. Bryan Bale, P.Eng. (HVC Chief Engineer – Tailings), acted in the role of TSF qualified person (QP); and
- Mr. Rick Friedel, P.Eng., was the engineer of record (EoR), as a representative of KCB.

[1] CDA. 2019. “Technical Bulletin – Application of Dam Safety Guidelines to Mining Dams.”
[2] Ministry of Energy, Mines and Low Carbon Innovation (EMLCI). 2021b. “Health, Safety and Reclamation Code for Mines in British Columbia, Revised.” February.

Activity During the Review Period

During the review period, the Bethlehem TSF was maintained within the design basis and conditions assumed in the approved design.

Other than routine maintenance activities, as defined in the Operations, Maintenance and Surveillance (OMS) Manual[3], there were no major repairs or construction activities completed during the review period.

November Regional Flooding

In November 2021, a combination of rainfall and early season snowmelt led to significant regional flooding and damage to public and private infrastructure, which impacted communities near the HVC Mine Site. The magnitude of the event was less at the HVC Mine Site and had no effect on the Bethlehem TSF. Regardless, HVC responded as they would have during any event-driven flood on site, which included increased frequency of inspections, pond level monitoring, and reporting.

The Bethlehem TSF is designed to manage the Probable Maximum Flood (PMF) event, which is significantly greater than the regional flooding that occurred in November 2021.

Governance and Surveillance

The OMS Manual, including the Emergency Preparedness and Response Plan (EPRP), was reviewed and updated during the review period and is suitable for the facility. The Bethlehem TSF surveillance program, described in the OMS Manual, is appropriate for an inactive, reclaimed tailings facility.

During the review period, routine surveillance activities were completed as per the OMS Manual.

The most recent dam safety review (DSR) of the Bethlehem TSF was completed in 2018. The next DSR is scheduled for 2023 to meet the requirements of the HSRC.

Bethlehem TSF Performance

The facility performance during the review period was consistent with historic performance; no issues of dam safety concern or unacceptable performance were identified. As the facility is inactive, changes in the conditions at the facility throughout the year, or on an annual basis, are primarily driven by variations in climate. KCB made the following key observations regarding the performance of the Bethlehem TSF during the review period:

- Existing design and management controls are in place and are performing as intended based on measured performance.
- All piezometers are measuring levels below those assumed in design analyses and are consistent with acceptable performance. Two piezometers measured levels marginally higher (~0.5 m) than typical levels; both instruments are installed in the impoundment upstream of the dams, and the magnitude of rise is well below what would be required to indicate a performance concern.

[3] HVC. 2022. “Bethlehem and Trojan Tailings Storage Facility Operation, Maintenance and Surveillance (OMS) Manual.” June.

- Horizontal deformation trends are consistent with expected performance based on survey monuments.
- Visual inspections by the HVC dam inspector, the EoR, and others working in the area did not identify any indications of unacceptable behaviour at the dam.
- Pond levels and seasonal fluctuations were similar to historic trends.
- The peak measured pond level was 6.4 m below the Bose Lake Dam crest and 0.6 m below the spillway invert which are both within expected conditions and exceed design requirements.

Design Basis and Failure Mode Reviews

A review by HVC and KCB concluded there had been no significant change to conditions (e.g., infrastructure, land use) downstream of the Bethlehem TSF during the review period.

HVC and KCB reviewed the current inflow design flood (IDF) and earthquake design ground motion (EDGM) for each of the Bethlehem TSF facilities to confirm they meet or exceed the equivalent requirements under the HSRC.

Potential failure modes for the Bethlehem TSF were also reviewed by HVC and KCB during the review period based on available information and existing controls. The review concluded that potential failure modes are being managed appropriately.

At the request of HVC, the AFPR does not include any reference to a consequence classification for the Bethlehem TSF facilities. Consequence classification is not part of HVC's tailings management governance and stewardship because there are components of that system that do not align with HVC's safety culture. HVC's internal governance has been developed to meet or exceed requirements under the HSRC.

Flood Routing

Flood-routing assessments for both the Bethlehem TSF and the R3 Seepage Pond were updated during the review period based on the most recent site-wide hydrology. The analysis confirmed the R3 Seepage Pond can route the IDF (100-year return period), and the Bethlehem TSF can route the Probable Maximum Flood event, which is greater than the IDF required under the HSRC.

Recommendations

All recommendations from past AFPRs and the 2018 DSR have been closed. Two new recommendations were made during this review, both applicable to the R3 Seepage Pond, and neither represents a dam safety concern at the facility (Table 1).

Table 1 2022 AFPR Recommendations Related to Facility Performance

ID No.	Performance Area	Recommended Action	Priority[1]	Deadline (Status)
R3 Seepage Pond				
R3-2022-01	Maintenance	Until full capacity of the LLO has been restored, maintain secondary pumping for the R3 Seepage Pond on site and establish a trigger in the OMS Manual to initiate mobilization and operation to control pond level.	3	Q4 2023
R3-2022-02	Governance	Add the inspection frequency to the OMS Manual with the first one to be completed by end of 2024.	4	Q4 2023

Notes:

1. Recommendation priority guidelines, specified by Teck and assigned by KCB:
   Priority 1: A high probability or actual dam safety issue considered immediately dangerous to life, health, or the environment, or a significant risk of regulatory enforcement.
   Priority 2: If not corrected, could likely result in dam safety issues leading to injury, environmental impact, or significant regulatory enforcement, or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
   Priority 3: Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
   Priority 4: Best Management Practice – Further improvements are necessary to meet industry best practices or reduce potential risks.

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CLARIFICATIONS REGARDING THIS REPORT

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the use of Teck highland Valley Copper Partnership (Client) for the specific application to the 2022 Dam Safety Support Project, and may be published or disclosed by the Client to the BC Ministry of Energy, Mines, and Low Carbon Innovation.

KCB has prepared this report in a manner consistent with the level of care, skill and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered; however, the use of this report will be at the user's sole risk absolutely and in all respects, and KCB makes no warranty, express or implied. This report may not be relied upon by any person other than the Client or BC Ministry of Energy, Mines, and Low Carbon Innovation without KCB's written consent.

Use of or reliance upon this instrument of service by the Client is subject to the following conditions:

1. The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report.
2. The Executive Summary is a selection of key elements of the report. It does not include details needed for the proper application of the findings and recommendations in the report.
3. The observations, findings and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.
4. The report is based on information provided to KCB by the Client or by other parties on behalf of the client (Client-supplied information). KCB has not verified the correctness or accuracy of such information and makes no representations regarding its correctness or accuracy. KCB shall not be responsible to the Client for the consequences of any error or omission contained in Client-supplied information.
5. KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.

This is a draft report only and we solicit your review and comments within four weeks of submission. This draft report must not be relied upon for design, implementation and/or construction.

1 INTRODUCTION

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (HVC) to complete the 2022 Annual Facility Performance Report (AFPR) of the Bethlehem No. 1 Tailings Storage Facility (Bethlehem TSF). The review period of this AFPR is from October 2021 through September 2022.

The Bethlehem TSF is located on the Highland Valley Copper Mine Site (HVC Mine Site); refer to Figure 1. This facility was operated from 1964 to 1989 and subsequently reclaimed. Table 1.1 summarizes the Bethlehem TSF structures and their functions. Refer to Figure 2 for the facility layout.

Table 1.1 Bethlehem TSF Retaining Structures

Facility	Structure	Function
Bethlehem TSF	Dam No. 1	Cross-valley dam that retains tailings on the west boundary of the Bethlehem TSF
	Bose Lake Dam	Cross-valley dam that retains tailings on the east boundary of the Bethlehem TSF
	R3 Seepage Pond Dam	Collects local runoff and seepage from Dam No. 1

HVC continues ongoing management of the Bethlehem TSF, including instrumentation monitoring, environmental sampling, visual inspections, and maintenance activities. Under this level of site presence, the Bethlehem TSF is in the Closure – Active Care Phase as based on the Canadian Dam Association (CDA) Mining Dam Technical Bulletin (CDA 2019).

During the review period, Mr. Bryan Bale, P.Eng. (HVC Chief Engineer – Tailings), acted in the role of the TSF qualified person (QP), and Mr. Rick Friedel, P.Eng., was the engineer of record (EoR), as a representative of KCB. These roles are consistent with the definitions from the Health, Safety and Reclamation Code for Mines in British Columbia (HSRC) (EMCLI 2021b).

The AFPR scope of work consisted of:

- site visit to observe the physical conditions of the various containment facilities;
- review of surveillance data for the review period provided by HVC;
- review of climate and water balance data for the site;
- review of the Operations, Maintenance and Surveillance (OMS) Manual and Emergency Preparedness and Response Plan (EPRP) to confirm they are appropriate for the existing facility; and
- review of construction activities completed at the site during the review period, if any.

The AFPR site visit of the Bethlehem TSF was completed by KCB representatives Mr. Friedel (EoR) and Ms. Cheryl Torres, Civil Consultant, on July 14, 2022. Mr. Aaron Sangha, P.Eng. (HVC Senior Dam Safety Engineer), also participated in the inspection.

The Bethlehem Mine, including the Bethlehem TSF, was operated under Permit M-11, issued by the Ministry of Energy, Mines and Petroleum Resources (EMPR) in January 1970, and reclamation work was carried out under Permit M-55, issued on October 27, 1989. In July 1998, the mining permits for the Highmont Mine, the Lornex Mine, and the Bethlehem Mine were amalgamated under the M-11 Permit (EMPR 2019). The most recent version of the permit was issued in 2021 (EMLCI 2021a).

Water discharge quantity and quality from the Bethlehem TSF are regulated under Permit PE-376 (MECCS 2022). Other pertinent permits include water licences C1311299 (BC 2014), and C114183 (BC 2002).

2 FACILITY DESCRIPTION

The HVC Mine Site is located near Logan Lake, approximately 45 km south of Kamloops, in the British Columbia Interior. The Bethlehem TSF is 4 km northeast of the operating Highland Mill and immediately east of the Trojan TSF; refer to Figures 1 and 2. Bose Lake is a natural lake approximately 60 m downstream of the Bose Lake Dam toe. The Bethlehem TSF was operated from 1963 to 1989 and stores an estimated 68 Mm^3 of tailings (HVC 2022).

Tailings are retained in the Bethlehem TSF by two dams: Dam No. 1 (Figure 3) at the western boundary, and Bose Lake Dam (Figure 4) at the eastern boundary. The R3 Seepage Pond (Figure 5) is located downstream of Dam No. 1. There are two free water ponds in the Bethlehem TSF that have formed in low points of the tailings surface and are present year-round (Figure 2): Pond No. 1, located centrally in the TSF; and Pond No. 2, located close to the Bose Lake Dam. Typical geometry and dimensions of the dams are summarized in Table 2.1. Figure 2.1, Figure 2.2, Figure 2.3, and Figure 2.4 show typical cross-sections of each retaining dam.

Bethlehem Dam No. 1

- Dam No. 1 comprises a glacial till starter dam (up to 20 m high), built in 1963. The dam foundation generally comprises competent glacial overburden up to 24 m thick overlying bedrock.
- The dam was raised using a modified centreline method, with mine waste (i.e., rockfill) placed to form a downstream shell that supports an upstream beach of spigotted or cycloned tailings hydraulically placed on the upstream beach. A rockfill toe buttress was added to the Dam No. 1 design in 1970 (Golder Brawner 1970).
- The design relies on a wide tailings beach, a minimum of 122 m (400 ft) wide, between the tailings pond and the dam rockfill. Under existing conditions, the minimum typical beach width is more than 800 m.
- Seepage from the underdrain system reports to the R3 Seepage Pond. Prior to 2016, some of the flow reporting to the R3 Seepage Pond was routed through Seepage Pond 1; in 2016, the retaining berm in Seepage Pond 1 was intentionally breached by HVC and replaced by a weir. This did not change the catchment or underdrain flow that reports to the R3 Seepage Pond and eliminated potential failure modes related to the Seepage Pond 1 retaining embankment.

Bose Lake Dam

- The Bose Lake Dam was constructed in four phases (Figure 2.2 and Figure 2.3), the first of which was finished in 1972, and the final stage was completed in 1981 (KC 1994). The dam is predominantly compacted glacial till with a rockfill toe berm that includes a filter blanket and seepage collection system that drains by gravity to a pump well at the low point along the downstream toe. The fourth construction phase (Figure 2.3) raised the crest with glacial till fill that was supported by downstream rockfill. This rockfill is observed over most of the downstream slope and also provides erosion protection.

- Seepage intercepted by the toe collection system reports to concrete manholes. The manholes are accessible immediately downstream of the toe and were used to monitor and sample flow in the collection system.
- In 1995, a permanent open-channel spillway for the Bethlehem TSF was constructed at the left abutment of the Bose Lake Dam (KC 2002) with an inlet at El. 1469.3 m. The channel extends to the public access road at the toe of the dam, where it is diverted through two culverts (1,380 mm diameter and 600 mm diameter) and discharges into Bose Lake.

R3 Seepage Pond Dam

- The R3 Seepage Pond is approximately 150 m downstream of Dam No. 1. The reservoir is retained by a compacted fill dam along the west side.
- Discharge is through a buried low-level outlet (LLO) at the left abutment. Flows report to the Lower Trojan Pond farther downstream or can be diverted directly to the Highland Mill.
- An open-channel spillway is located near the north abutment.

Table 2.1 Summary of Approximate Dam Geometry

Dam	Dam No. 1	Bose Lake Dam	R3 Seepage Pond Dam
Crest Length (m)	2000.0	600.0	60.0
Minimum Crest Elevation (m)	1477.0 (top of sand fill) 1472.0 (top of rockfill)	1475.0	1371.8[(2)]
Minimum Crest Width (m)	25.0	9.0	5.0
Maximum Height[(1)] (m)	91.0	31.0	4.0
Upstream Slope	n/a (tailings beach)	2H:1V	2H:1V
Downstream Slope	3H:1V (from sandfill crest) 2.2H:1V (from rockfill crest)	2H:1V	2.5H:1V
Construction Method	Modified Centreline (downstream rockfill shell and upstream cycloned sand beach)	Downstream (4 stages)	Unknown (believed single raise)

Notes:
1. Height is measured as the vertical distance between the downstream toe and the crest.
2. The low point of the safety berm on upstream side of the crest is reported as crest elevation as it taken as a reference for freeboard calculation as reported in KCB (2022b). The low point of the crest surface is El. 1371.3 m.
3. Dimensions and elevations are estimated from 2014 LiDAR data unless otherwise noted.

Figure 2.1 Typical Cross Section of the Dam No. 1 (KC 1996)

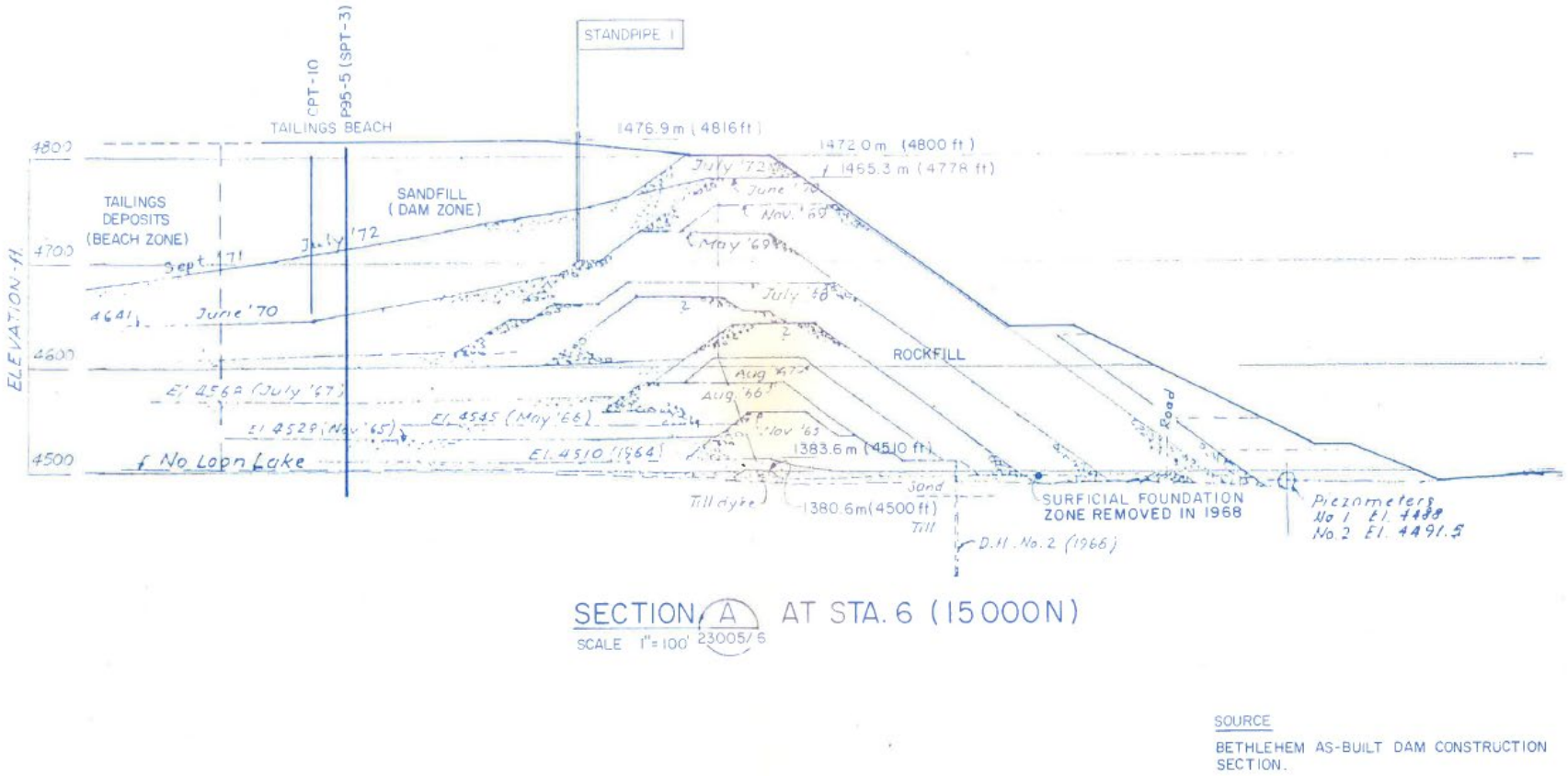


Figure 2.2 Typical Cross Section of the Bose Lake Dam – Construction Phases 1 to 3 (Gepac 1972)

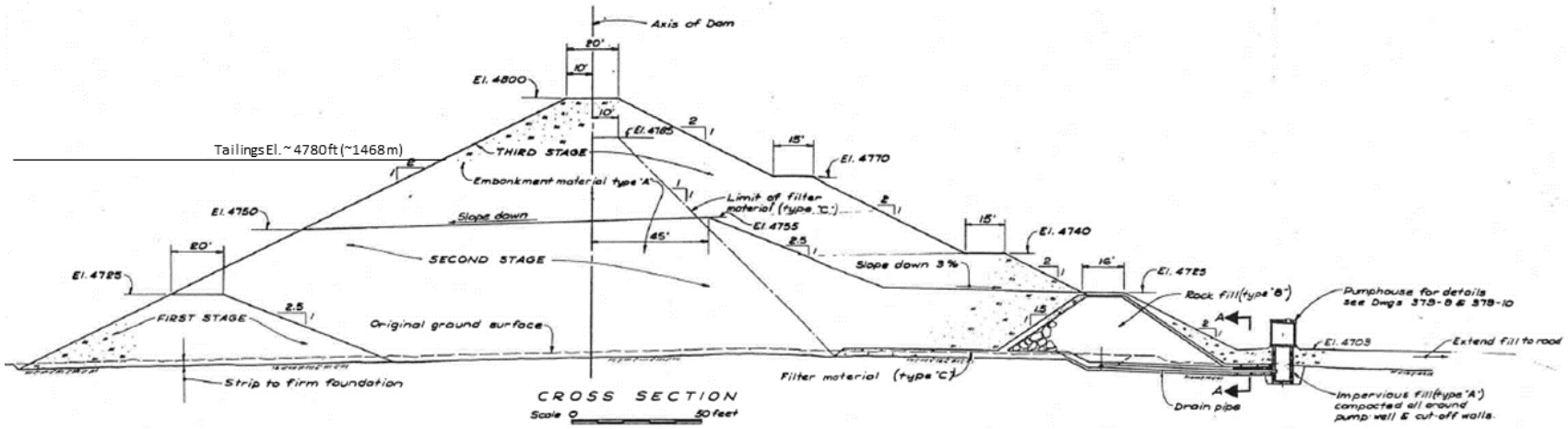


Figure 2.3 Typical Cross Section of the Bose Lake Dam – Construction Phase 4 (Fellhauer 1980)

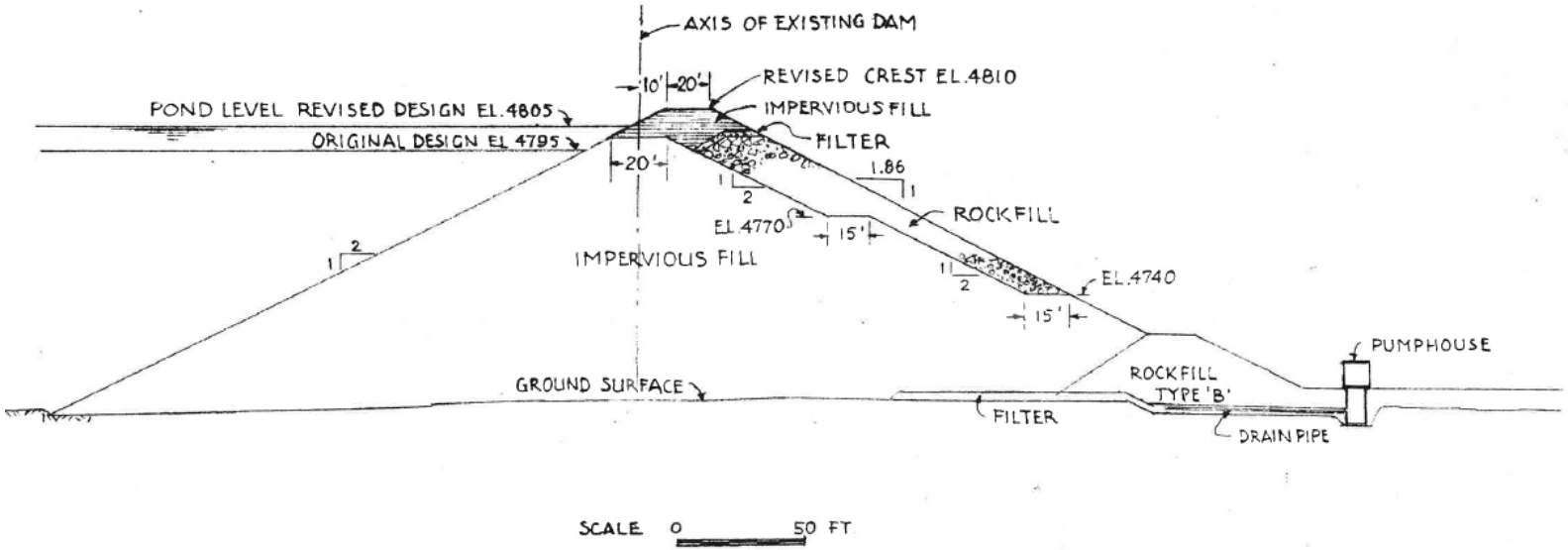
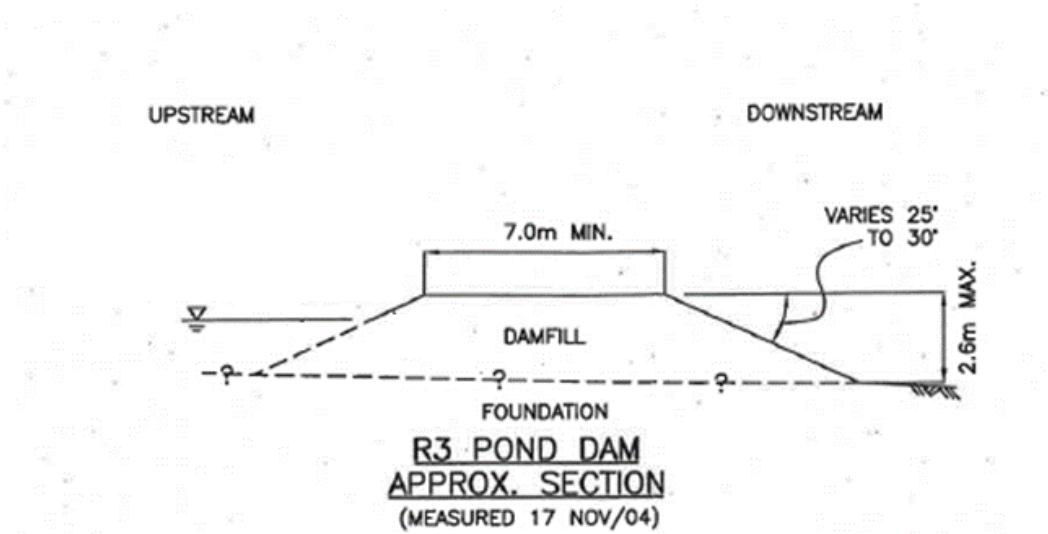


Figure 2.4 Typical Cross Section of the R3 Seepage Pond Dam (KC 2005)



3 ACTIVITIES DURING THE REVIEW PERIOD

3.1 Routine Activities

During the review period, the Bethlehem TSF, with the exception at the R3 Seepage Pond discussed below, was maintained within the operational conditions assumed in the approved design.

Routine maintenance activities, as defined in the OMS Manual (HVC 2022), were completed and included clearing vegetation from the upstream face and the spillway inlet of the R3 Seepage Pond.

3.2 R3 Seepage Pond Spill Event

On June 29, 2022, water from the R3 Seepage Pond was discharged through the spillway. This was caused by a blockage in the Low-Level Outlet (LLO) upstream of the junction where outflows from the R3 Seepage Pond and from the R4 Seepage Pond mix (Item 9 on Figure 6). The spillway performed as intended, which is to release water from the basin before it approaches the crest and prevent overtopping. However, based on the conditions under which this occurred, HVC reported the event to the regulator as an unauthorized discharge.

While HVC worked to remove the obstruction from the LLO, they mobilized a pump to the R3 Seepage Pond that pumped water to the R4 Seepage Pond to maintain the pond level below the spillway invert. HVC was able to partially clear the obstruction from the LLO sufficient to manage the pond level without the aid of pumping. HVC is planning additional works to restore full functionality of the LLO pipe (i.e., clear remaining obstructions and modify the pipe grade to prevent a reoccurrence). Until this work is completed, KCB recommends HVC maintain standby pumping at the R3 Seepage Pond during freshet to prevent the likelihood of a similar event.

4 WATER MANAGEMENT

4.1 Overview

The flow schematic for the Bethlehem TSF and the nearby Trojan TSF is shown in Figure 6.

Under normal conditions, there are no surface discharges from the Bethlehem TSF. Evaporation from the pond surface and seepage are sufficient to offset inflows on an annual basis. There has been no pond discharge through the spillway since it was constructed in 1995. The Bethlehem TSF water balance is passive (i.e., no active management by HVC).

4.2 Climate

HVC provided climate data from the L-L Dam Weather Station for the review period. KCB corrected the climate data for the Highmont/Bethlehem and Trojan areas using the adjustment factors provided in Golder (2021). HVC communicated to KCB that the L-L Weather Station stopped recording data in early August 2022 due to equipment failure (Table 4.1). HVC also maintains a climate station at Shula Flats that can be used, similar to the L-L Dam Weather Station, to reflect climate conditions at the Bethlehem TSF.

In addition, KCB reviewed the climate data from the Kamloops Pratt Road Weather Station[4] (Environment Canada Station No. 116C8P0, El. 729.0 m, 58 km to the east) to review and compare precipitation trends against the L-L Dam Weather Station data.

Table 4.1 summarizes the monthly precipitation during the review period from the reference climate stations, as well as the monthly average values, also corrected based on Highmont/Bethlehem and Trojan area factors from Golder (2021) for comparison. The monthly precipitation record for the review period is shown on Figure 4.1. Overall observations regarding precipitation trends are as follows:

- For months that had >95% of daily readings, four of the 10 months reported above-average precipitation: October and November 2021, and June and July 2022. June measured the largest precipitation (75.5 mm), which was also the largest increment above the historic average (67%).
- Precipitation from December 2021 to May 2022 was 33% below the historic average. The lowest rain in magnitude and relative to historic averages was during March and April 2022. As will be discussed later, this was also the period when snowmelt occurred, and the low precipitation during this period impacted the intensity of freshet.

[4] The Kamloops Pratt Road Weather Station was used for comparison rather than the Kamloops Airport Station (El. 345.3 m, 44 km away in the NE direction) because the elevation is closer to that of the L-L Dam Weather Station and climate is sensitive to elevation.

KCB also reviewed the available rainfall data for storm events and notes the following:

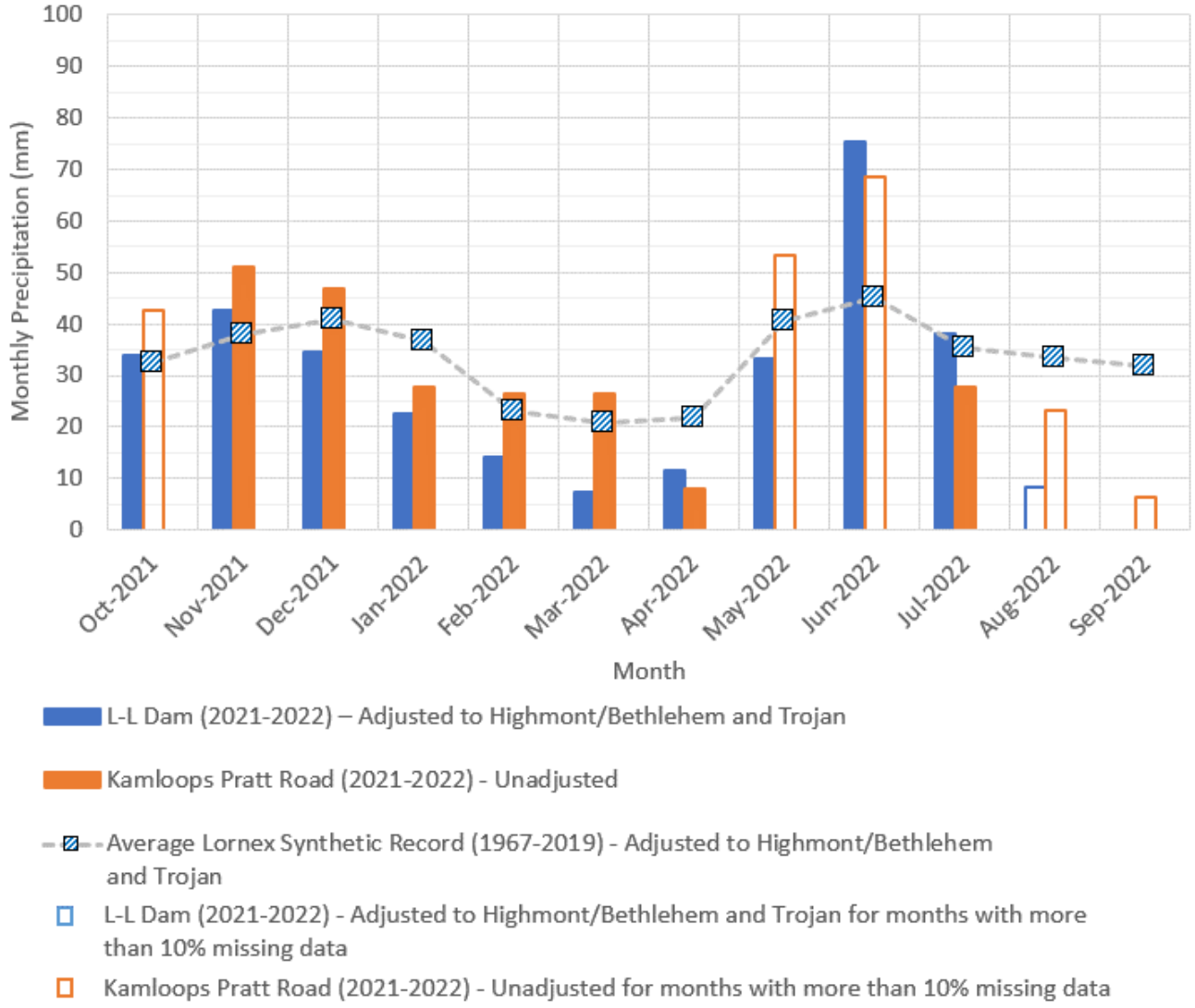
- All rainfall storm events during the review period were less than the 10-year return period event: 40 mm in 24 hours (Golder 2021). The largest 24-hour rainfall events measured at the L-L Dam Weather Station during the review period were 23.9 mm on November 15, 2021; 20.4 mm on July 3, 2022; and 15.5 mm on June 14, 2022.
- In November 2021, a combination of rainfall and early season snowmelt led to significant regional flooding and damage to public and private infrastructure, which impacted communities closest to the HVC Mine Site. Based on the L-L Dam Weather Station, the magnitude of the event was less than a 10-year return period at the HVC Mine Site.

Table 4.1 Monthly Precipitation for the Review Period (Oct. 2021 to Sept. 2022)

Month	Availability of Data (%)		Precipitation (mm)		
	L-L Dam Weather Station	Kamloops Pratt Road Weather Station[1]	L-L Dam Weather Station Data (Corrected)[2]	Kamloops Pratt Road Weather Station[1]	Historic Monthly Average Climate Values (Corrected)[2,3]
Oct 2021	100	81	33.9	42.6	32.4
Nov 2021	100	100	42.6	51.2	37.8
Dec 2021	100	100	34.7	47.0	41.0
Jan 2022	100	100	22.5	27.8	36.5
Feb 2022	100	100	14.1	26.6	23.1
Mar 2022	100	100	7.4	26.6	20.9
Apr 2022	100	100	11.6	7.9	21.8
May 2022	100	71	33.2	53.4	40.5
Jun 2022	100	83	75.5	68.6	45.2
Jul 2022	98	100	38.3	27.8	35.3
Aug 2022	24	83	*8.3*	23.2	33.5
Sept 2022	0	77	*No readings*	6.4	31.7
Annual Total	–	–	322.1	409.1	399.8

Notes:
1. Environment Canada Station No. 116C8P0, El. 729.0 m, 58 km to the east.
2. Precipitation data has been corrected based on Highmont/Bethlehem and Trojan area adjustment factors provided in Golder (2021).
3. Historic monthly averages are based on the Lornex synthetic climate record, converted based on Highmont/Bethlehem and Trojan area adjustment factors provided in Golder (2021).

Figure 4.1 Monthly Precipitation

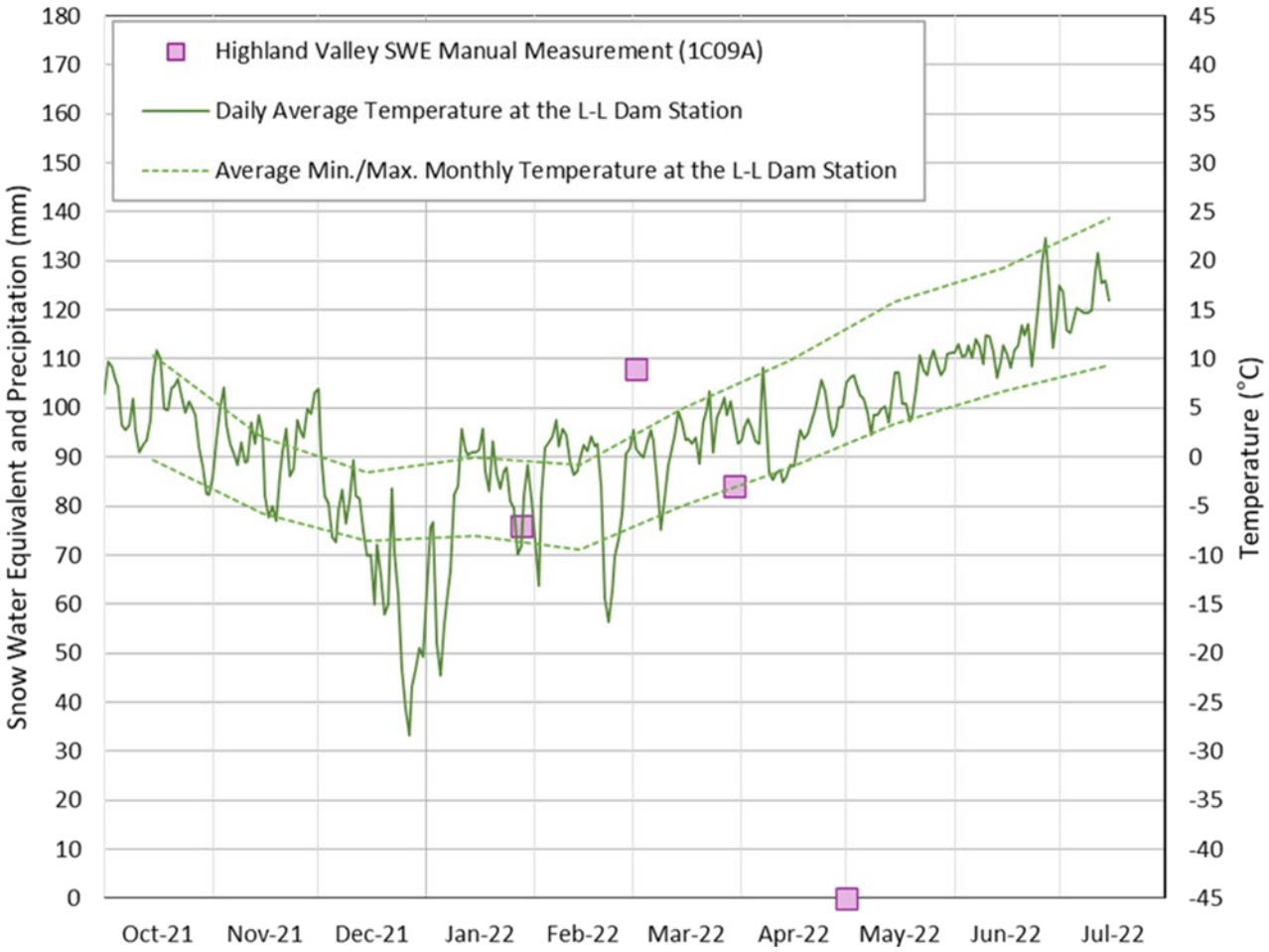


Seasonal snowpack depth is not measured at the L-L Dam Weather Station. Instead, HVC monitors snowpack with monthly measurements at the Highland Valley Snow Survey Station (Station No. 1C09A). Snowpack measurements were made from January through May and are reported on Figure 4.2 in snow-water equivalent (SWE) along with temperature data from the L-L Dam Weather Station from October 2021 to July 2022. The following observations are inferred from these data:

- The daily temperatures recorded between January and June 2022 are generally within the historic monthly average records based on Golder (2021), with some notable cold periods prior to November 2022.

- Snowpack melt started in March, but the majority of melt occurred during April, with all snow gone by May 1. This is consistent with the historic warming period and the forecast snowmelt pattern used in the HVC site-wide water balance, based on Golder (2020).
- Consistent with historic observations, temperature, not rain, is the primary factor that drove snowmelt during the review period. Snowmelt started in March, when daily temperatures started to rise and were consistently above 0°C, and had completed by the end of April. During that same period, precipitation was less than 50% of historic averages (Table 4.1).

Figure 4.2 Temperature Records and Measured Snowpack Between January and June 2022



Notes:
1. SWE is manually measured at the Highland Valley snow pillow station (1C09A), typically once per month.
2. Daily average temperature data at the L-L Dam Station for 2022 was provided by HVC.
3. The average maximum and minimum monthly temperatures at the L-L Dam Station were developed by Golder (2021).

4.3 Water Balance

Under existing conditions, the water balance is entirely driven by climate (Section 4.2). Bathymetric surveys of the pond areas within the impoundment are not available to estimate pond volume. However, pond level can be used to infer change in pond volume as the facility is inactive with no active deposition. Refer to Section 5.2 for a discussion of pond levels during the review period.

4.4 Flood Management

The flood management requirements for the Bethlehem TSF and R3 Seepage Pond are summarized in Table 4.2. Flood-routing analyses for both facilities were updated (KCB 2022b) based on the most recent site-wide hydrology (Golder 2021). The analysis (KCB 2022b) concluded the following:

- The Bethlehem TSF spillway can route the PMF (24-hour) flood event, which is greater than the minimum IDF (Table 4.2) required under the HSRC (EMLCI 2021b). At peak PMF flood level, the estimated freeboard at the Bose Lake Dam is 4.4 m, and the minimum beach width upstream of Dam No. 1 is approximately 200 m. Both of these exceed minimum design requirements.
- The R3 Seepage Pond can safely route, with adequate freeboard, the IDF (Table 4.2) required under the HSRC (EMCLI 2021b).

Table 4.2 Inflow Design Flood Requirements for the Bethlehem TSF

Facility	Outfall Type	Inflow Design Flood[1]	Spillway Design Event[2]	Peak Design Flood Level	Peak Design Outflow
Bethlehem TSF	Open channel	2/3 between 1,000-year and PMF	PMF 24-hour	1470.6 m	7.9 m^3/s
R3 Seepage Pond	Open channel	100-year	100-year 24-hour	1371.1 m	1.5 m^3/s

Notes:
1. The IDF events meet the requirements under the HSRC (EMLCI 2021b) as discussed in KCB (2022b).
2. Spillway design events were reviewed based on the most recent flood routing (KCB 2022b).

5 REVIEW OF MONITORING RECORDS AND DOCUMENTS

5.1 Monitoring Plan

The OMS Manual (HVC 2022) was updated and reissued during the review period. This was a routine update to the document and included revisions to align with the most recent industry guidance documents (MAC 2019), updating emergency contact information and modifying the surveillance program to reflect changes agreed upon with the EoR.

The Bethlehem TSF surveillance program, described in the OMS Manual (HVC 2022), is appropriate for an inactive, reclaimed tailings facility and includes the following activities: visual inspections; measured behaviour from piezometers, pond level readings, survey monuments, and an inclinometer installed at the facility; and a Trigger-Action-Response Plan (TARP). Surveillance information is reviewed, once completed, by HVC, including the TSF QP.

Surveillance activities and frequencies, specified in the OMS Manual (HVC 2022), are summarized in Table 5.1. Surveillance records provided to KCB by HVC, and reviewed by the EoR, demonstrate that OMS Manual (HVC 2022) requirements were met during the review period. As discussed in Section 5.6, reference to seepage flow measurements downstream of Dam No. 1 are not required for dam performance monitoring and will be removed from surveillance requirements in 2023 routine update of the OMS Manual.

HVC added routine condition assessments of the R3 Seepage Pond LLO pipe to the surveillance program. These are to be completed every five years, but HVC did not define the date of the first condition assessment. KCB supports this addition and recommends the first inspection be completed prior to the end of 2024 and the timing be added to the OMS Manual (HVC 2022).

The most recent dam safety review (DSR) of the Bethlehem TSF was completed by SRK Consulting (SRK) in 2018. The report concluded that the facility is well-managed, with a high level of technical stewardship and appropriate operating procedures, and the failure modes are understood and effectively controlled. All recommendations from SRK (2019) have been addressed, and the next DSR is due in 2023.

Table 5.1 Surveillance Requirements from the OMS Manual (HVC 2022) and Activities Completed During the Review Period

Surveillance Activity	Facility	Minimum Frequency	Responsible Party	Documentation	Frequency Compliance	Notes for the Review Period
INSPECTIONS						
Routine Visual Inspection[1]	Dam No. 1 and Bose Lake Dam	Monthly	HVC	HVC inspection reports (reviewed by KCB)	Yes	
	R3 Seepage Pond	Quarterly	HVC		Yes	
Event-Driven Inspection	All	Event Driven[2]	HVC		N/A	None triggered based on the OMS Manual, but HVC did complete during a November 2021 regional flood event.
AFPR	All	Annually	KCB		Yes	
Dam Safety Review (DSR)	All	Every 5 years	HVC	Report	N/A	Next DSR due in 2023.
INSTRUMENTATION MONITORING						
Piezometers	Dam No. 1 and Bose Lake Dam	Monthly (When Accessible)	HVC	AFPR report by KCB	Yes	
Inclinometers	Dam No. 1	Twice per year (min. 5 months apart)	HVC		Yes	
Seepage Flow	Dam No. 1	Monthly	HVC	Electronic record of weir measurements	N/A	Not required for dam performance monitoring as will be removed from OMS Manual during 2023 update.
Pond Level	Pond No. 1 and Pond No. 2	Monthly[3]	HVC	Pond level survey database	Yes	Pond levels were surveyed from April 2022 to July 2022.
	R3 Seepage Pond	Monthly	HVC	GeoExplorer and HVC visual inspection sheets	Yes	
SURVEYS						
Survey Monuments	Dam No. 1 and Bose Lake Dam	Annually	HVC	AFPR report by KCB	Yes	Carried out in June 2022.
Pipe Condition Assessment	R3 Seepage Pond	Every 5 years	HVC	HVC Internal Report (reviewed by KCB as part of the AFPR)	N/A	Added to the surveillance program in 2022.

Notes:
1. Visual inspections include pond level measurements and observations of unusual condition and/or dam safety concerns (e.g., settlement, sinkholes, slope sloughing, erosion, piping, etc.).
2. HVC staff are to complete an event-driven inspection in response to one of the following events: earthquake greater than magnitude 5 within 100 km of the site or any earthquake felt at site, or rainfall event greater than the 10-year, 24-hour duration storm: 39.9 mm (Golder 2021).
3. When accessible, typically outside of winter.

5.2 Pond Levels and Freeboard

The Bethlehem TSF Pond No. 1 and Pond No. 2 levels were surveyed monthly except when frozen and/or snow covered (i.e., October 2021 through March 2022). There was discharge through the R3 Seepage Pond, as discussed in Section 3.2, but no surface discharge through the Bethlehem TSF spillway during the review period.

Bethlehem TSF Pond No. 1:

- During 2022, the pond level followed the established seasonal pattern (Figure 5.1), reaching the peak early in the year, related to freshet, and then dissipating during the remainder of the year. One exception was the levelling of the pond from June to July, which coincides with the above-average precipitation during those months (Section 4.2).
- Since the end of 2019, the pond level has shown a steady decrease, approximately 1.1 m, when comparing pond levels from September 2019 to 2022. This pattern has been observed in the past as the pond level has fluctuated since operations were suspended (Table 5.2).

Bethlehem TSF Pond No. 2:

- During 2022, the pond level followed the established seasonal pattern (Figure 5.1), reaching the peak early in the year, related to freshet, and then dissipating during the remainder of the year.
- The peak pond level during the review period was about 0.4 m lower than the previous year, but that gap reduced to 0.1 m by the end of the review period; refer to Figure 5.1 and Table 5.3. This is attributed to the above-average rainfall in June and July (Section 4.2), which delayed pond drain down over that period.

Table 5.2 Bethlehem TSF Pond No. 1 Change in Pond Levels

Annual Change	Change in Pond Level 2021 to 2022	Range of Annual Pond Level Change 2017 to 20221
Peak Pond	–0.6 m	–0.6 m to 0.3 m
Pond at End of Review Period [1]	–0.5 m	–0.6 m to 0.2 m

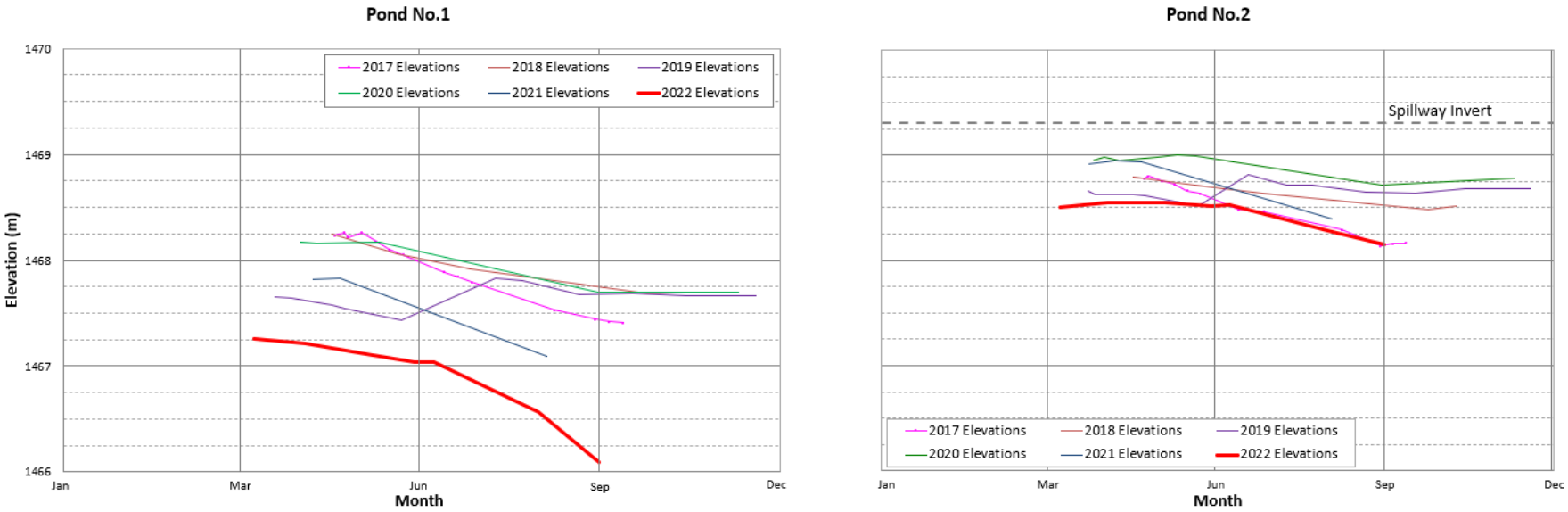
Notes:
1. Pond levels at end of September of each year.

Table 5.3 Bethlehem TSF Pond No. 2 Change in Pond Levels

Annual Change	Change in Pond Level 2021 to 2022	Range of Annual Pond Level Change 2017 to 2021
Peak Pond	–0.4 m	–0.4 m to 0.2 m
Pond at End of Review Period [1]	–0.1 m	–0.3 m to 0.3 m

Notes:
1. Pond levels at end of September of each year.

Figure 5.1 Bethlehem TSF Pond No. 1 and Bethlehem TSF Pond No. 2 Pond Levels – 2017 to 2022



During the follow-up to the spill through the R3 Seepage Pond spillway (Section 3.2), HVC identified that the pond level transducer in the R3 Seepage Pond was not properly calibrated. HVC addressed this, and the pond level being measured by the transducer is consistent with pond levels measured during visual inspections.

The minimum freeboard measured during the review period at the Bose Lake Dam (based on Pond No. 2) and the R3 Seepage Pond are summarized in Table 5.4 and meet the minimum requirements for flood and non-flood conditions.

Table 5.4 Freeboard at the Bethlehem TSF and R3 Seepage Pond

Facility	Minimum Freeboard (m)[1]		
	Flood Freeboard Required (During IDF)	Normal Freeboard Required (During Non-Flood Conditions)	Observed During the Review Period[2]
Bethlehem TSF	2.2	1.3	6.4
R3 Seepage Pond	0.5	0.5	0.9

Notes:
1. Refers to the minimum vertical distance between the dam crest and the pond level based on KCB (2022b).
2. Based on the maximum recorded pond elevation during the review period.

5.3 Piezometers

Piezometers have measured relatively consistent trends and values, some for more than 10 years, and measurements are well below levels assumed in the design analysis. Notification Level thresholds have been defined that, if exceeded, identify to HVC and the EoR of any changes in pattern or typical levels. An exceedance of these thresholds does not represent a performance concern. Thresholds were reviewed as part of the 2022 update to the OMS Manual.

Dam No. 1

At the end of the review period, 31 piezometers were active near Dam No. 1 (Figure 3): 20 in the impoundment, six near the crest, and five below the downstream slope. Piezometric levels at Dam No. 1 are plotted with the Pond No. 1 level on Figures 8 to 10. The current suite of instruments is considered sufficient to monitor piezometric levels in each area to confirm consistency with design assumptions.

Key observations from piezometric readings during the review period are as follows:

- Two piezometers exceeded their Notification Level threshold during the review period, both of which were in the impoundment area (refer to Figure 8):
  - BP9B (~250 m upstream of the crest) exceeded the threshold by 0.8 m in November 2021, but then dropped over the year and was 0.9 m below the threshold at the end of the review period.
  - BP12A (~350 m upstream of the crest) exceeded the threshold for the review period but only by 0.1 m.

  - Neither of these exceedances represents a significant change in behaviour or performance of the structure. They could have been a delayed response to the elevated levels at Pond No. 1 prior to 2020 (Figure 5.1) or a localized response.
- Impoundment Piezometers (Figure 8): These instruments were measured more frequently during 2022 than over the past eight years. Levels throughout the year were within the historic range and did not show large variance, which is consistent with expectations. Some, but not all, piezometers show a downward trend since 2019, which could be related to the falling level in Pond No. 1 (Section 5.2).
- Crest Area Piezometers (Figure 9): Of the six piezometers installed near the crest (all of which are in dam fill or cycloned sand beach), only one is below the water table. Although the other piezometers have been measured as "dry" for 10 years, they provide value in demonstrating that the piezometric level in the cycloned sand beach remains low and is not rising.
- Downstream Slope Piezometers (Figure 10): Levels and trends are consistent with previous years and continue to indicate a downward gradient through the foundation.

Bose Lake Dam

At the end of the review period, 11 piezometers were active near the Bose Lake Dam (Figure 4): six in the impoundment, three at the crest, and two downstream of the toe. Piezometric readings at the Bose Lake Dam are plotted with the Pond No. 2 level on Figure 15 to Figure 17. The current suite of instruments is considered sufficient to monitor piezometric levels in each area to confirm consistency with design assumptions.

Key observations from piezometric readings during the review period are as follows:

- No piezometers exceeded Notification Level thresholds during the review period.
- Impoundment Piezometers (Figure 15): These instruments were measured more frequently during 2022 than over the past eight years. Overall readings throughout the year were within the historic range and did not show a seasonal variance consistent with the lowest levels during winter, then rose to a peak following freshet and above-average rain in June–July.
- Crest Area Piezometers (Figure 16): Includes three nested instruments installed in the dam fill and foundation. Overall piezometric levels in 2022 were lower (~0.5 m) than in 2020 and 2021. This is consistent with pond level variance during that same period.
- Toe Area Piezometers (Figure 17): Piezometric levels at these instruments have been relatively consistent over the past eight years and show very limited seasonal variance over the year.

5.4 Survey Monuments

Surveys of the monuments at Dam No. 1 and the Bose Lake Dam are plotted on Figure 11 and Figure 18, respectively. In November 2019, HVC started to use GPS Real-Time Kinematics (RTK) to survey the monuments. The horizontal surveys plotted on Figures 11 and 18 are for the RTK method only, based on the baseline location from the November 2019 survey. However, a continuous record of settlement has been maintained.

The RTK surveys have shown an improvement (i.e., less variance between readings) over the previous method with respect to horizontal location (i.e., northing/easting) but show higher variance in elevation. This pattern is evident when reviewing readings since 2020 (Figure 11 and Figure 18). For example, the Bose Lake Dam is a compacted fill dam on a competent foundation. Survey monitoring for 10 years, prior to 2020, showed very little elevation change. However, with the new survey method, all monuments are showing a settlement trend since 2020. KCB interprets is as being related to the survey method and not actual movement. There has been no change in loading or other observation at the structure that would explain this change in behaviour.

HVC and KCB agree that the accuracy in elevation observed with the previous survey method should be restored. HVC has been collecting INSAR data since January 2021 as part of a site-wide trial. The information will be reviewed as a potential alternative method for monitoring deformation at Dam No. 1 and the Bose Lake Dam during 2023.

During the review period, there were no threshold value exceedances, and the annual survey during the review period was within the cluster of previous readings and showed no prevalent deformation trend at either dam. Although there is increased variance in the readings, the overall settlement trend at Dam No. 1 continues. This is related to settlement of the waste rock shell that was placed in thick lifts by the mining fleet.

5.5 Inclinometers

A single inclinometer (IB16-1) is installed at Dam No. 1. IB16-2 and was read twice during 2022, as per the OMS Manual (HVC 2022). No significant deformations in the downstream direction have been observed (Figure 12).

5.6 Seepage

There have been no downstream seepage measurements since January 2021 (Figure 13) when the weir downstream of Dam No. 1 (TB-R3-FS-01) was removed by HVC. For the existing condition of the structures, turbid seepage is the primary performance indicator rather than flow. This is captured by visual inspection and no such observations were observed during the review period.

References to seepage flow monitoring at Bethlehem TSF will be removed from the OMS Manual (HVC 2022) in the 2023 routine update.

5.7 Water Quality

HVC's Water Quality Monitoring and Reporting Plan, approved under PE-376 effluent permit (MECCS 2022), specifies minimum water-quality sampling requirements at the HVC Mine Site, including downstream of the Bethlehem TSF. Water-sampling activities and results during the review period are reported in HVC's annual water-quality monitoring report, prepared by an appropriately qualified professional. The annual water-quality monitoring report was being prepared at the time of writing this AFPR and will be submitted to the Ministry of Environment and Climate Change Strategy, and the Ministry of Mines prior to March 31, 2023. This report, when available, should be referred to for

monitoring data and a discussion of the results. HVC has confirmed that the water-quality monitoring requirements related to the Bethlehem TSF were met during the review period.

HVC reports that the only incident during the review period that could have impacted downstream water quality was the unauthorized discharge from the R3 Seepage Pond spillway that is discussed in Section 3.2. Further discussion of downstream water-quality impacts related to this event are included in the annual water-quality report being prepared by specialists in this area.

With regards to the design of the Bethlehem TSF, excluding the R3 Seepage Pond, there were no surface discharges from the impoundment and the primary controls related to seepage (i.e., tailings beach, low-permeability fill at the Bose Lake Dam, seepage collection downstream of Dam No. 1) were in place and performance was consistent with design expectations during the review period.

6 SITE VISIT OBSERVATIONS AND PHOTOGRAPHS

The AFPR site visit checklists, observations, and photographs are included in Appendix I, with key observations summarized as follows:

Bethlehem TSF Dam No. 1 (Appendix I-A)

- The dam was in good physical condition with no significant visual change or issues of concern observed.
- The downstream slope of the dam is in good physical condition and not showing signs of ongoing erosion. No significant change of the remediated or existing erosion features was observed compared to recent site visit observations. Existing erosion features typically have vegetation growth along the base indicating that the ongoing erosion rate, if any, is slow.
- The sinkhole on the beach, more than 340 m upstream of the crest, remains similar to previous observations. The sinkhole was first identified in 1993 and was reviewed by the designers during operations. In 1997, based on reviews undertaken and monitoring, the designers concluded that it is not a concern for dam safety.

Bethlehem TSF Bose Lake Dam (Appendix I-B)

- The dam was in good physical condition with no significant visual change or issues of concern observed.
- Vegetation growth (grass, bushes, and small trees) is present from the spillway inlet to the start of the riprap channel. Due to the available freeboard and capacity of the spillway to route the IDF (Section 4.4), the vegetation present does not pose a risk to performance. It will be cleared by HVC next year as part of routine maintenance defined in the OMS Manual (HVC 2022).
- The location of animal burrows (Photo I-B-5) on the downstream slope of the Bose Lake Dam (glacial till zone) were visited. As reported in the 2021 AFPR (KCB 2022a), HVC and KCB reviewed the potential impact of animal burrows in this area on dam performance and concluded that they do not represent a concern as they are above predicted flood levels.

R3 Seepage Pond Dam (Appendix I-C)

- The dam was in good physical condition with no visual change or issues of concern observed.
- At the time of the site visit, the outlet pipe debris fence was partially obstructed with vegetation, and trees were partially obstructing the spillway inlet. HVC provided photographs to show that the vegetation was cleared as part of routine maintenance following the site visit.
- There was flow through the spillway prior to the site visit (Section 3.2). Discharge flows were well below peak design flows, and no degradation of the spillway or riprap was observed.

7 ASSESSMENT OF DAM SAFETY

7.1 Review of Potential Downstream Consequences

Conditions and land use downstream of all tailings and water-retaining structures were reviewed by HVC and KCB during the review period as part of the failure mode review (Section 7.2), and no significant changes were identified.

HVC and KCB reviewed the current IDF and earthquake design ground motion (EDGM) for each of the Bethlehem TSF facilities to confirm they meet or exceed the equivalent requirements under the HSRC (EMLCI 2021b), which defines such requirements based on a consequence classification.

At the request of HVC, the AFPR does not include any reference to a consequence classification for the Bethlehem TSF facilities. Consequence classification is not part of HVC's tailings management governance and stewardship because there are components of that system that do not align with HVC's safety culture where any fatality represents an unacceptable consequence. HVC's internal governance has been developed to align with the GISTM (2020) requirements and to meet or exceed requirements under the HSRC (EMLCI 2021b).

7.2 Failure Mode Review

7.2.1 Overview

HVC's stated long-term goal for their TSFs is to reach landform status, with all potential failure modes that could result in the catastrophic release of tailings and/or water being either reduced to non-credible or managed to ALARP (i.e., as low as reasonably practicable) under appropriate loading conditions. KCB fully supports this goal, which is also consistent with the GISTM (2020).

Potential failure modes for the Bethlehem TSF were reviewed by HVC and KCB during the review period based on currently available information and existing controls. The conclusion was that potential failure modes are being managed appropriately.

Design and operational controls in place to manage potential failure modes are summarized below, along with their status at the end of the review period.

7.2.2 Dam No. 1

Overtopping

Overtopping at Dam No. 1 is not possible as the dam crest is 2 m higher than the crest of the Bose Lake Dam, and any ponding near Dam No. 1 would flow towards the Bose Lake Dam before flowing over the crest of Dam No. 1.

Slope Stability

The current condition of the dam meets design factor of safety (FoS) criteria for global slip surfaces that would result in an uncontrolled release of tailings under static (FoS $\geq$ 1.5) and post-earthquake (FoS $\geq$ 1.2) loading (KCB 2020). The key design controls related to dam stability are the downstream rockfill shell and toe buttress, as well as a low piezometric level in the upstream cycloned sand beach, which is consistent with piezometer readings. Under the current configuration, the piezometric levels and gradients through the tailings and dam are lower than during operations, which increases the factor of safety against slope failure. The inclinometer installed through the downstream slope does not show any horizontal movement through the dam shell or foundation.

The slope stability review (KCB 2020) identified a potential hazard to mine roads and downstream infrastructure (e.g., seepage ponds) related to slumping of the rockfill toe buttress under an extreme earthquake load. If such an event occurred, the toe buttress would most likely slump to a shallower slope, but this would not result in a flow failure and/or uncontrolled release of the contained materials.

Internal Erosion Through Dam Fill or Foundation:

The primary control for managing internal erosion through the dam is the wide tailings beach, which reduces the piezometric levels and seepage gradients through the dam fill and foundation. There are no filter zones between the cycloned sand beach and dam fill.

Measured performance (i.e., piezometers) and visual observations during the review period are consistent with historic performance and demonstrate that the beach has been successful at preventing the progression of internal erosion. This was also the case during operations when piezometric levels and seepage flows through the cycloned sand beach, into the foundation and dam fill, were higher during operations while tailings were spigotted from the dam crest.

7.2.3 Bose Lake Dam

Overtopping

The spillway design flood (PMF 24-hour) is greater than the minimum IDF (Table 4.2) recommended under the HSRC (EMLCI 2021b) and is an effective control to prevent overtopping. In addition, under existing conditions, the following controls and factors significantly reduce the potential for overtopping:

- Freeboard: At the peak flood level during the PMF (24-hour), freeboard is 4.4 m. This exceeds the minimum freeboard of 0.2 m required to accommodate wave run-up and wind (Table 5.4).
- Spillway: The design assumes that the pond level is at the invert of the spillway at the onset of the storm; under normal conditions, the pond level was 0.6 m or more below the invert. This provides additional flood attenuation that is not accounted for in the design and significantly reduces the potential for overtopping.

Slope Stability

The current condition of the dam meets design factor of safety (FoS) criteria for global slip surfaces that would result in an uncontrolled release of tailings under static (FoS $\geq$ 1.5) and post-earthquake (FoS $\geq$ 1.2) loading (KC 1996). The key design controls related to dam stability are the downstream compacted fill shell built on a competent foundation of glacial till and shallow bedrock (granodiorite). Neither dam fill nor foundation deposits are susceptible to significant strength loss during the design seismic loading at the site.

Internal Erosion Through Dam Fill or Foundation:

The primary controls to manage internal erosion through the dam are low-permeability glacial till dam fill to reduce seepage gradients and flows through the dam fill, and the filter zones between the glacial till dam fill and granular drainage features near the downstream toe.

Measured performance (i.e., piezometers) and visual observations during the review period are consistent with historic performance and demonstrate that these controls have been successful at preventing the progress of internal erosions.

7.2.4 R3 Seepage Pond Dam

Overtopping

The design flood for the emergency spillway (100-year) meets the requirements under the HSRC (EMLCI 2021b). The spillway is capable of routing much larger flood events, including the PMF (24-hour), albeit with less than minimum flood freeboard.

Slope Stability

The existing condition of the dam meets the design factor of safety criteria for global slip surfaces that would result in an uncontrolled release of water under static (FoS $\geq$ 1.5) and post-earthquake (FoS $\geq$ 1.2) loading (KCB 2021).

7.3 Emergency Preparedness and Response

The Bethlehem TSF EPRP forms part of the OMS Manual (HVC 2022), which was reviewed and revised during the review period. The revision included updating procedures and contacts based on current side-wide emergency plans. The EPRP is appropriate for the existing structure and includes a list of preventative actions that can be taken in response to potential unusual or emergency conditions.

On October 26, 2022, participants from HVC's operation team (including site management), including a representative designated by the HVC QP, and the EoR participated in a simulated exercise to test the TSF mine emergency response plans.

8 SUMMARY

Based on the review of measured performance and observations summarized herein, KCB concludes that the Bethlehem TSF performed as expected, was maintained within design requirements, and operated in accordance with the OMS Manual (HVC 2022) from October 2021 through September 2022.

All recommendations from past AFPRs and the 2018 DSR have been closed. Two new recommendations were made during this review, both applicable to the R3 Seepage Pond; neither represents an imminent or present dam safety concern (Table 8.1).

Table 8.1 2022 AFPR Recommendations Related to Facility Performance

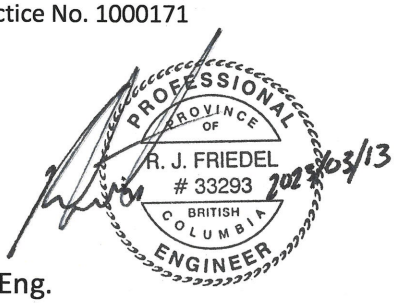
ID No.	Performance Area	Recommended Action	Priority(1)	Deadline (Status)
R3 Seepage Pond				
R3-2022-01	Maintenance	Until full capacity of the LLO has been restored, maintain secondary pumping for the R3 Seepage Pond on site and establish a trigger in the OMS Manual to initiate mobilization and operation to control pond level.	3	Q4 2023
R3-2022-02	Governance	Add the inspection frequency to the OMS Manual with the first one to be completed by end of 2024.	4	Q4 2023

Notes:
1. Recommendation priority guidelines, specified by Teck and assigned by KCB:
   Priority 1: A high probability or actual dam safety issue considered immediately dangerous to life, health, or the environment, or a significant risk of regulatory enforcement.
   Priority 2: If not corrected, could likely result in dam safety issues leading to injury, environmental impact, or significant regulatory enforcement, or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
   Priority 3: Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
   Priority 4: Best Management Practice – Further improvements are necessary to meet industry best practices or reduce potential risks.

9 CLOSING

We thank you for the opportunity to work on this project. Should you have any questions, please contact the undersigned.

KLOHN CRIPPEN BERGER LTD.
B.C Permit to Practice No. 1000171



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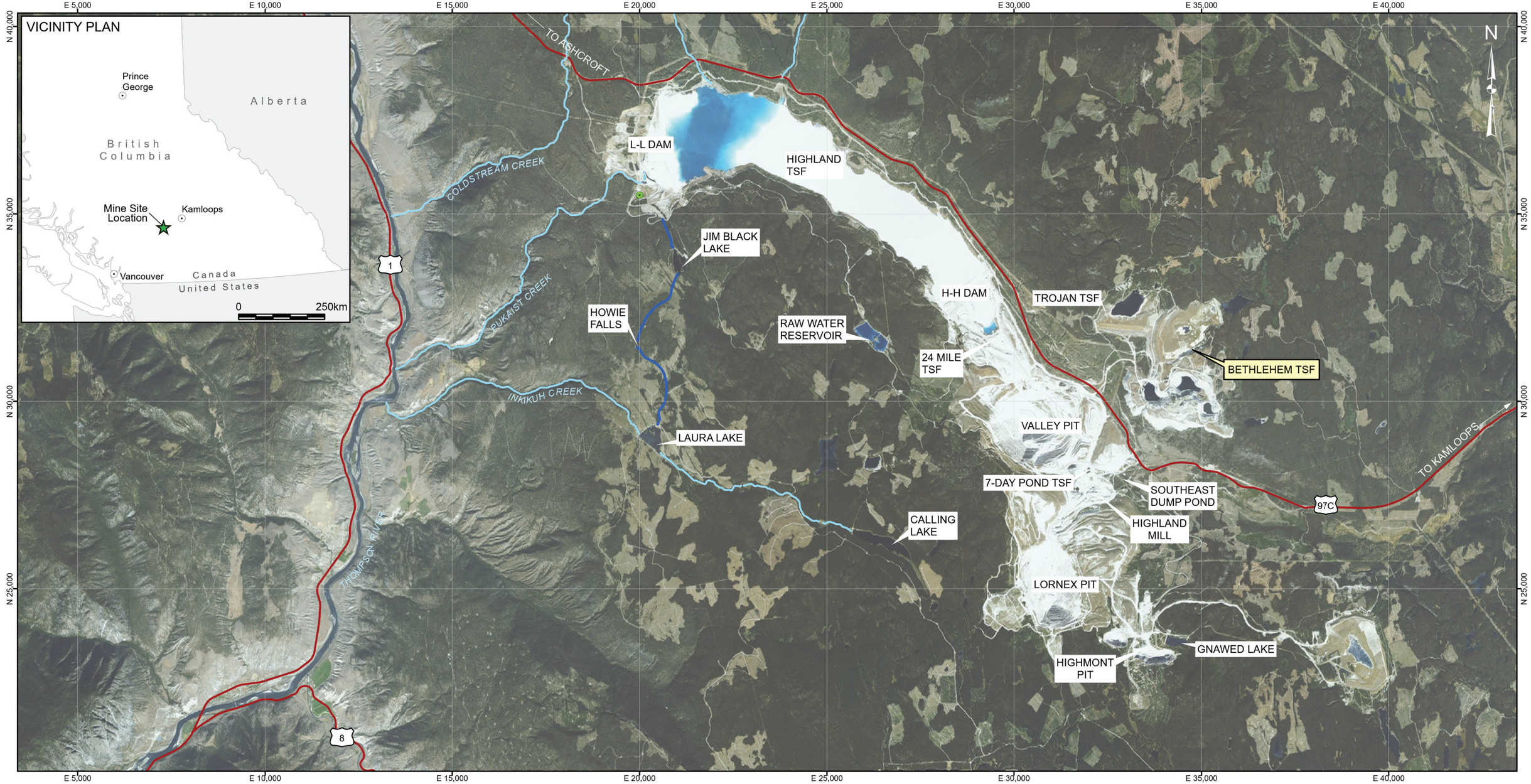
FIGURES



LEGEND

- L-L DAM WEATHER STATION
- CREEK/RIVER
- HIGHWAY
- INKIKUH DIVERSION

NOTES:

1. PROJECTION: HVC MINE GRID.
2. TSF = TAILINGS STORAGE FACILITY.
3. HIGHWAY AND CREEK DATA FROM THE GOVERNMENT OF CANADA (CANVEC).
4. IMAGERY FROM ESRI.

NOT FOR CONSTRUCTION

SCALE 0 5km

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck	PROJECT: BETHLEHEM TAILINGS STORAGE FACILITY 2022 ANNUAL FACILITY PERFORMANCE REPORT
Klohn Crippen Berger	TITLE: MINE SITE PLAN
SCALE: AS SHOWN	PROJECT No.: M02341C42
FIG No.: 1	

SAVE DATE: 2023-03-08 3:07 PM
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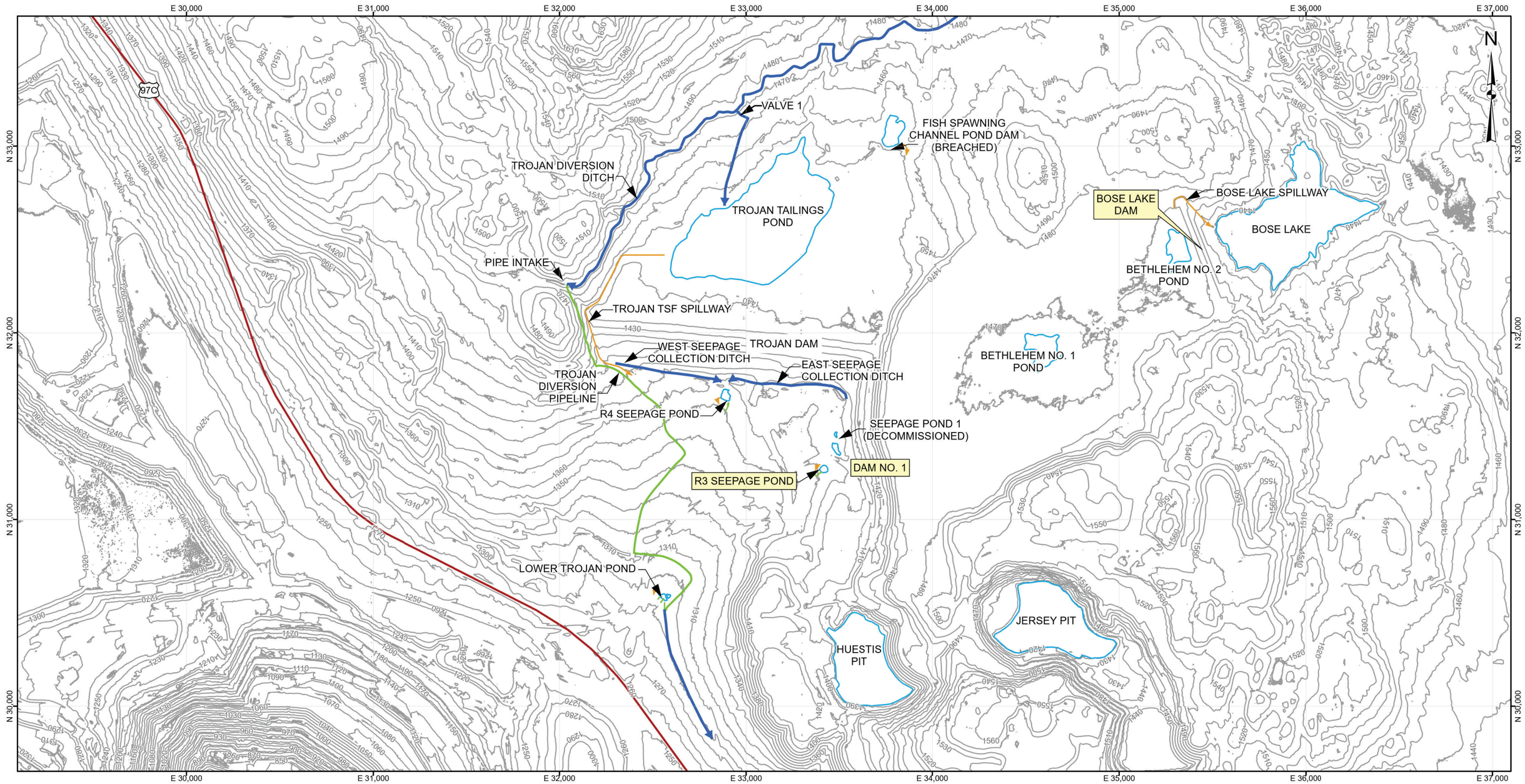

LEGEND

- SPILLWAY
- DITCH
- ABOVE GROUND PIPELINE
- HIGHWAY
- WATERBODY

NOTES:

1. PROJECTION: HVC MINE GRID.
2. TSF = TAILINGS STORAGE FACILITY.
3. TOPOGRAPHY FROM HVC, LIDAR FLOWN ON AUGUST 23, 2014.
4. TAILINGS AND SEEPAGE POND EXTENTS BASED ON IMAGERY FROM SEPTEMBER, 2016.

NOT FOR CONSTRUCTION

SCALE 0 500 m

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

Klohn Crippen Berger

TITLE: BETHLEHEM NO. 1
TAILINGS STORAGE FACILITY
OVERVIEW

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C42	2

SAVE DATE: 2023-03-08 3:08 PM
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LEGEND

- WAYPOINT (BTH-2022-xx)
- VIBRATING WIRE PIEZOMETER
- STANDPIPE PIEZOMETER
- MANUAL INCLINOMETER
- TOTAL STATION POINT
- DITCH
- BURIED PIPE
- SPILLWAY
- CREEK
- DAM

NOTES:

1. PROJECTION: HVC MINE GRID.
2. IMAGERY OBTAINED SEPTEMBER 2020 AND OCTOBER 2021.
3. TOPOGRAPHY FROM HVC, LIDAR FLOWN ON AUGUST 23, 2014.

NOT FOR CONSTRUCTION

SCALE 0 250m

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: DAM NO. 1
PLAN

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C42	3

SAVE DATE: 2023-03-08 3:14 PM
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LEGEND

- WAYPOINT (BTH-2022-xx)
- VIBRATING WIRE PIEZOMETER
- STANDPIPE PIEZOMETER
- TOTAL STATION POINT
- SPILLWAY
- DAM

NOTES:

1. PROJECTION: HVC MINE GRID.
2. IMAGERY OBTAINED SEPTEMBER, 2020.
3. TOPOGRAPHY FROM HVC, LIDAR FLOWN ON AUGUST 23, 2014.
4. LOCATIONS OF SURVEY MONUMENTS BD8, BD09, AND BD10 ARE APPROXIMATE.

NOT FOR CONSTRUCTION

SCALE 0 50m

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BOSE LAKE DAM
PLAN

Klohn Crippen Berger

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C42	4

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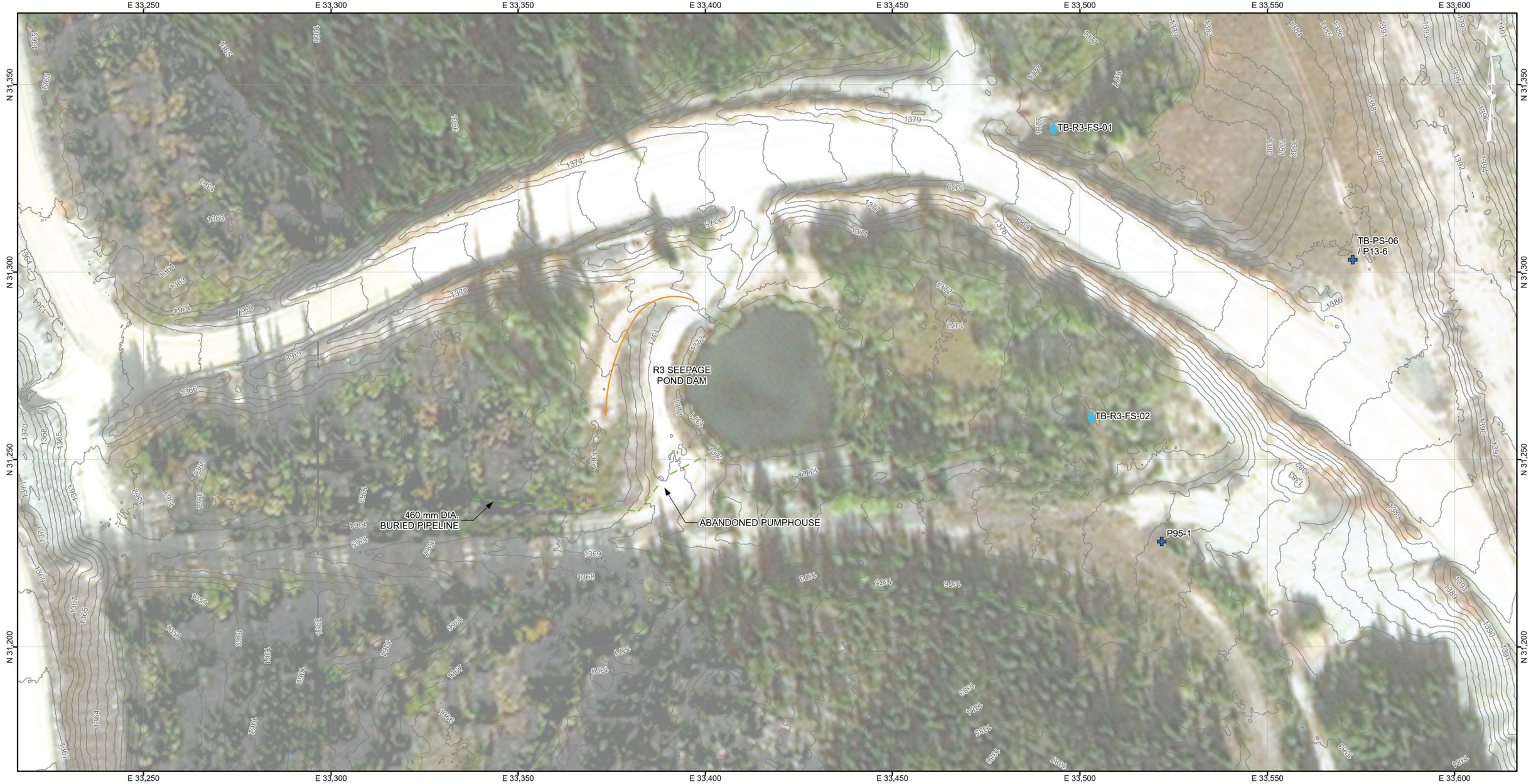

LEGEND

- WAYPOINT (BTH-2022-xx)
- BURIED PIPE
- SPILLWAY

ACTIVE INSTRUMENT

- STANDPIPE PIEZOMETER
- WEIR

NOTES:

1. PROJECTION: HVC MINE GRID.
2. IMAGERY OBTAINED SEPTEMBER, 2020 AND OCTOBER 2021.
3. TOPOGRAPHY FROM HVC, LIDAR FLOWN ON AUGUST 23, 2014.
4. LOCATION OF BURIED PIPES ARE APPROXIMATE.

NOT FOR CONSTRUCTION

SCALE 0 25m

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: R3 SEEPAGE POND DAM
PLAN

Klohn Crippen Berger

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C42	5

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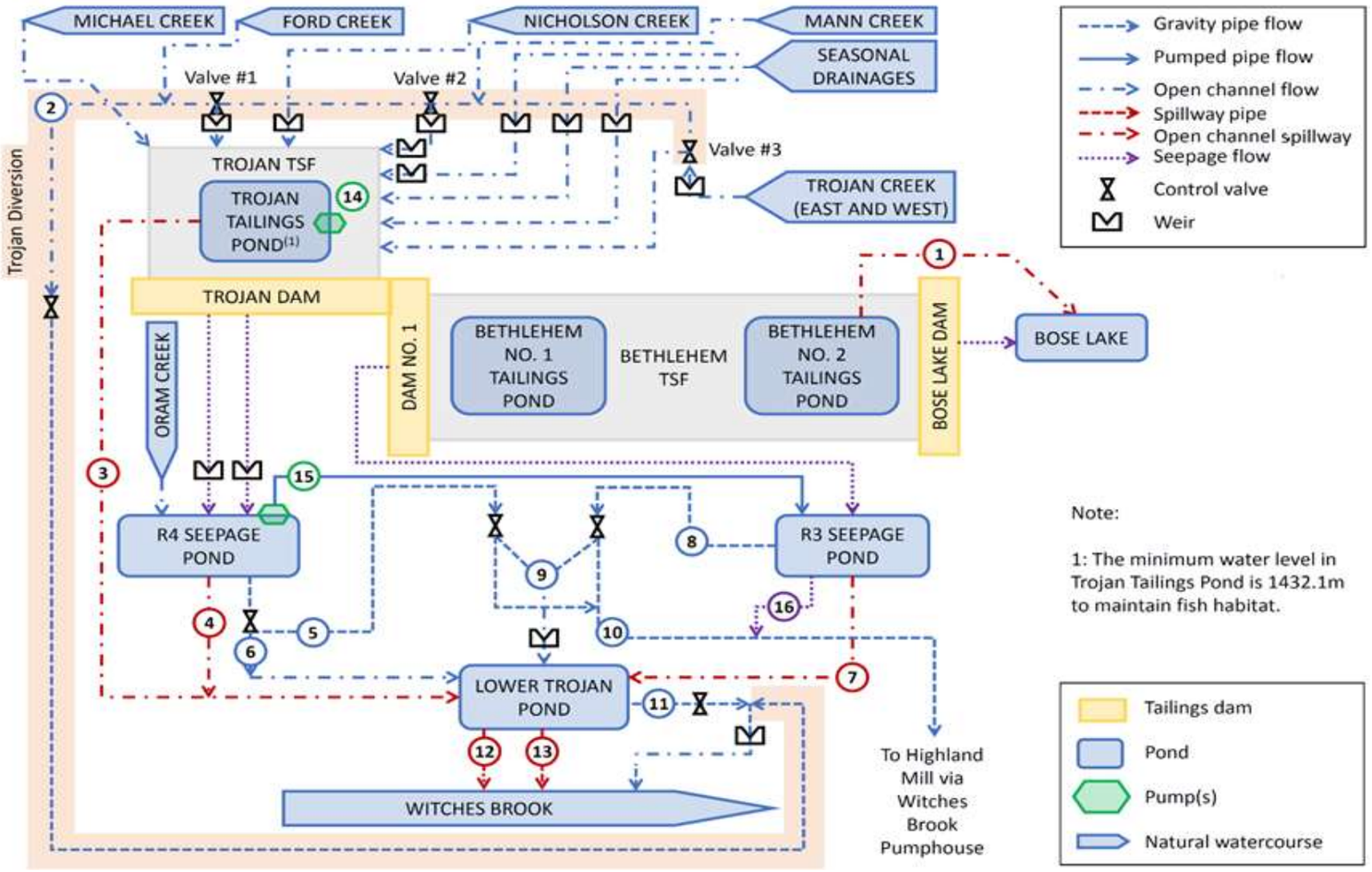


Note:

1: The minimum water level in Trojan Tailings Pond is 1432.1m to maintain fish habitat.

No.	Name	Description	Status
1	Bethlehem No.1 TSF Spillway	3 m wide channel with concrete sill founded in tailings (3 m wide, vegetated) and natural ground (3 m, riprap-lined)	Operational
2	Trojan Diversion	6.5 km long series of channels, culverts, and pipelines	Operational
3	Trojan Spillway	957 m long open channel founded in tailings (5 m wide, vegetated), natural ground (3 m, riprap-lined) and bedrock (3 m)	Operational
4	R4 Spillway	2 m wide riprap-lined channel	Operational
5	R4 Low-Level Outlet	300 mm dia. HDPE pipe with U/S and D/S control valves and intake trash rack	Operational
6	R4 Overflow	100 mm dia. HDPE pipe with U/S control valve	Operational
7	R3 Spillway	2 m wide riprap-lined channel	Operational
8	R3 Low-Level Outlet	460 mm dia. HDPE pipeline with D/S control valve	Operational
9	R3/R4 Seepage to Lower Trojan Pond	Open channel from Valve Box to Lower Trojan Pond	Operational
10	R3/R4 Seepage to Northern Collection Line	10” dia. buried pipeline	Operational
11	LTD Low-Level Outlet	460 mm dia. HDPE pipe with control valve and intake trash rack	Operational
12	LTD Spillway	7 m wide channel	Operational
13	LTD Overflow	810 mm dia. HDPE pipe	Operational
14	Trojan Pump	Pump for Trojan Tailings Pond	Non-operational
15	R4 Pump to R3 Pond	Steel pipe from R4 Pumphouse discharged to R3 Pond	Non-operational
16	R3 Overland Collector	8”-12” HDP pipe collecting surface water	Operational

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

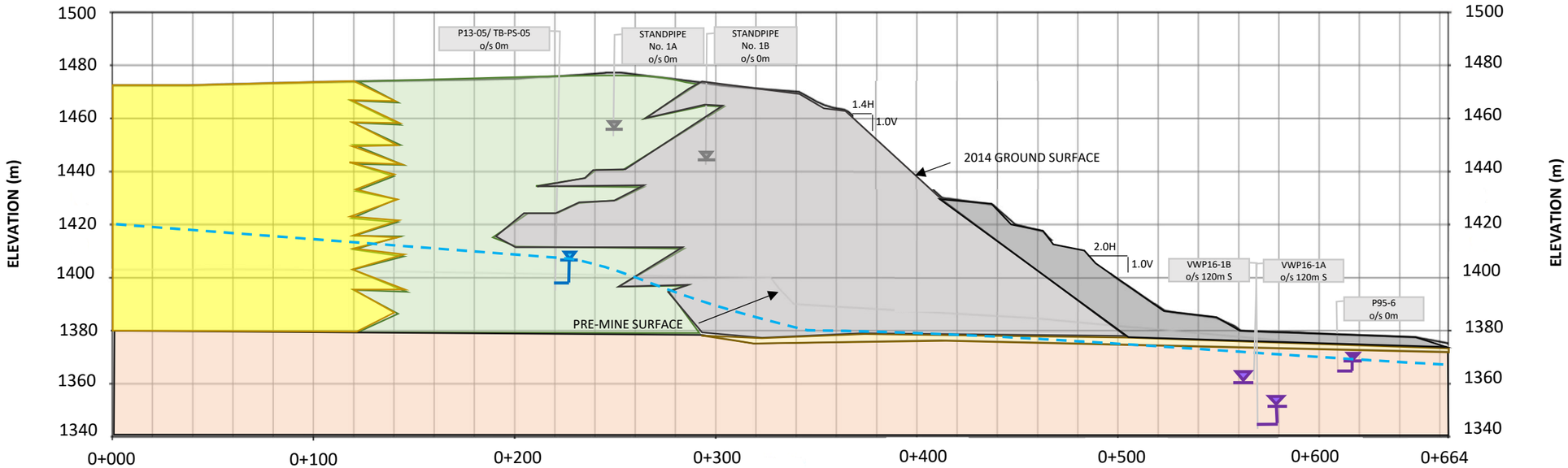
Klohn Crippen Berger

PROJECT: BETHLEHEM NO.1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: FLOW SCHEMATIC FOR BETHLEHEM No. 1 AND TROJAN TAILINGS STORAGE FACILITIES

SCALE	PROJECT No.	FIG. No.
NTS	M02341C42	6

FILE PATH: \\VAT.KLOHN.COM\PROJDATA\MV\CR\M02341C42-HVC-2022 AFPR\700 DELIVERABLES\720 WORKING\BETHLEHEM\FIGURES\DO NOT ISSUE - FOR PFD (FIG6)\211202 - FIG 6- PFD.XLSX - 2023-01-13 14:16



SECTION A/3 BOSE LAKE DAM

NOTES

1. THE LOCATIONS OF THE INSTRUMENTS OFF THE SECTION ARE APPROXIMATE.
2. INTERNAL ZONING OF THE BETHLEHEM EMBANKMENT WAS DELINIATED USING INFORMATION PRESENTED IN THE 2013 DSR (AMEC 2014)
3. OPERATIONAL PIEZOMETRIC LINES WERE DELINIATED FROM ANALYSES PRESENTED IN THE 2013 DSR (AMEC 2014)

LEGEND

- TAILINGS
- CYCLONED SAND
- DAM ROCKFILL
- BUTTRESS ROCKFILL
- GLACIAL TILL OVERBURDEN
- ROCK UNDERDRAIN
- WATER ELEVATION AT FOUNDATION PIEZOMETER (AUG. 2022)
- WATER ELEVATION AT CYCLONED SAND OR FILL PIEZOMETER (AUG. 2022)
- DRY PIEZOMETER / CPT
- INFERRED PIEZOMETRIC LINE - EXISITING

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BETHLEHEM DAM No. 1
TYPICAL SECTION A

SCALE	PROJECT No.	FIG. No.
NTS	M02341C42	7

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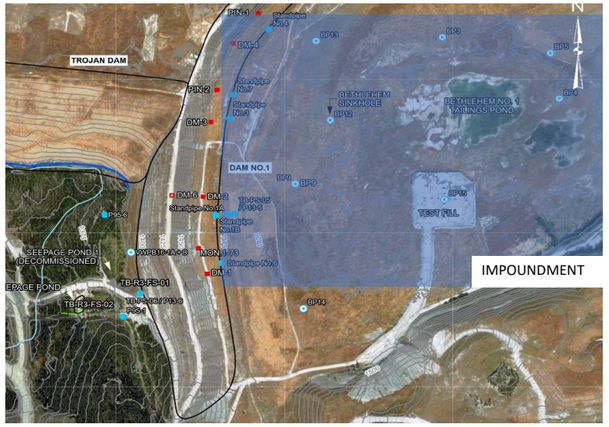
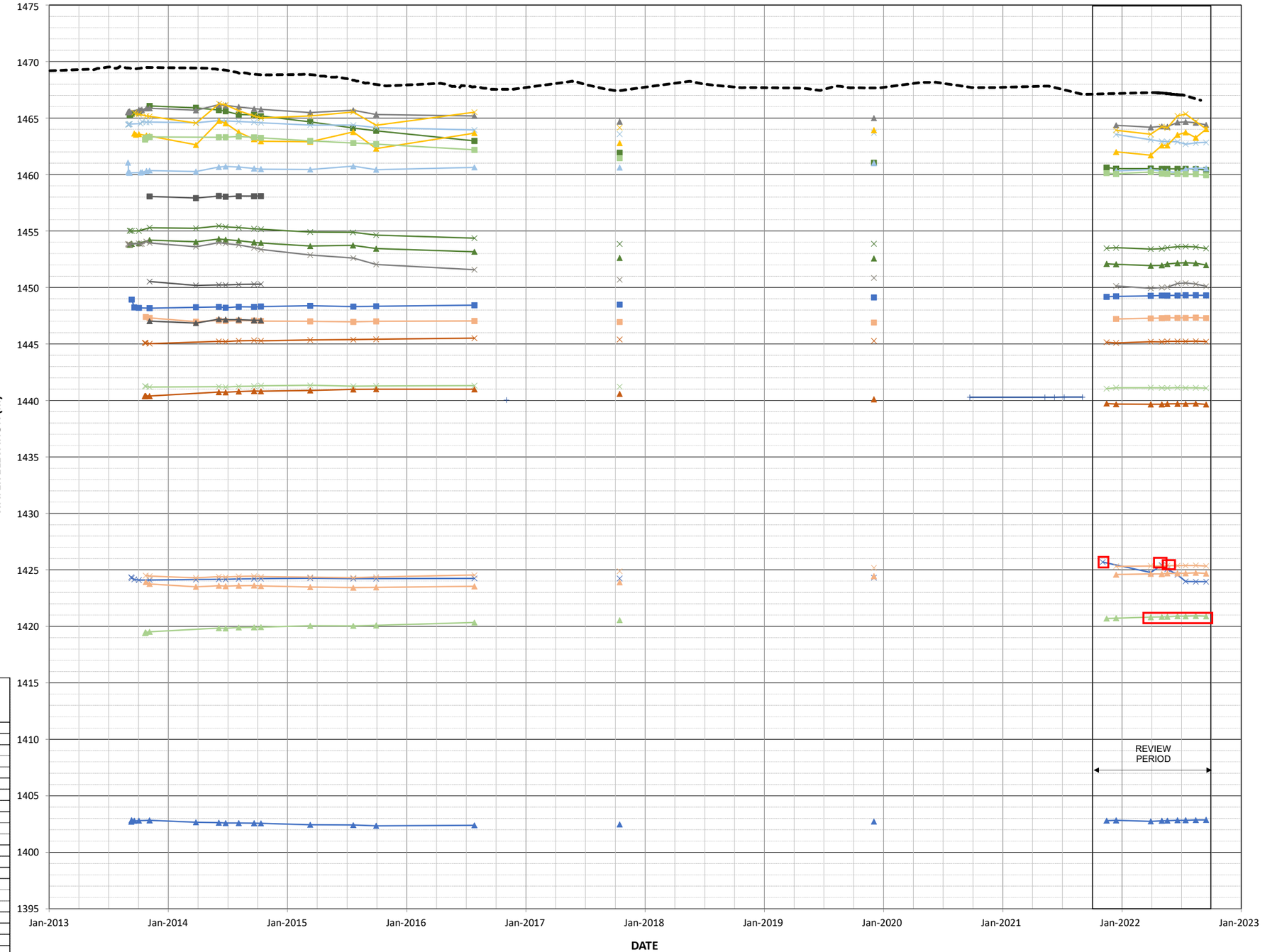




LEGEND:

- STANDPIPE NO. 7 (TIP El. 1439.9 m, UPSTREAM DAM FILL)
- BP3A (TIP El. 1439.4 m, GLACIAL TILL)
- BP3B (TIP El. 1444 m, TAILINGS)
- BP3C (TIP El. 1457.7 m, TAILINGS)
- BP4A (TIP El. 1421.9 m, GLACIAL TILL)
- BP4B (TIP El. 1449.4 m, TAILINGS)
- BP5A (TIP El. 1450.0 m, GLACIAL TILL)
- BP5B (TIP El. 1459.1 m, TAILINGS)
- BP9A (TIP El. 1371.8 m, TAILINGS)
- BP9B (TIP El. 1411.5 m, TAILINGS)
- BP9C (TIP El. 1441.9 m, TAILINGS)
- BP10A (TIP El. 1452.8 m, TAILINGS)
- BP10B (TIP El. 1462.0 m, TAILINGS)
- BP12A (TIP El. 1404.0 m, TAILINGS)
- BP12B (TIP El. 1426.1 m, TAILINGS)
- BP12C (TIP El. 1456.6 m, TAILINGS)
- BP13A (TIP El. 1431.6 m, GLACIAL TILL)
- BP13B (TIP El. 1442.9 m, TAILINGS)
- BP14A (TIP El. 1417.8 m, GLACIAL TILL)
- BP-14B (TIP El. 1423.9 m, TAILINGS)
- BP14C (TIP El. 1447.0 m, TAILINGS)
- BP15A (TIP El. 1394.9 m, GLACIAL TILL)
- BP15B (TIP El. 1411.7 m, TAILINGS)
- BP15C (TIP El. 1440.6 m, TAILINGS)
- BETHLEHEM NO.1 POND LEVEL

PIEZOMETER ID	2022 NOTIFICATION LEVEL THRESHOLDS VALUE (m)
BP3A	1454.8
BP3B	1455.9
BP3C	1466.6
BP4A	1466.7
BP4B	1454.6
BP5A	1461.6
BP5B	1465.3
BP9A	1403.4
BP9B	1424.9
BP9C	1449.6
BP10A	1465.2
BP10B	1466.8
BP12A	1420.8
BP12B	1441.8
BP12C	1463.9
BP13A	1441.5
BP13B	1446.0
BP14A	1425.0
BP-14B	1425.7
BP14C	1447.9
BP15A	1447.7
BP15B	1451.0
BP15C	1458.6

READING DURING REVIEW PERIOD ABOVE NOTIFICATION LEVEL

NOTES:

1. STANDPIPE NO. 7 IS REPORTED DRY/PLUGGED
2. PIEZOMETER BP15A/B/C ARE DEFUNCT.

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

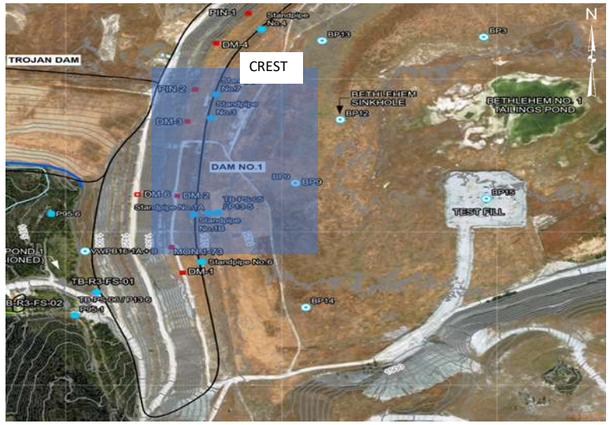
PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

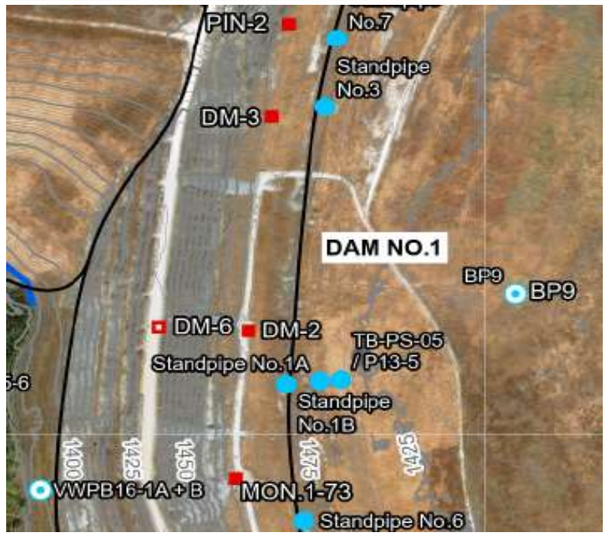
TITLE: DAM No. 1 PIEZOMETRIC DATA
YEARS 2013 TO 2022

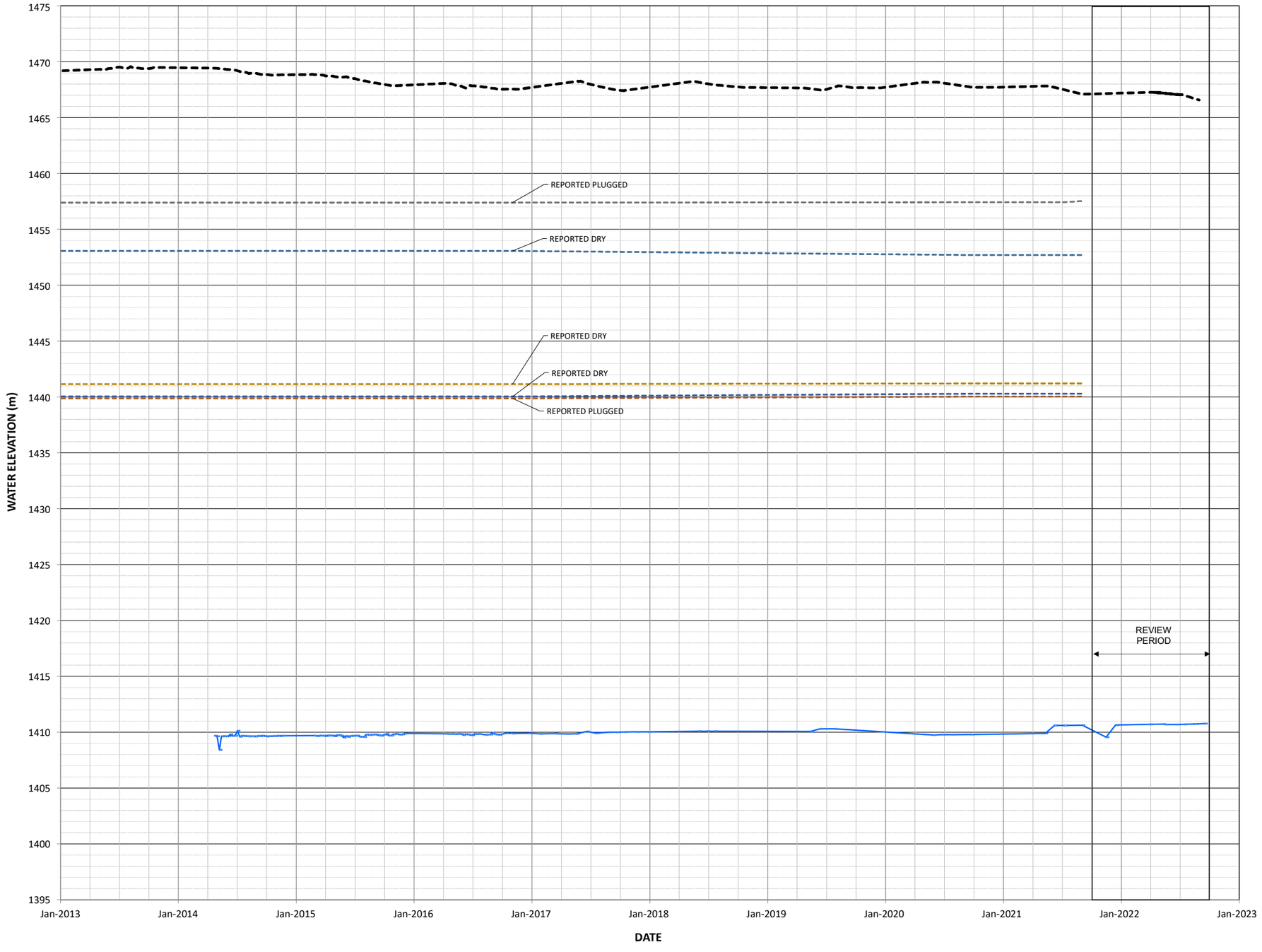
IMPOUNDMENT

PROJECT No. M02341C42

FIG No. 8







LEGEND:

- STANDPIPE NO. 1A (TIP El. 1446.6 m, UPSTREAM DAM FILL)
- STANDPIPE NO. 1B (TIP El. 1440.3 m, UPSTREAM DAM FILL)
- STANDPIPE NO. 3 (TIP El. 1442.8 m, UPSTREAM DAM FILL)
- STANDPIPE NO. 4 (TIP El. 1451.8 m, UPSTREAM DAM FILL)
- STANDPIPE NO. 7 (TIP El. 1439.9 m, UPSTREAM DAM FILL)
- 13-SRK-09/P13-5 (TIP El. 1391.2 m, TAILINGS)
- BETHLEHEM NO.1 POND LEVEL

PIEZOMETER ID	2022 NOTIFICATION LEVEL THRESHOLDS VALUE (m)
STANDPIPE No. 1A	1457.9
STANDPIPE No. 1B	1440.4
STANDPIPE No. 3	1443.1
STANDPIPE No. 4	1453.6
STANDPIPE No. 7	1440.5
13-SRK-09/P13-5	1411.0

NOTES:

1. INSTRUMENTS ARE STILL REPORTING DRY/ PLUGGED FOR THE 2022 REPORTING PERIOD.

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

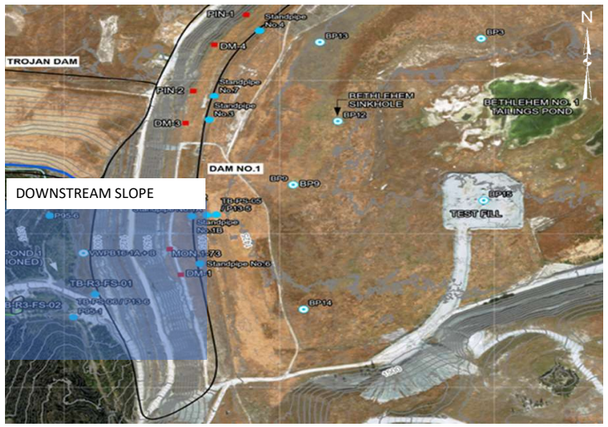
TITLE: DAM No. 1 PIEZOMETRIC DATA
YEARS 2013 TO 2022

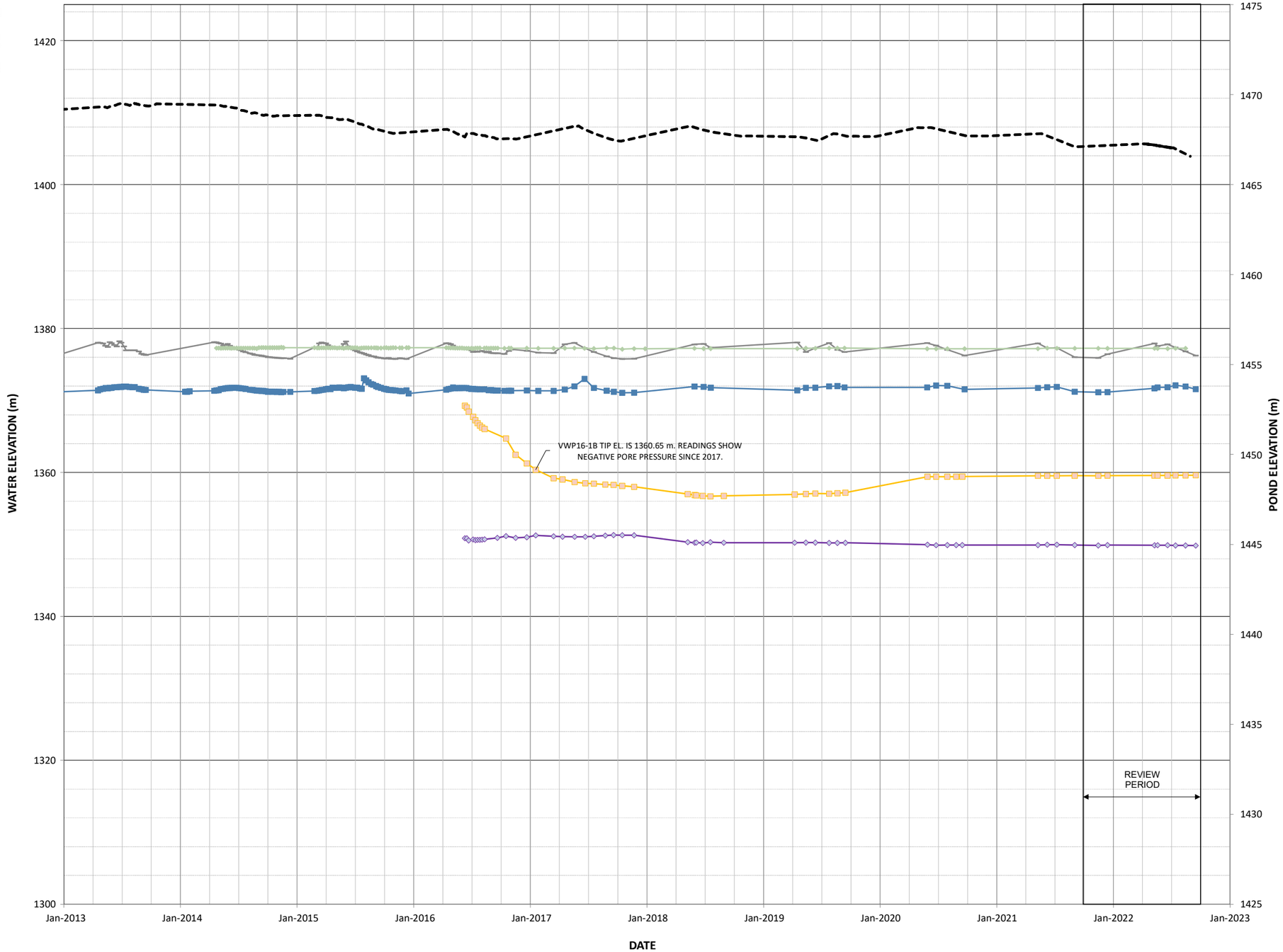
CREST

PROJECT No. M02341C42

FIG No. 9

January 13, 2023
\\int.klohn.com\ProjData\MVCRM\02341C42-HVC-2022 APFR\300 Design\320 Piezometer Data\Bethlehem\Rev 1 - used HVC dip\[220928 Bethlehem Piezo.xlsx]Fig 9 No1 CREST





LEGEND:

- VWP16-1B (TIP El. 1360.7 m, GLACIAL TILL)
- P95-1 (TIP El. 1373.7 m, DOWNSTREAM FOUNDATION)
- P95-6 (TIP El. 1368.2 m, DOWNSTREAM FOUNDATION)
- 13-SRK-12B/P13-6 (TIP El. 1357.2 m, GLACIAL TILL)
- VWP16-1A (TIP El. 1346.2 m, GLACIAL TILL)
- BETHLEHEM NO.1 POND LEVEL

PIEZOMETER ID	2022 NOTIFICATION LEVEL THRESHOLDS VALUE (m)
P95-1	1379.0
P95-6	1373.6
13-SRK-12B/P13-6	1377.9
VWP16-1A	1351.7
VWP16-1B	1369.8

NOTES:

1. PIEZOMETER WATER ELEVATIONS PLOTTED ON PRIMARY (LEFT) AXIS, POND ELEVATION PLOTTED ON SECONDARY (RIGHT) AXIS.
2. FALLING HEAD TEST CARRIED OUT ON P95-6 DURING JULY 2015 - CAUSE OF SPIKE IN PIEZOMETRIC LEVELS.
3. JUNE 25, 2020 WATER LEVELS AT VWP16-1A AND VWP16-1B ARE NOT MEASURED AND PLOTTED BECAUSE THE BAROMETRIC PRESSUER READINGS WERE NOT TAKEN.

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

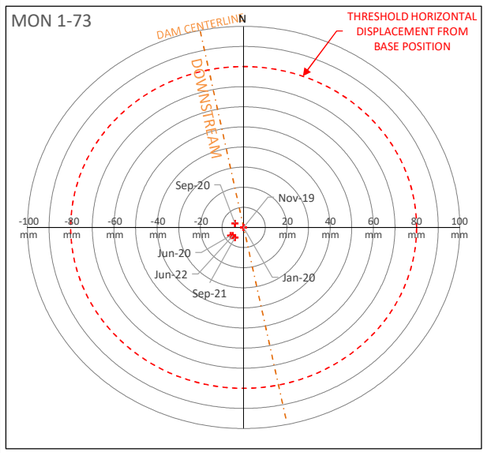
PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

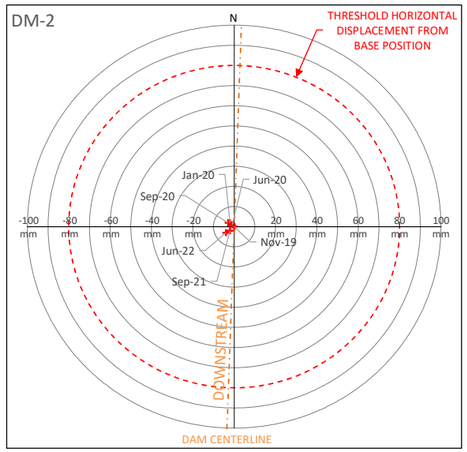
TITLE: DAM No. 1 PIEZOMETRIC DATA
YEARS 2013 TO 2022

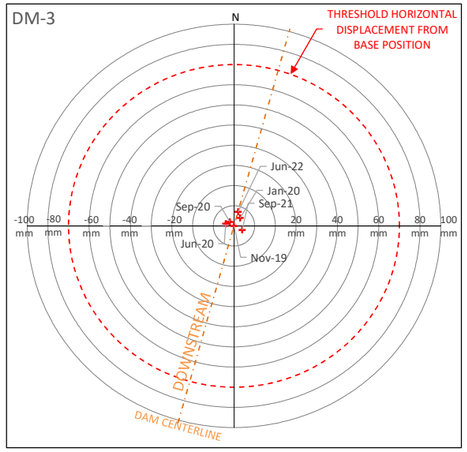
DOWNSTREAM SLOPE

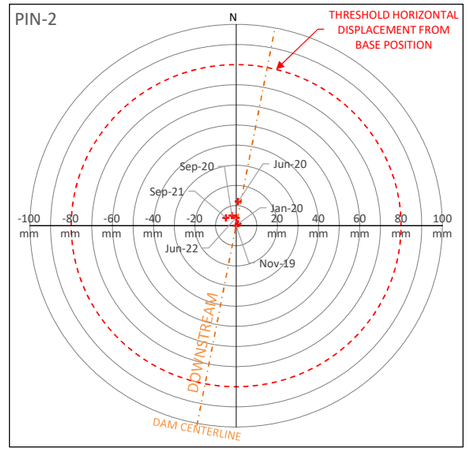
PROJECT No. M02341C42

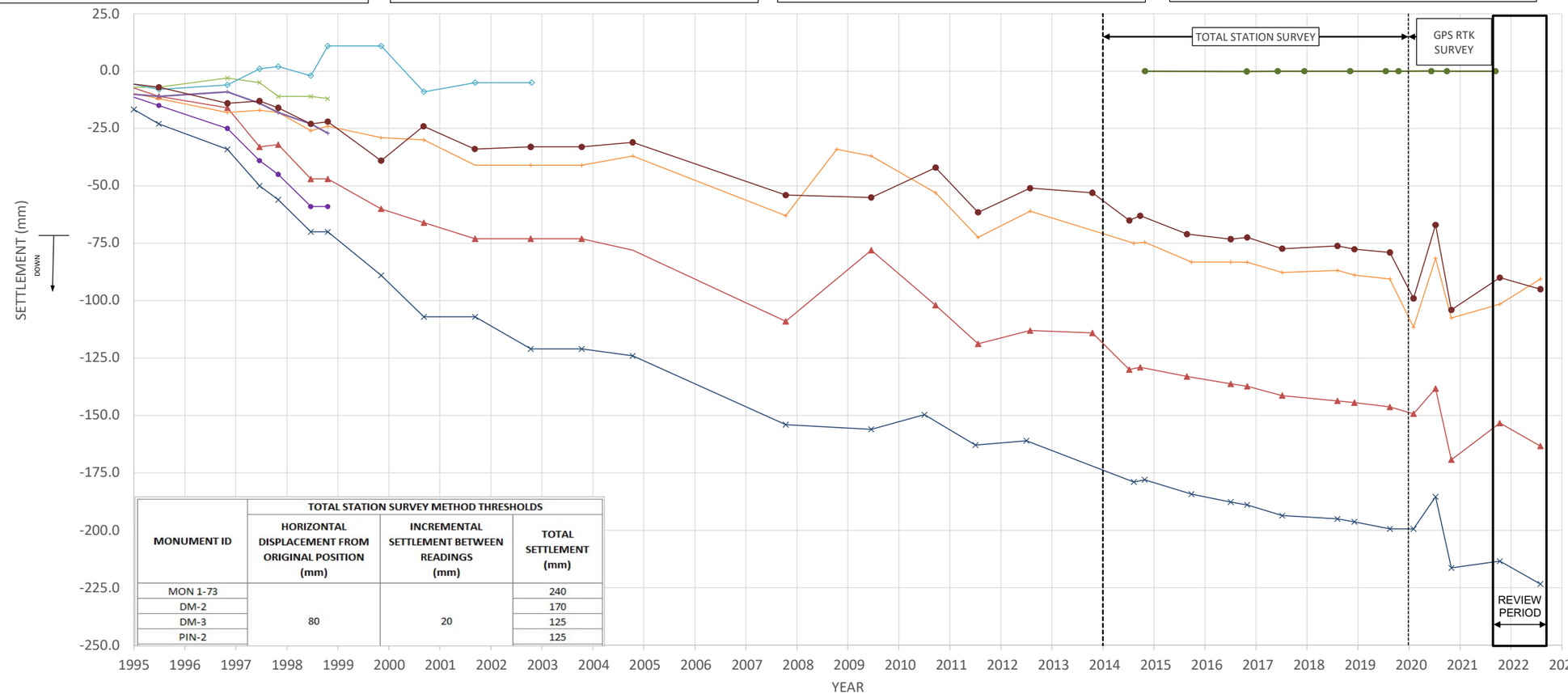
FIG No. 10











MONUMENT ID	TOTAL STATION SURVEY METHOD THRESHOLDS		
	HORIZONTAL DISPLACEMENT FROM ORIGINAL POSITION (mm)	INCREMENTAL SETTLEMENT BETWEEN READINGS (mm)	TOTAL SETTLEMENT (mm)
MON 1-73	80	20	240
DM-2			170
DM-3			125
PIN-2			125

LEGEND:

- DM-1
- DM-2
- DM-3
- DM-4
- DM-5
- DM-6
- MON. 1-73
- PIN-2
- Bethlehem Sinkhole

NOTES:

1. SURVEY METHOD SWITCHED FROM TOTAL STATION TO GPS RTK ON NOVEMBER 26, 2019.
2. HORIZONTAL DISPLACEMENT PRIOR TO NOVEMBER 2019 NOT SHOWN. HORIZONTAL DISPLACEMENT BASELINES SET TO NOVEMBER 26, 2019 GPS RTK SURVEY READINGS.
3. REFER TO FIGURE 3 FOR MONUMENT LOCATIONS IN PLAN VIEW.
4. 2021 SETTLEMENT PLOTTED BY ADDING INCREMENTAL DISPLACEMENT BETWEEN GPS RTK SURVEY READINGS TO CUMULATIVE TOTAL DISPLACEMENT ON JULY 16, 2019. THIS ASSUMES NO SETTLEMENT OCCURED BETWEEN JULY 16 AND NOVEMBER 26, 2019.
5. THE FINAL DATA POINT RECORDED FOR BETHLEHEM SINKHOLE IS 11 mm ON SEPTEMBER 11, 2021.

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

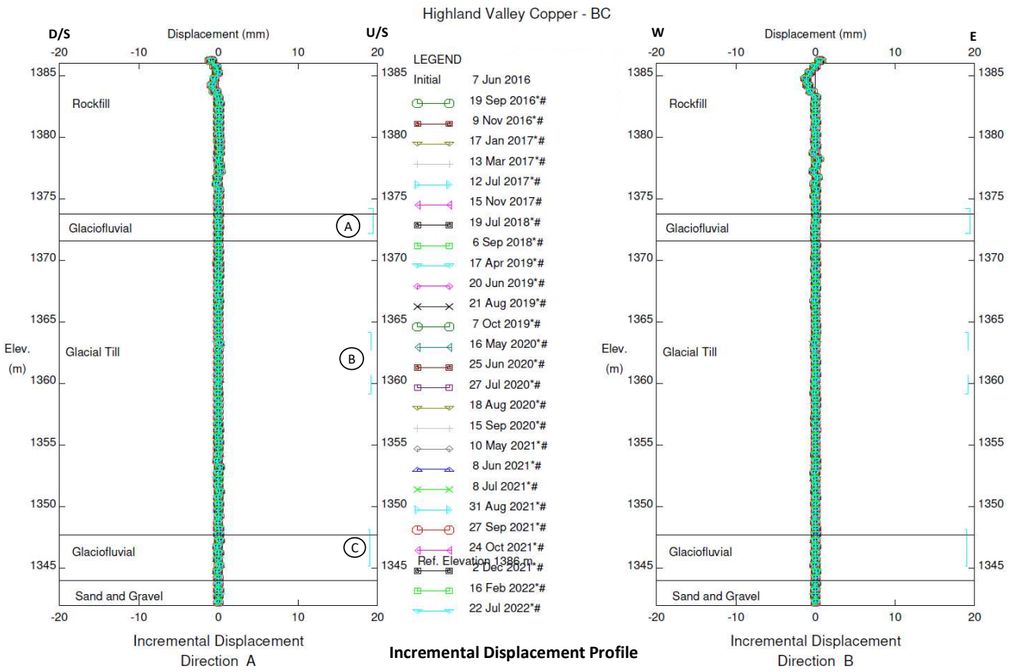
PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: DAM No. 1
SURVEY MONUMENT READINGS

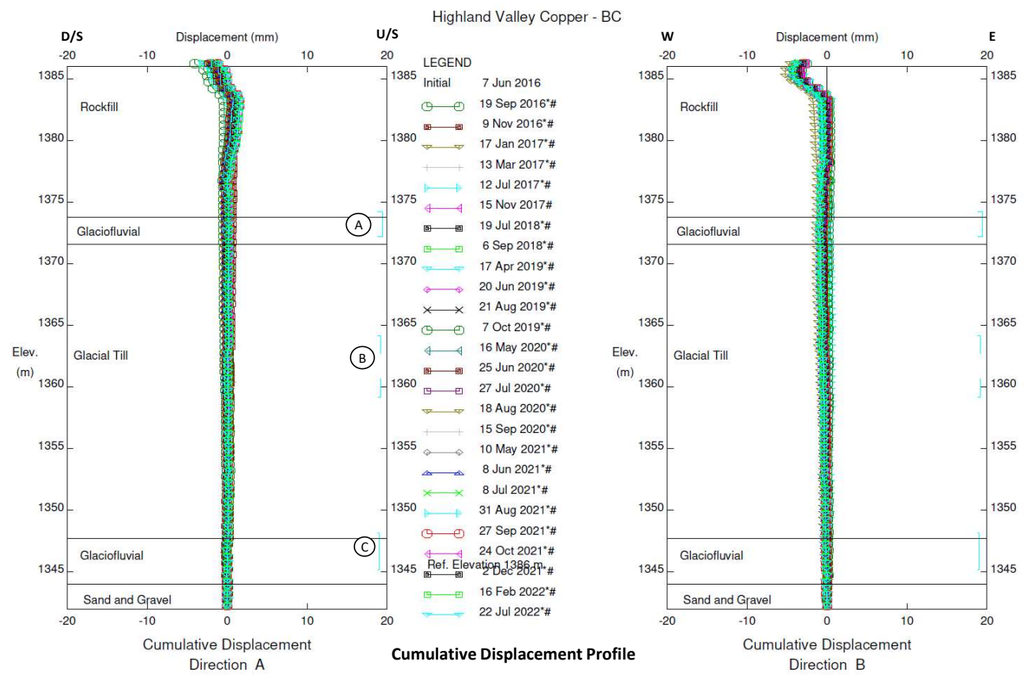
PROJECT No. M02341C42

FIG No. 11

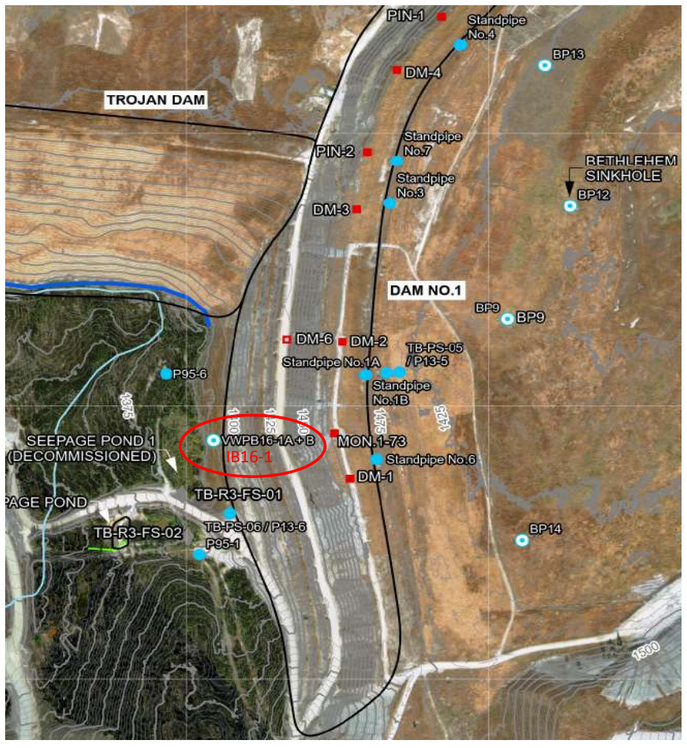
January 13, 2023
\\int.klohn.com\Proj\Data\MVCR\M02341C42\HVC-2022 AFPR\300 Design\340 Dam Movement Monitoring\343 Survey Monuments\Bethlehem\[220909 BethMain\DamMonitoring.xlsm]Fig 11



Incremental Displacement Profile

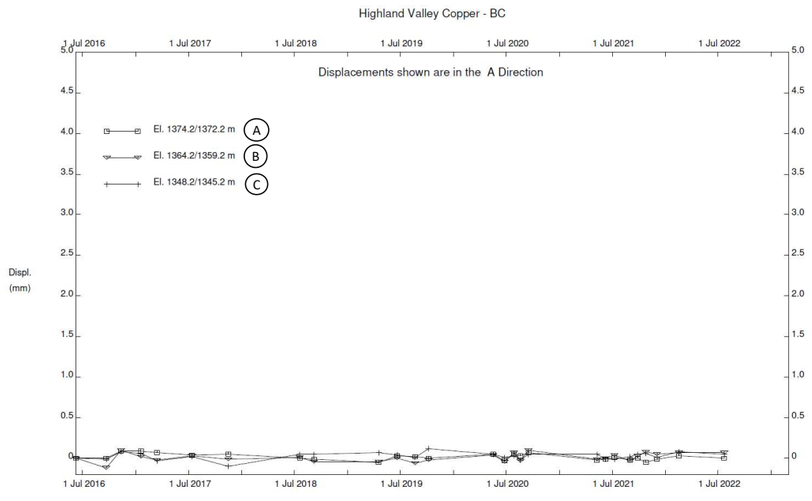


Cumulative Displacement Profile

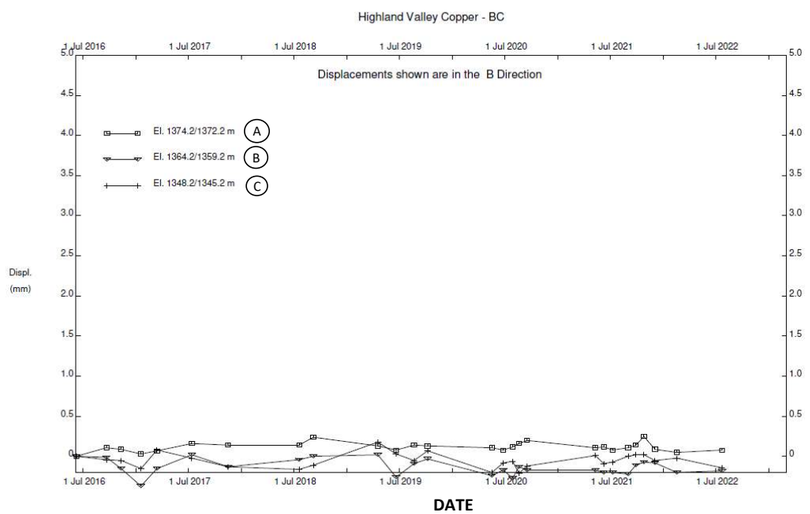


NOTES:

1) IB16-1 WAS INSTALLED ON APRIL 20, 2016.
2) IB16-1 WAS INITIALIZED ON JUNE 07, 2016.
3) REEL/PROBE SERIAL NUMBER FOR THE INITIAL READING: DR15020000/DP06580000.



CUMULATIVE DISPLACEMENT PROFILE VS. TIME IN THE "A" DIRECTION



CUMULATIVE DISPLACEMENT PROFILE VS. TIME IN THE "B" DIRECTION

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

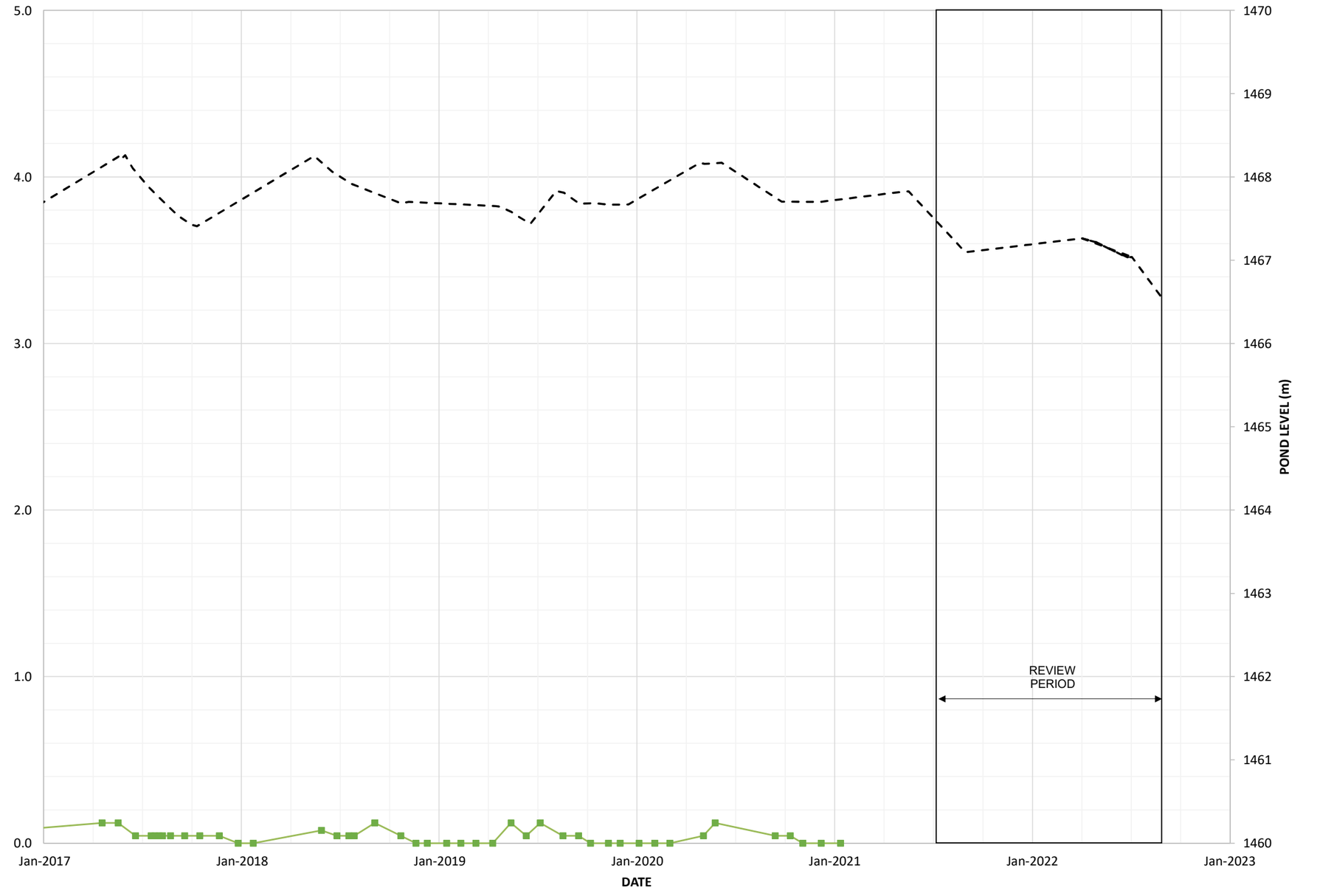
PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BETHLEHEM NO. 1 DAM
INCLINOMETER DISPLACEMENT PROFILE
IB16-1

PROJECT No. M02341C42

FIG No. 12

January 13, 2023
\\nt.klohn.com\ProjData\MV\CRM\02341C42-HVC-2022 AFPR\300 Design\340 Dam Movement Monitoring\341 Inclinometers, SAAVs, IPIs\[221003 Inclinometer plots (Beth and Troj).xlsx]Figure 12 Beth



LEGEND:

TB-R3-FS-01

BETHLEHEM No. 1 POND LEVEL

Note:
1. WEIR FLOW PLOTTED ON PRIMARY (LEFT) AXIS, BETHLEHEM POND ELEVATION PLOTTED ON SECONDARY (RIGHT) AXIS.
2. TB-R3-FS-01 DATA WAS NOT PROVIDED FOR THE 2022 REPORTING PERIOD.

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

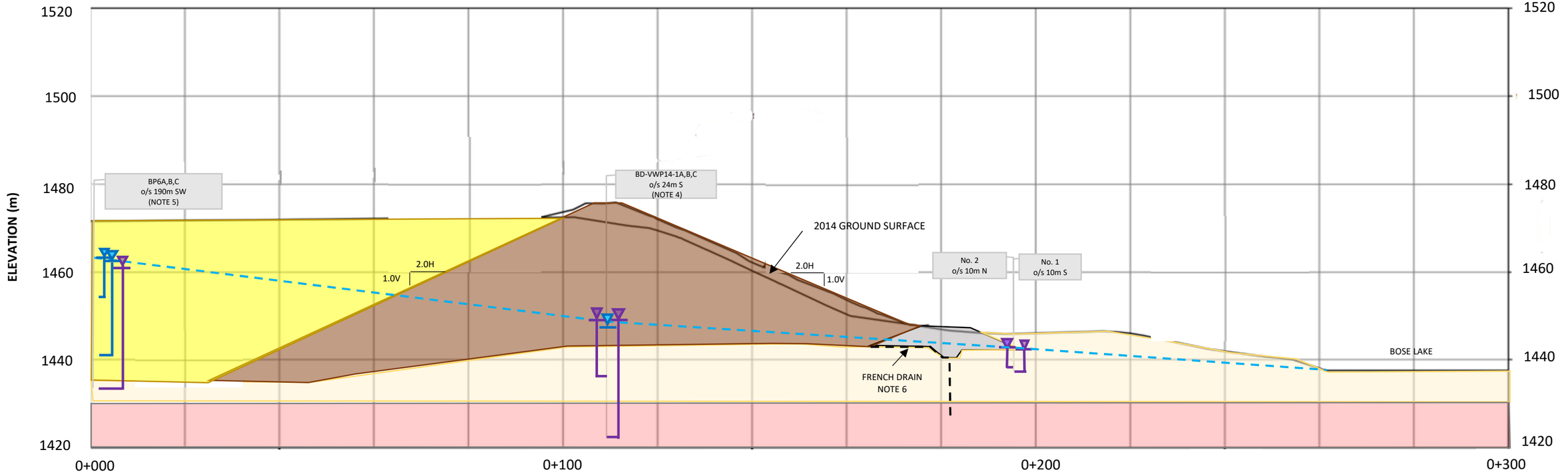
PROJECT: BETHLEHEM TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: DAM NO. 1
WEIR FLOWS

PROJECT No. M02341C42

FIG No. 13

January 27, 2023
\\int.klohn.com\Proj\Data\MIVCR\M02341C42-HVC-2022 AFPR\300 Design\350 Seepage Data\[Master Sheet_LEGACY.xlsx]Beth Fig 12



SECTION B (4) BOSE LAKE DAM

NOTES:

1. THE LOCATIONS OF THE INSTRUMENTS OFF THE SECTION ARE APPROXIMATE.
2. INTERNAL GEOMETRY OF THE BETHLEHEM EMBANKMENT WAS DELINIATED USING INFORMATION PRESENTED IN THE 2013 DSR (AMEC 2014).
3. OPERATIONAL PIEZOMETRIC LINES WERE DELINIATED FROM ANALYSES PRESENTED IN THE 2013 DSR (AMEC 2014).
4. VWP14-1A TIP LOCATED IN BEDROCK, AT EL. 1425.2m. VWP14-1B TIP LOCATED IN OVERBURDEN, AT EL. 1435.1m. VWP14-1C TIP LOCATED IN DAM FILL, AT EL. 1448.1m.
5. BP6A TIP LOCATED IN OVERBURDEN, AT EL. 1431.1m. BP6B TIP IS LOCATED IN TAILINGS, AT EL. 1441.8m. BP6C TIP LOCATED IN TAILINGS, AT EL. 1455.5m. THE INSTRUMENT IS LOCATED 190 m UPSTREAM OF THE CURRENT LOCATION THE SECTION IS SHOWING.
6. FRENCH DRAIN GOES THROUGH GLACIAL TILL DEPOSITS AND TERMINATES IN BEDROCK.

LEGEND

- TAILINGS
- GLACIAL TILL
- STARTER DAM ROCKFILL
- GLACIAL TILL OVERBURDEN
- GRANODIORITE BEDROCK
- WATER ELEVATION AT FOUNDATION PIEZOMETER (AUG. 2022)
- WATER ELEVATION AT TAILINGS (AUG. 2022)
- DRY PIEZOMETER / CPT
- INFERRED PIEZOMETRIC LINE - EXISITING

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

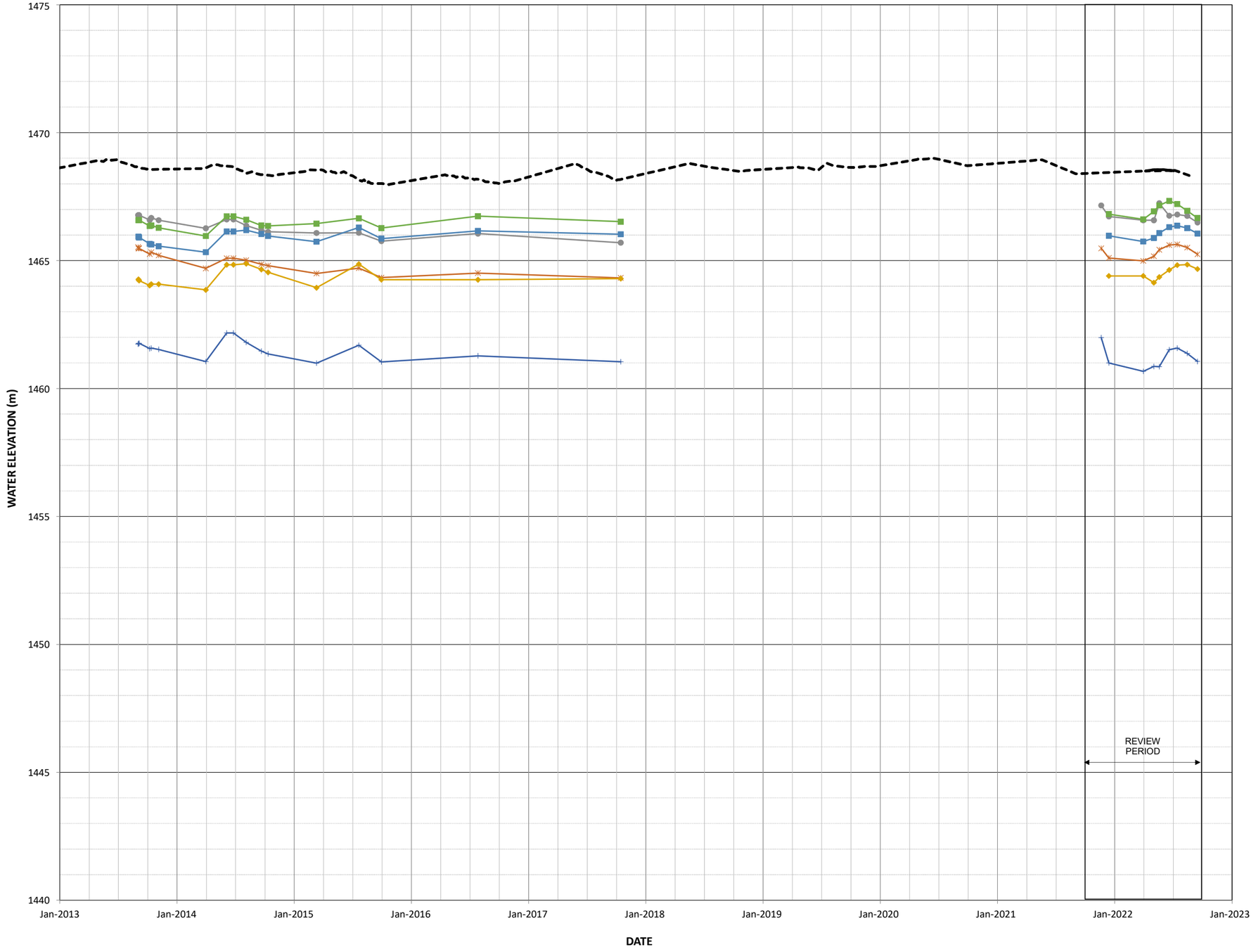
Klohn Crippen Berger

PROJECT: BETHLEHEM BOSE LAKE DAM
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BOSE LAKE DAM
TYPICAL SECTION B

SCALE	PROJECT No.	FIG. No.
NTS	M02341C42	14

FILE PATH: \\INT.KLOHN.COM\VPROJDATA\MV\CR\M02341C42-HVC-2022 AFPR\300 DESIGN\330 INSTRUMENTATION SECTIONS\BETH DAM SECTIONS\221213 BETHLEHEM SECTIONS.XLSX - 2023-01-13 15:37



LEGEND:

- BP6A (TIP El. 1431.1 m, GLACIAL TILL)
- BP6B (TIP El. 1441.8 m, TAILINGS)
- BP6C (TIP El. 1455.5 m, TAILINGS)
- BP7A (TIP El. 1439.6 m, GLACIAL TILL)
- BP7B (TIP El. 1448.7 m, TAILINGS)
- BP7C (TIP El. 1459.4 m, TAILINGS)
- BETHLEHEM NO.2 POND LEVEL

PIEZOMETER ID	2022 NOTIFICATION LEVEL THRESHOLDS VALUE (m)
BP6A	1462.8
BP6B	1466.0
BP6C	1467.3
BP7A	1469.1
BP7B	1469.1
BP7C	1468.3

NOTES:

1. NO READINGS WERE TAKEN IN 2019 or 2020.

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BOSE LAKE DAM PIEZOMETRIC DATA
YEARS 2013 TO 2022

IMPOUNDMENT

PROJECT No. M02341C42

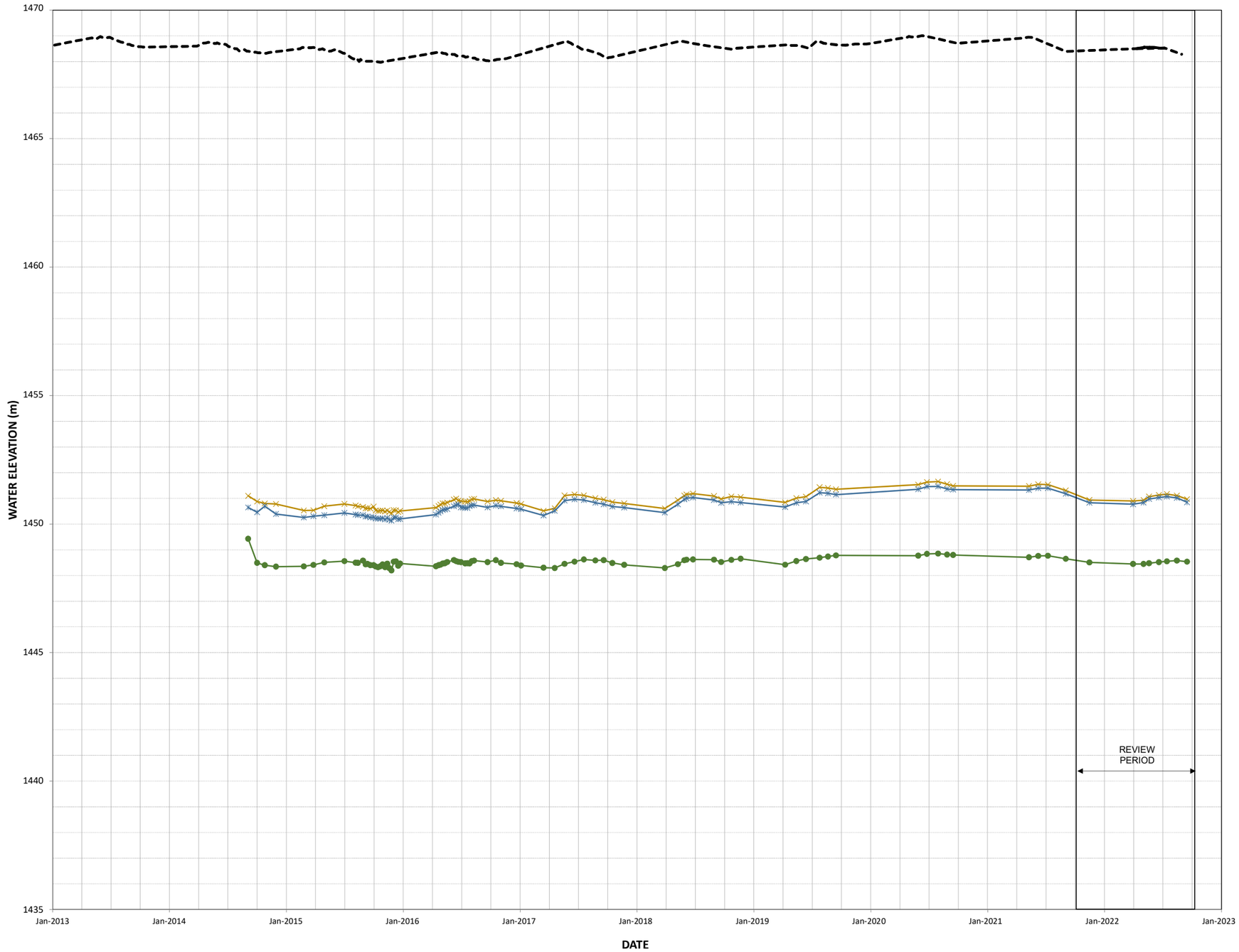
FIG No. 15

January 13, 2023
\\int.klohn.com\ProjData\MVCRM\02341\C42-HVC-2022 AFPR\300 Design\320 Piezometer Data\Bethlehem\Rev 1 - used HVC dip\[220928 Bethlehem Piezo.xlsx]Fig 9 No1 CREST

LEGEND:

- BD-VWP14-1A (TIP El. 1425.1 m, BEDROCK)
- BD-VWP14-1B (TIP El. 1435.1 m, OVERBURDEN)
- BD-VWP14-1C (TIP El. 1448.1 m, DAM FILL)
- BETHLEHEM NO.2 POND LEVEL

PIEZOMETER ID	2022 NOTIFICATION LEVEL THRESHOLDS VALUE (m)
BD-VWP14-1A	1452.0
BD-VWP14-1B	1451.8
BD-VWP14-1C	1449.9



NOTES:

1. PIEZOMETER WATER ELEVATIONS PLOTTED ON PRIMARY (LEFT) AXIS, POND ELEVATION PLOTTED ON SECONDARY (RIGHT) AXIS.
2. JUNE 25, 2020 WATER LEVELS ARE NOT MEASURED AND PLOTTED BECAUSE THE BAROMETRIC PRESSUER READINGS WERE NOT TAKEN.

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

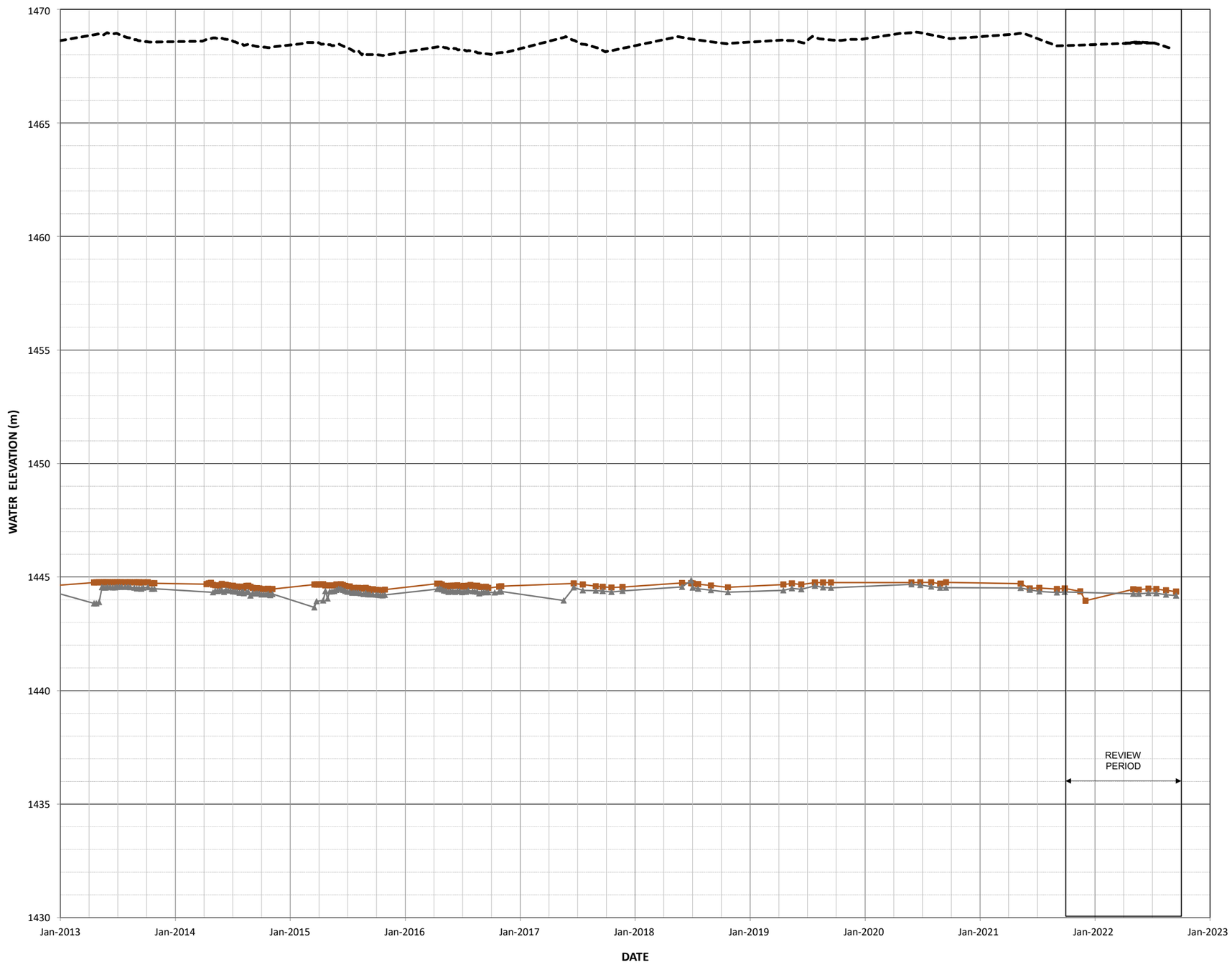
PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BOSE LAKE DAM PIEZOMETRIC DATA
YEARS 2013 TO 2022

CREST

PROJECT No. M02341C42

FIG No. 16



LEGEND:

- No. 1 (TIP El. 1433.0 m, OVERBURDEN / BEDROCK)
- No. 2 (TIP El. 1434.2 m, OVERBURDEN / BEDROCK)
- BETHLEHEM NO.2 POND LEVEL

PIEZOMETER ID	2022 NOTIFICATION LEVEL THRESHOLDS VALUE (m)
No. 1	1445.3
No. 2	1445.2

NOTES:

1. PIEZOMETER NO. 1 WAS REPORTED FROZEN ON NOVEMBER 15 2021, DECEMBER 2 2021, AND MARCH 31 2022.

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2022 ANNUAL FACILITY PERFORMANCE REPORT

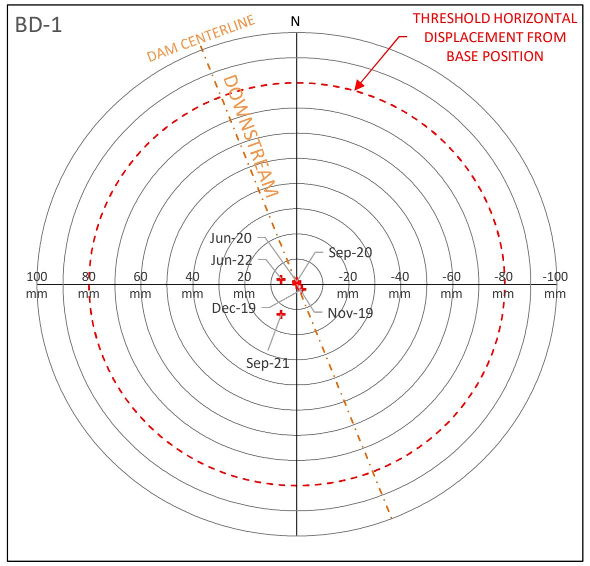
TITLE: BOSE LAKE DAM PIEZOMETRIC DATA
YEARS 2013 TO 2022

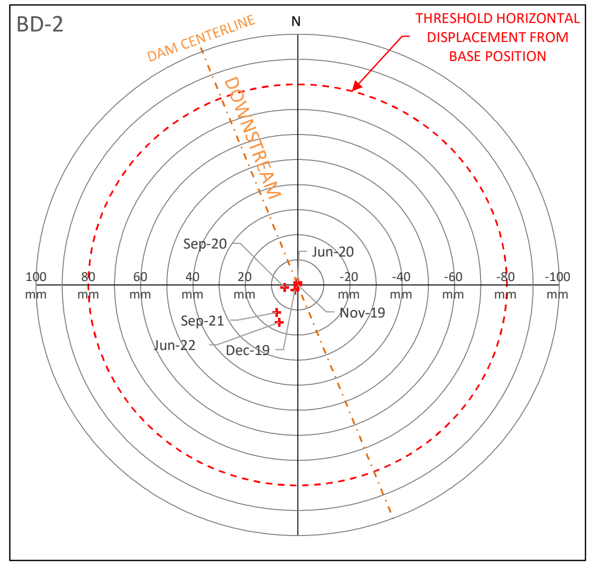
DOWNSTREAM TOE

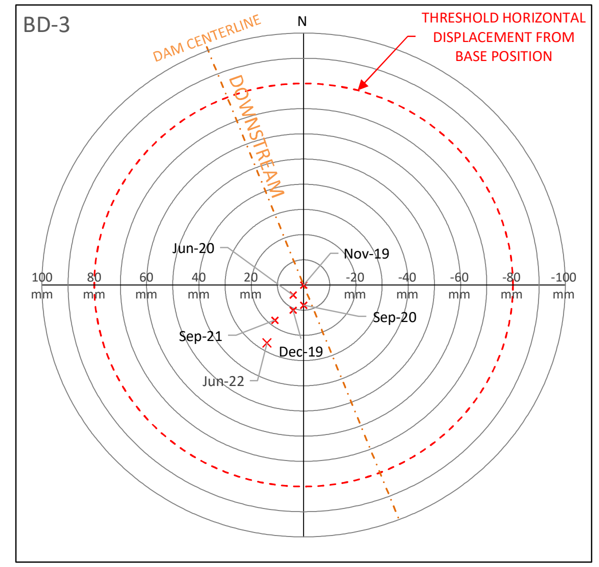
PROJECT No. M02341C42

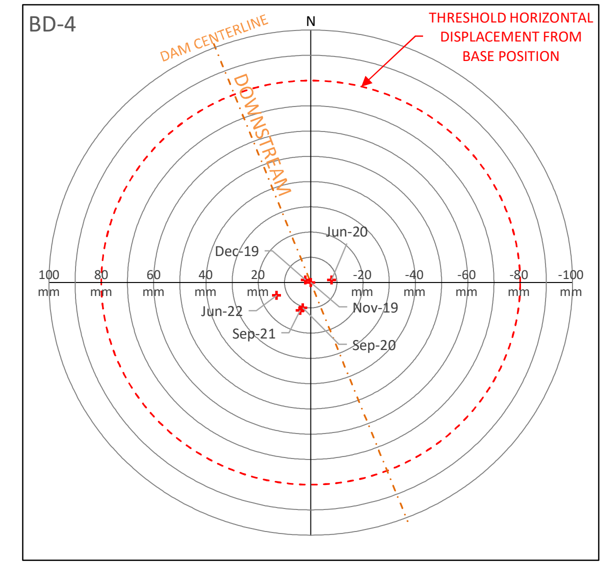
FIG No. 17

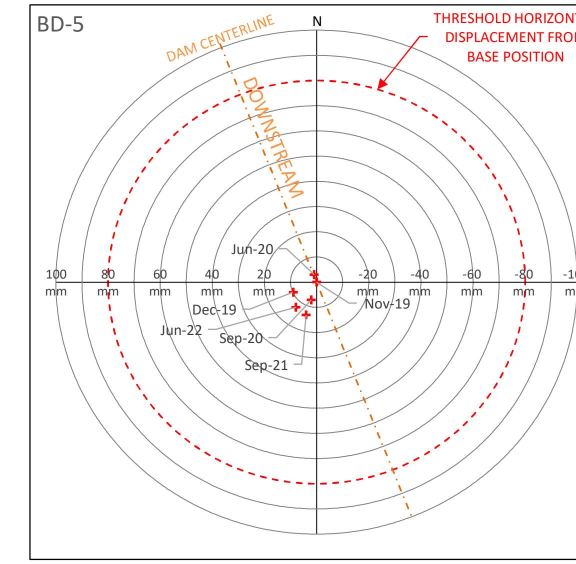
January 13, 2023
\\nt.kkhn.com\ProjData\MV\CRM\02341C42-HVC-2022 AFPR\300 Design\320 Piezometer Data\Bethlehem\Rev 1 - used HVC dip\[220928 Bethlehem Piezo.xlsx]Fig 9 No1 CREST

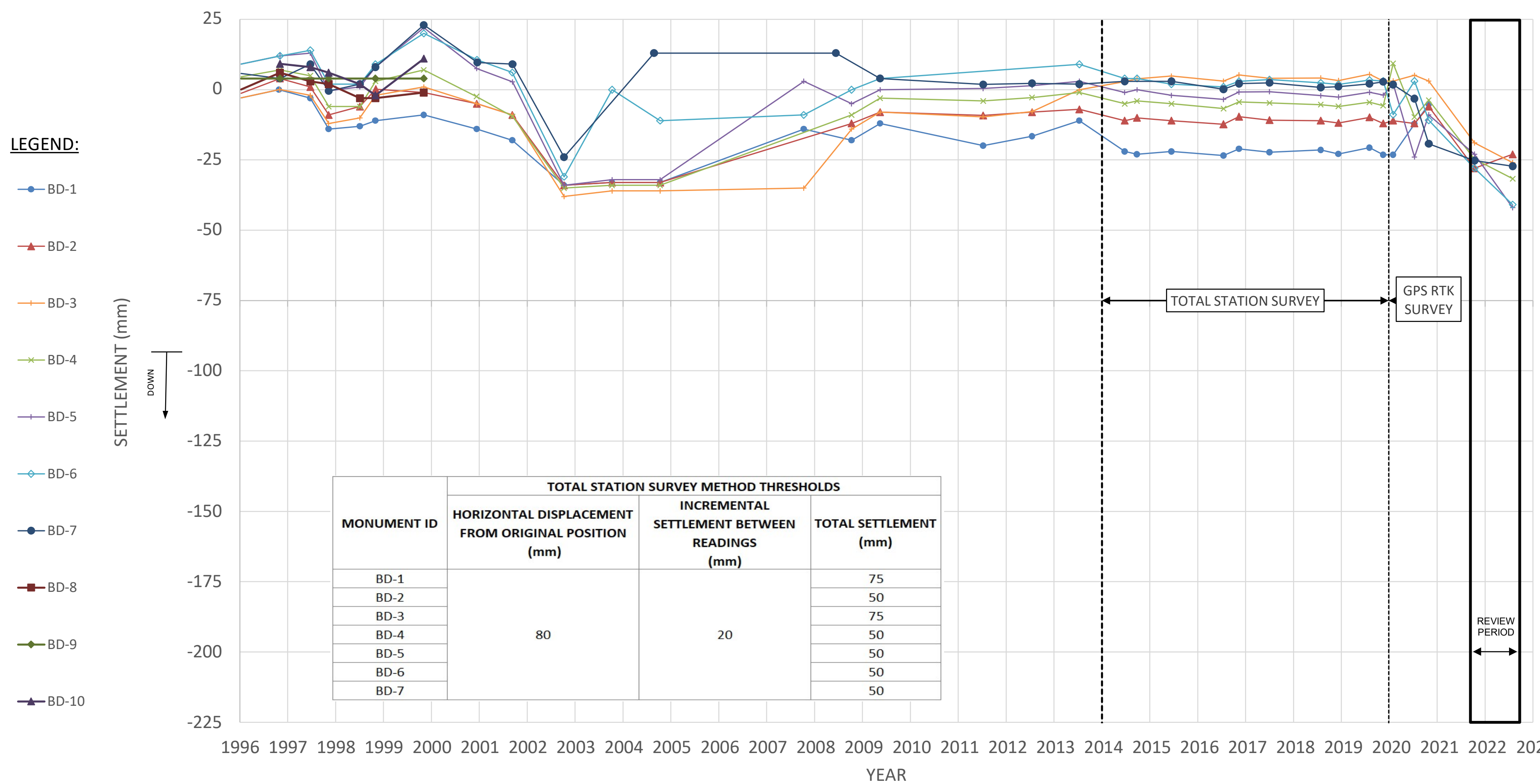




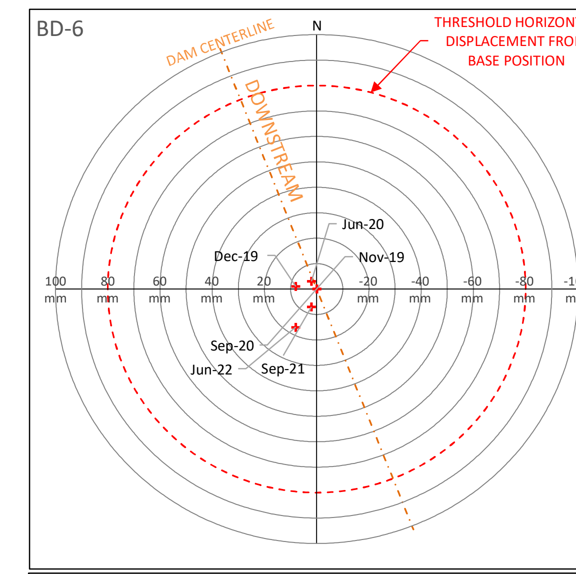


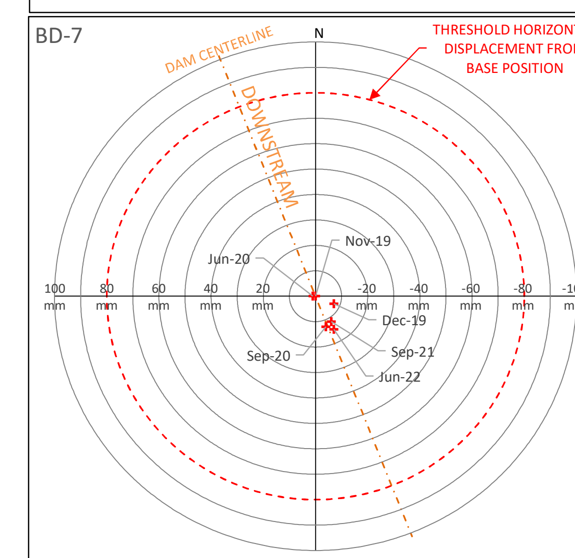






MONUMENT ID	TOTAL STATION SURVEY METHOD THRESHOLDS HORIZONTAL DISPLACEMENT FROM ORIGINAL POSITION (mm)	INCREMENTAL SETTLEMENT BETWEEN READINGS (mm)	TOTAL SETTLEMENT (mm)
BD-1			75
BD-2			50
BD-3			75
BD-4	80	20	50
BD-5			50
BD-6			50
BD-7			50





GENERAL NOTES:

1. SURVEY METHOD SWITCHED FROM TOTAL STATION TO GPS RTK ON NOVEMBER 12, 2019.
2. HORIZONTAL DISPLACEMENT PRIOR TO NOVEMBER 2019 NOT SHOWN. HORIZONTAL DISPLACEMENT BASELINES SET TO NOVEMBER 12, 2019 GPS RTK SURVEY READINGS.
3. REFER TO FIGURE 4 FOR MONUMENT LOCATIONS IN PLAN VIEW.
4. BD-8, BD-9 AND BD-10 DESTROYED IN 1999 OR 2000.
5. 2007 SETTLEMENT DATA OF BD-4, AND BD-2 WERE OUTLIERS AND NOT PLOTTED.

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED: MARCH 2023

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY 2022 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BOSE LAKE DAM SURVEY MONUMENT READINGS

PROJECT No. M02341C42

FIG No. 18

January 13, 2023
\\int.klohn.com\ProjData\M\VCR\M02341C42-HVC-2022 AFPR\300 Design\340 Dam Movement Monitoring\343 Survey Monuments\Bethlehem\[220908 BoseLakeDamMonitoring.xlsm]Fig 18

APPENDIX I

Annual Facility Performance Report

Site Visit Checklist, Observations, and Photographs

APPENDIX I-A

Dam No. 1

Site Visit Checklist, Observations, and Photographs

Appendix I-A
Site Visit Checklist, Observations and Photographs
Dam No. 1

SITE VISIT CHECKLIST

Facility:	Bethlehem Dam No. 1	**Site Visit Date:**	July 14, 2022
Weather:	Sunny	**Inspector(s):**	Rick Friedel, P.Eng. Cheryl Torres
Freeboard (pond level to dam crest):	8.96 m, based on the July 8th Pond survey		

Are the following components of the facility in ***SATISFACTORY CONDITION***?

EMBANKMENT	Yes/No
U/S Slope	☒ Yes ☐ No
Crest	☒ Yes ☐ No
D/S Slope	☒ Yes ☐ No
D/S Toe	☒ Yes ☐ No
Drains	☒ Yes ☐ No

Were any of the following ***POTENTIAL PROBLEM INDICATORS*** found?

INDICATOR	EMBANKMENT
Piping	☐ Yes ☒ No
Sinkholes	☐ Yes ☒ No (See Notes)
Seepage	☐ Yes ☒ No
External Erosion	☐ Yes ☒ No
Cracks	☐ Yes ☒ No (See Notes)
Settlement	☐ Yes ☒ No
Sloughing/Slides	☐ Yes ☒ No
Animal Activity	☐ Yes ☒ No
Excessive Growth	☐ Yes ☒ No
Excessive Debris	☐ Yes ☒ No

List and describe any deficiencies (all deficiencies require assessment and/or repair):

- No dam safety deficiencies observed.

SITE VISIT OBSERVATIONS

Crest and Tailings Beach

Good physical condition. There is a highpoint between the pond and the downstream slope which is upstream of the crest. The tailings beach is well vegetated. No observations of concern were noted (Photo I-A-1).

The sinkhole on the beach, more than 340 m upstream of the crest, remains similar to previous observations (Photo I-A-3). This feature first appeared in 1993 and was reviewed by the designers during operations in 1997 and concluded this is not a risk or concern for dam safety.

Left and Right Abutments

Good physical condition. The location of the left abutment is not visible due to the blending of dam fill and waste rock from a previously used waste dump. No signs of significant erosion, deterioration, or cracking at either abutment were observed.

Downstream Slope

The remediated erosion gullies are in good physical condition and not showing signs of ongoing erosion (Photo I-A-4 to Photo I-A-6). No significant change of the remediated or existing erosion features compared to 2021 AFPR site visit observations. Existing erosion features typically have vegetation growth along the base indicating the ongoing erosion rate, if any, is slow.

Cracking is present within the rockfill that was pushed over the downstream slope to fill the erosion gullies. Observations indicate that cracking is related to shallow localized sloughing of the rockfill slope and KCB believes that the cracks do not extend to the dam crest. In addition, cracks appeared to be partially filled, indicating no recent displacement.

Pond

No visual indicators of change or concern over tailings beach were observed. Although there is significant vegetation cover. In addition, there are no indications of a recent high-water event or encroachment of pond towards the crest were observed.

Seepage

No signs of unexpected seepage in addition to the flow from the underdrains which discharges to the R3 Seepage Pond.

SITE VISIT PHOTOGRAPHS

LEGEND:

- BTH = Bethlehem Tailings Facility.
- BTH-2022-## refers to 2022 AFPR waypoint shown on Figure 3.
- All photographs taken during site visit on July 14, 2022.

Photo I-A-1 Dam No. 1 cycloned beach and impoundment (central pond) (BTH-2022-01)

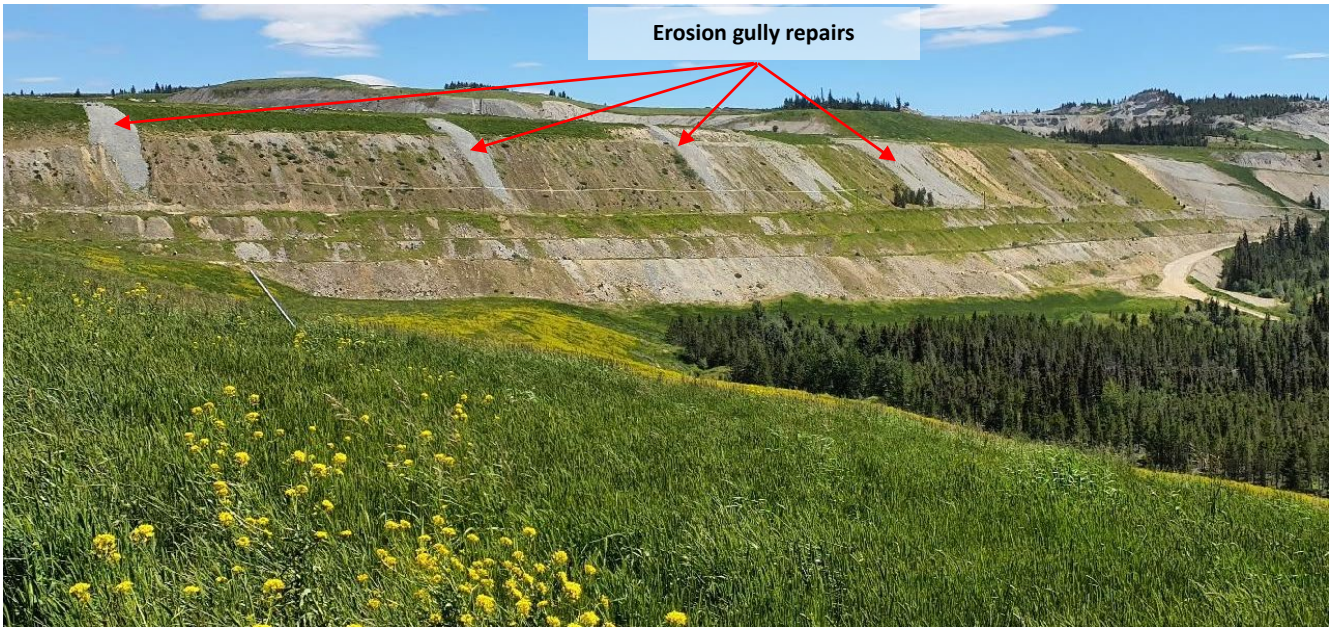
Photo I-A-2 Dam No. 1 west abutment road and transition from rockfill to elevated cyclone beach (BTH-2022-02)

Photo I-A-3 Bethlehem sinkhole on tailings beach, no visual change from 2021 AFPR visual observations (BTH-2022-03)

Photo I-A-4 Overview of downstream slope and toe area and of previously documented erosion area. Cracking remains filled, indicating area has been inactive (BTH-2022-04)

Photo I-A-5 Overview of downstream slope. No new erosion areas were observed (BTH-2022-05)

Photo I-A-6 Overview of downstream slope and toe from Trojan Dam. No new erosion areas were observed, and previous repairs are holding up well (BTH-2022-06)



APPENDIX I-B

Bose Lake Dam
Site Visit Checklist, Observations, and Photographs

Appendix I-B
Site Visit Checklist, Observations and Photographs
Bose Lake Dam

SITE VIST CHECKLIST

Facility:	Bose Lake Dam	**Site Visit Date:**	July 14, 2022
Weather:	Sunny	**Inspector(s):**	Rick Friedel, P.Eng. Cheryl Torres
Freeboard (pond level to dam crest):	6.62 m, based on the July 8th pond survey.		

Outlet Condition Survey

Description	Outlet Controls?	Was it flowing?	Flow rate
Spillway Channel	N/A	☐ Yes ☒ No	N/A

Are the following components of the facility in ***SATISFACTORY CONDITION***?

EMBANKMENT	Yes/No	SPILLWAY	Yes/No
U/S Slope	☒ Yes ☐ No	Debris Boom	☒ Yes ☐ No
Crest	☒ Yes ☐ No	Entrance	☒ Yes ☐ No
D/S Slope	☒ Yes ☐ No	Sill	☒ Yes ☐ No
D/S Toe	☒ Yes ☐ No	Road Culvert	☒ Yes ☐ No
Drains	☒ Yes ☐ No	Channel Invert	☒ Yes ☐ No
		Channel Slopes	☒ Yes ☐ No

Were any of the following ***POTENTIAL PROBLEM INDICATORS*** found?

INDICATOR	EMBANKMENT	SPILLWAY
Piping	☐ Yes ☒ No	☐ Yes ☒ No
Sinkholes	☐ Yes ☒ No	☐ Yes ☒ No
Seepage	☐ Yes ☒ No	☐ Yes ☒ No
External Erosion	☐ Yes ☒ No	☐ Yes ☒ No
Cracks	☐ Yes ☒ No	☐ Yes ☒ No
Settlement	☐ Yes ☒ No	☐ Yes ☒ No
Sloughing/Slides	☐ Yes ☒ No	☐ Yes ☒ No
Animal Activity	☒ Yes ☐ No (See Notes)	☐ Yes ☒ No
Excessive Growth	☐ Yes ☒ No	☐ Yes ☒ No
Excessive Debris	☐ Yes ☒ No	☐ Yes ☒ No

List and describe any deficiencies (all deficiencies require assessment and/or repair):

- No dam safety deficiencies observed.

SITE VIST OBSERVATIONS

Crest

Good physical condition. No indications of major lateral movement, depressions, or cracking (Photo I-B-1 and Photo I-B-2).

Left and Right Abutments

Good physical condition. An access road runs along the abutments which connects the crest and toe roads. No signs of seepage, excessive scour, or displacement were observed (Photo I-B-3).

Access road along the left abutment is steep and showing some signs of erosion scour. Travel up this slope could be difficult during high rainfall periods. This does not impact dam performance and is captured under routine maintenance. In the event of an emergency, the crest can be used to access left abutment and spillway.

Downstream Slope

Good physical condition. No signs of adverse displacement or cracking were observed. The majority of the slope is protected from erosion by coarse rockfill. The slope at the toe of the dam is vegetated (Photo I-B-4 and Photo I-B-5).

Animal burrows on the downstream slope of Bose Lake Dam (glacial till zone) in the area shown on Photo I-B-6 were visited. HVC and KCB reviewed the potential impact of burrows in this area on dam performance and concluded the animal burrows don't represent a concern as this area is above predicted flood levels.

Local sand piles on the downstream slope of the dam appear similar to previous observations. There were no signs of flow from the area. This area is well above nearest water level measurement. These sand piles are not interpreted as active seepage features or dam safety concerns.

Upstream Slope and Tailings Beach

Good physical condition. The beach immediately upstream of the dam is well vegetated. There were no visual issues of concern or indication of recent flooding observed (Photo I-B-7 and Photo I-B-8).

Pond

During the site visit, the pond appeared typical for the time of year. The water was observed to be approximately 40 m upstream of the crest within a localized depression on the tailings beach (Photo I-B-7).

Spillway Inlet

Good physical condition and consistent trapezoidal shape. Vegetation was observed throughout the channel (Photo I-B-9). No major obstructions or signs of deterioration were observed. The debris boom is secured in place with no observed signs of damage. Vegetation observed at the spillway inlet should be cleared as part of HVC routine monitoring and maintenance.

Spillway Channel and Outlet

Good physical condition. Initial segment of channel is vegetated with no or very modest grade (Photo I-B-10). As the channel crosses the dam centerline, the spillway channel transitions to a riprap lined trapezoidal channel which continues downslope parallel to the dam abutment. There were no visible signs of significant degradation of the riprap or blockage of the culverts that pass flow below the public road downstream of the dam toe (Photo I-B-10 and Photo I-B-11).

Seepage Collection System

The seepage relief wells were locked and could not be inspected. The outer casings showed no signs of damage.

Water could be heard flowing within the culverts. At the gauge-house, water was observed flowing out of the outflow pipe and into the riprap lined basin. No surface outflow from the basin was observed which indicates water could be lost through seepage and/or evaporation.

SITE VIST PHOTOGRAPHS

LEGEND:

- BTH = Bethlehem Tailings Facility.
- BTH-2022-## refers to 2022 AFPR waypoint shown on Figure 4.
- All photographs taken during the site visit on July 14, 2022.

Photo I-B-1 Overview of dam crest from right abutment (top photo) and from middle of the dam (bottom photo) (BTH-2022-07 and BTH-2022-08)

Photo I-B-2 Overview of dam crest and downstream slope from approximately the right abutment (BTH-2022-07)

Photo I-B-3 Left abutment with no observation of erosion scours or damage (BTH-2022-09)

Photo I-B-4 **View of downstream slope and toe area from crest looking downstream from approximately middle of dam crest (BTH-2022-08)**

Photo I-B-5 **View of downstream slope. Vegetation cover over lower portion of slope suggests this segment of downstream slope is comprised of glacial till fill. No sign of erosion of slope (rock or glacial till) was observed (BTH-2022-10)**

Photo I-B-6 Typical animal burrow observed in the upper glacial till raise. HVC and KCB reviewed potential impact of burrows in the area shown on the photo on the dam performance and concluded the burrows in this area don't represent a concern as this area is above flood levels (BTH-2022-09)

Photo I-B-7 Overview of Bethlehem No. 2 Tailings Pond and tailings beach (BTH-2022-08)

Photo I-B-8 Overview of upstream beach, looking towards right abutment. No sign of erosion or depression was observed (BTH-2022-08)

Photo I-B-9 Spillway inlet and approach channel. Channel is vegetated with grass and bushes. Clearing of vegetation is managed as part of routine maintenance (BTH-2022-11)

Photo I-B-10 Spillway channel at transition point between inlet and riprap-lined segment, looking towards north (BTH-2022-11)

Photo I-B-11 Riprap lined portion of spillway channel looking towards Bose Lake (BTH-2022-12)

APPENDIX I-C

R3 Seepage Pond Dam
Site Visit Checklist, Observations, and Photographs

Appendix I-C
Site Visit Checklist, Observations and Photographs
R3 Seepage Pond Dam

SITE VISIT CHECKLIST

Facility:	R3 Seepage Pond Dam	**Site Visit Date:**	July 14, 2022
Weather:	Sunny	**Inspector(s):**	Rick Friedel, P.Eng. Cheryl Torres
Freeboard (pond level to dam crest):	1.45 m, based on maximum water elevations on July 15th from Geo-explorer		

Outlet Condition Survey

Description	Outlet Controls?	Was it Flowing?	Flow rate	Visual Review?	Testing
Low Level Outlet (LLO)	No outlet control was seen	☒ Yes ☐ No	Not estimated	☒ Yes ☐ No	☐ Yes ☒ No
Spillway Channel	N/A	☐ Yes ☒ No	N/A	☒ Yes ☐ No	N/A

Are the following in ***SATISFACTORY CONDITION***?

DAM	Yes/No	LOW LEVEL OUTLET	Yes/No	SPILLWAY CHANNEL	Yes/No
U/S Slope	☒ Yes ☐ No	Outlet Pipe	Inlet visible (clear), pipeline buried.	Invert	☒ Yes ☐ No
Crest	☒ Yes ☐ No	Outlet Controls	☐ Yes ☒ No	Side Slopes	☒ Yes ☐ No
D/S Slope	☒ Yes ☐ No			Erosion Protection	☒ Yes ☐ No
D/S Toe	☒ Yes ☐ No				

Were ***POTENTIAL PROBLEM INDICATORS*** found?

INDICATOR	DAM	SPILLWAY CHANNEL
Piping	☐ Yes ☒ No	☐ Yes ☒ No
Sinkholes	☐ Yes ☒ No	☐ Yes ☒ No
Seepage	☐ Yes ☒ No	☐ Yes ☒ No
Erosion	☐ Yes ☒ No	☐ Yes ☒ No
Cracks	☐ Yes ☒ No	☐ Yes ☒ No
Settlement	☐ Yes ☒ No	☐ Yes ☒ No
Sloughing/Slides	☐ Yes ☒ No	☐ Yes ☒ No
Animal Activity	☐ Yes ☒ No	☐ Yes ☒ No
Excessive Growth	☒ Yes ☐ No	☐ Yes ☒ No
Excessive Debris	☐ Yes ☒ No	☐ Yes ☒ No

Deficiencies:

- No dam safety deficiencies observed.

SITE VISIT OBSERVATIONS

Crest

Good physical condition. No indication of adverse lateral movement, depressions or cracking was observed (Photo I-C-2).

Left and Right Abutment

Good physical condition. No signs of significant erosion, deterioration, or cracking were observed.

Downstream Slope

Good physical condition. No indication of adverse displacement was observed. There were no observation of erosion, deterioration, or seepage.

Upstream Slope

Heavy vegetation was observed on upstream slope during the AFPR site visit. HVC advised that the vegetation was cleared after site visit as part of routine maintenance after the site visit.

Pond

At the time of the site visit, the pond was less than 1 m below the spillway invert (Photo I-C-3).

Low-level Outlet

At the time of the site visit, the outlet pipe debris fence was partially obstructed with vegetation (Photo I-C-3). Following the site visit, after water level was drawn down, HVC reconfigured the inlet with a new grate and knife gate.

Spillway

Good physical condition. No visual signs of riprap degradation (Photo I-C-5 to Photo I-C-6). There was flow through the spillway during the review period, prior to site visit, as discussed in Section 3.2 of main report text. Discharge flows were well below peak design flows and no degradation of spillway observed.

At the time of the site visit, trees were present upstream, partially obstructing the spillway inlet (Photo I-C-4). HVC provided a photograph taken after the site visit showing that they had scrubbed the bushes along the spillway inlet as part of routine maintenance.

Seepage

None observed.

SITE VISIT PHOTOGRAPHS

LEGEND:

- BTH = Bethlehem Tailings Facility.
- BTH-2022-## refers to 2022 Annual Facility Performance Report waypoint shown on Figure 5.
- All photographs taken during the site visit on July 14, 2022.

Photo I-C-1 Overview of R3 Seepage Pond (BTH-2022-13)

Photo I-C-2 R3 Seepage Pond dam crest, no cracking or no sign of distress was observed (BTH-2022-13)

Photo I-C-3 View of R3 Seepage Pond and debris mesh for Low-Level Outlet (LLO). Clear water was flowing at the time of the site visit. The debris mesh is clogged below and above water (BTH-2022-14)

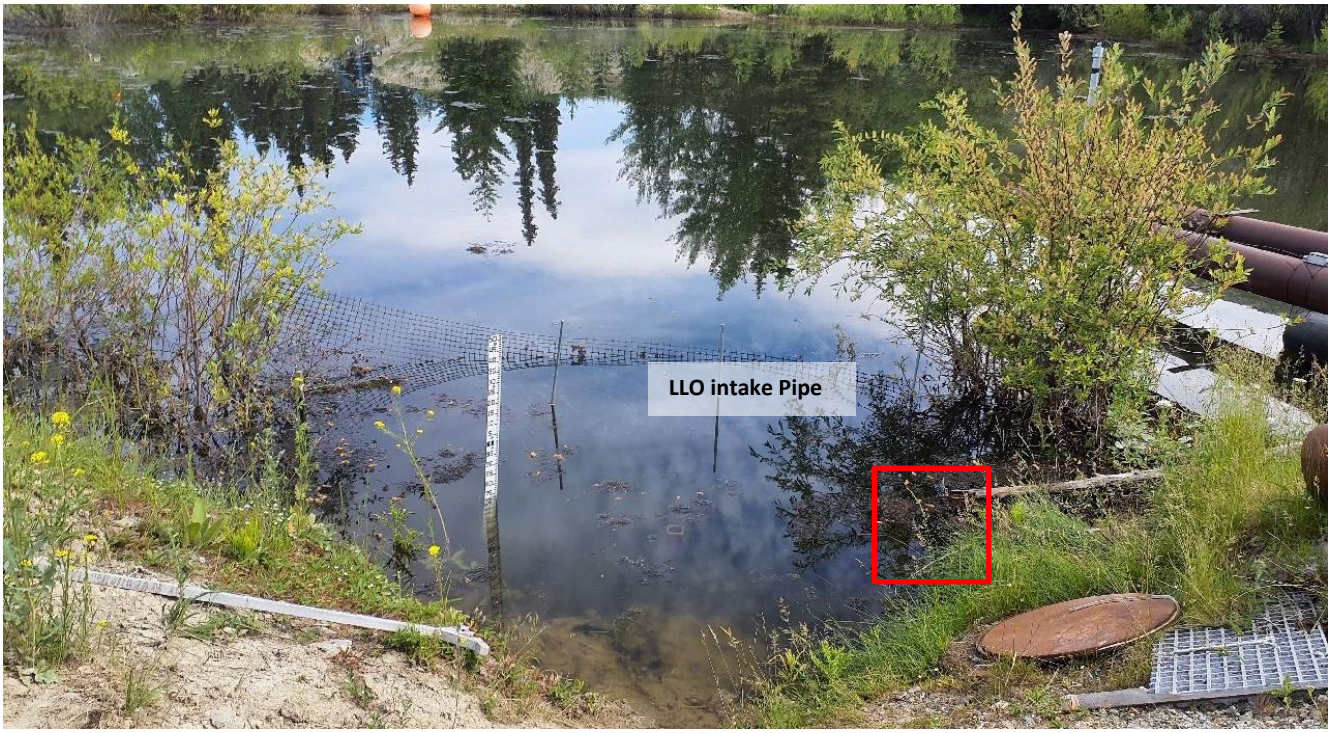


Photo I-C-4 View of spillway inlet, looking downstream. Discharge through spillway was related to LLO blockage, refer to discussion in main text of report (BTH-2022-15)

Photo I-C-5 Spillway channel and road crossing at right abutment, looking downstream (BTH-2022-15)

Photo I-C-6 Spillway channel at midpoint, looking downstream (BTH-2022-13)

Photo I-C-7 Segment of R3 Seepage Pond LLO pipe that backed up and resulted in spillway discharge, refer to discussion in main text (BTH-2022-16)