Klohn Crippen Berger

Teck Highland Valley Copper Partnership

2023 Annual Facility Performance Report

Bethlehem No.1 Tailings Storage Facility

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March 2024

March 27, 2024

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

Mr. Carl Diederichs, P.Eng.
Superintendent, Geotechnical

Dear Mr. Diederichs:

2023 Annual Facility Performance Report
Bethlehem No. 1 Tailings Storage Facility

We are pleased to submit the final Bethlehem No. 1 Tailings Storage Facility 2023 Annual Facility Performance Report. The review period for this document is from October 2022 through September 2023.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

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

RF/CT:cd

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Teck Highland Valley Copper Partnership

2023 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 2023 Annual Facility Performance Report (AFPR) for the Bethlehem No. 1 Tailings Storage Facility (Bethlehem TSF). The review period of this AFPR is from October 2022 through September 2023.

The Bethlehem TSF is located on the Highland Valley Copper Mine Site (HVC Mine Site) 4 km north of the operating Highland Mill. The Bethlehem TSF was operated (i.e., tailings were deposited into the facility) from 1964 to 1985 and stores an estimated 68 Mm^3 of tailings. After operations, the facility was subsequently reclaimed, is maintained by HVC, and is considered to be in the Closure – Active Care Phase, based on the Canadian Dam Association (CDA) definition[1].

The Bethlehem TSF Structures

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

- Dam No. 1 – comprises a compacted glacial till starter dam, which was raised using a modified centreline method with a rockfill downstream shell and tailings spigotted from the crest to form an upstream beach and ultimate crest level. A downstream rockfill toe buttress was constructed in the valley section.
- Bose Lake Dam – constructed primarily of compacted glacial till fill with some rockfill over the downstream slope and a rockfill toe that includes a filter blanket and seepage collection system. The dam crest was raised in four phases using the downstream method.
- R3 Seepage Pond – formed by a compacted glacial till dam, located downstream from Dam No. 1, it collects seepage 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 by approximately 3 m , relative to the end of operations. No significant dam safety incidents have been reported at the facility since the end of operations. 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 against internal erosion.

During the review period, Mr. Rick Friedel, P.Eng., was the Engineer of Record (EoR), as a representative of KCB. In April 2023, the TSF Qualified Person (QP) role transitioned from Mr. Bryan Bale, P.Eng. to Mr. Carl Diederichs, P.Eng. (Superintendent, Geotechnical). These roles are consistent with the definitions in the Health Safety and Reclamation Code for Mines in B.C. (HSRC)[2].

[1] CDA. 2019. "Technical Bulletin – Application of Dam Safety Guidelines to Mining Dams."
[2] EMLI. 2022. "Health, Safety and Reclamation Code for Mines in British Columbia, Revised." November.

Activity During the Review Period

During the review period, the Bethlehem TSF was maintained within the design basis and conditions assumed in the 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. HVC installed a temporary diesel pump and related infrastructure at the R3 Seepage Pond to address a recommendation from the 2022 AFPR and also replaced the debris boom to reduce debris build up on the outlets and to reduce the frequency of clearing.

Governance and Surveillance

The OMS Manual, including the Emergency Preparedness and Response Plan (EPRP), is suitable for the facility. A routine update to the OMS Manual was prepared and issued in March 2024. The 2022 version of the OMS Manual was current during the review period and is used as the reference document for this AFPR.

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.

HVC commissioned a Dam Safety Review (DSR) of the Bethlehem TSF during 2023, which meets the 5-year DSR frequency required under the HSRC. The DSR report was being finalized during the preparation of this report and is due for submission to the Ministry of Energy, Mines and Low Carbon Innovation (EMLI) prior to the end of March 2024. An action plan to address any recommendations will be prepared by HVC and the EoR, and reported in the next AFPR. The next DSR is scheduled to be initiated in 2028 (5-year frequency).

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 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 than typical levels but still below what would be required to indicate a performance concern.
- There are no continuous horizontal deformation trends, which is consistent with expected performance based on design and previous monitoring.

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

- Visual inspections by the HVC inspection team, the EoR, and others working in the area did not identify unacceptable behaviour at the dam.
- Pond levels and seasonal fluctuations were similar to historic trends. For the first time since 2010, Pond No. 1 (~600 m upstream of Dam No. 1) did not have ponded water at the start and at the end of the review period.
- The peak measured pond level was 6.4 m below the Bose Lake Dam crest and 0.7 m below the spillway invert, both of which are within expected conditions and exceed design requirements.

Design Basis and Failure Mode Reviews

The CDA Dam Safety Guidelines[4] provide a dam classification scheme based on the potential consequences of a hypothetical failure that can be used to provide guidance on the standard of care expected of dam owners and designers. The consequence classification is not related to the likelihood of a failure, but rather to the potential impact resulting from a failure if it did occur.

A “Very High” consequence category, based on the CDA classification scheme, has been assigned to the Bethlehem TSF. The R3 Seepage Pond has been assigned consequence categories of “Low.” There have been no material changes to the facilities, or to the upstream or downstream conditions during the review period that support a modification to the consequence category.

The spillway design flood and the earthquake design ground motion (EDGM) for each of the facilities meet or exceed the equivalent requirements under the HSRC and each dam meets the associated design criteria.

Potential failure modes and the risk assessment 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.

Recommendations

During the review period the two outstanding recommendations from previous AFPRs, both related to the R3 Seepage Pond, were closed (Table 1).

One new recommendation was identified (Table 2) to regrade the crest to prevent ongoing surface flow over the downstream slope. This does not represent an imminent dam safety concern at the facility but should be done to prevent ongoing erosion.

[4] CDA. 2013. “Dam Safety Guidelines 2007 (Revised 2013)”.

Table 1 Previous Recommendations Related to Facility Performance – Status Update

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 CLOSED*
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 CLOSED*

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.

Table 2 2023 AFPR Recommendations Related to Facility Performance

ID No.	Performance Area	Recommended Action	Priority(1)	Deadline (Status)
Dam No. 1				
BD1-2023-01	Maintenance	Regrade the area of the crest where runoff flowed over the downstream slope and establish a berm to prevent continued erosion where the scour originated.	3	Q3 2024

Notes: Refer to Table 1 notes.

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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 2023 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.

1 INTRODUCTION

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (HVC) to complete the 2023 Annual Facility Performance Report (AFPR) for the Bethlehem No. 1 Tailings Storage Facility (Bethlehem TSF). The review period of this AFPR is from October 2022 through September 2023.

The Bethlehem TSF is on the Highland Valley Copper Mine Site (HVC Mine Site); refer to Figure 1. Tailings from the now inactive Bethlehem Mine were discharged into the Bethlehem TSF from 1964 to 1985 and the facility has subsequently been 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. Rick Friedel, P.Eng., was the Engineer of Record (EoR), as a representative of KCB. In April 2023, the TSF Qualified Person (QP) role transitioned from Mr. Bryan Bale, P.Eng. to Mr. Carl Diederichs, P.Eng. (Superintendent, Geotechnical). These roles are consistent with the definitions in the Health, Safety and Reclamation Code for Mines in British Columbia (HSRC) (EMLI 2022).

The AFPR scope of work consisted of:

- a 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 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 and HVC representatives, including the EoR.

The Bethlehem Mine, including the Bethlehem TSF, was operated under Permit M11, 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 M11 Permit (EMPR 2019). The most recent version of the permit was issued in 2021 (EMLI 2021).

Water discharge quantity and quality from the Bethlehem TSF are regulated under Permit PE-376 (MECCS 2023). Other pertinent permits include water licences C131299 (BC 2014), and C114183 (BC 2002).

2 FACILITY DESCRIPTION

The HVC Mine Site is approximately 14 km west of Logan Lake in the British Columbia Interior. The Bethlehem TSF is 4 km north of the operating Highland Mill, immediately east of the Trojan TSF; refer to Figures 1 and 2. Bose Lake is a natural lake approximately 60 m downstream of the east end of the facility. The Bethlehem TSF was operated (i.e., tailings were deposited into the facility) from 1964 to 1985 and stores an estimated 68 Mm^3 of tailings (HVC 2022).

Tailings are retained in the Bethlehem TSF by two dams (Figure 3): Dam No. 1 at the western boundary, and Bose Lake Dam at the eastern boundary. The R3 Seepage Pond (Figure 4) is downstream of Dam No. 1. In 2014, HVC constructed and instrumented a test fill pad in the mid-portion of the south side of the impoundment to characterize the response of the tailings under load.

There are two ponds in the Bethlehem TSF that have formed in low points of the tailings surface: 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.

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 deposits up to 24 m thick overlying bedrock. In the base of the valley, the dam was constructed on organic and loose surface deposits, except for an area that was excavated to competent ground for slope stability.
- The dam was raised using a modified centreline method (Figure 2.1), with mine waste (i.e., rockfill) up to El. 1472 m. Tailings were spigotted from the crest to maintain a tailings beach between the rockfill and operational pond. A rockfill toe buttress was added to the Dam No. 1 design in 1970 (Golder Brawner 1970) and built in 1971. In 1981, Dam No. 1 was raised to El. 1476.9 m using cycloned sand spigotted from the crest.
- The design relies on a tailings beach, a minimum of 122 m (400 ft) wide, between water ponded in the impoundment and the dam rockfill. When water is ponded in Pond No. 1, under typical seasonal pond levels, the beach width is more than 600 m.
- Seepage from the toe of Dam No. 1 reports to the R3 Seepage Pond.

Bose Lake Dam

- The Bose Lake Dam was constructed in four phases (Figure 2.2 and Figure 2.3), the first phase 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.
- Seepage intercepted by the 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

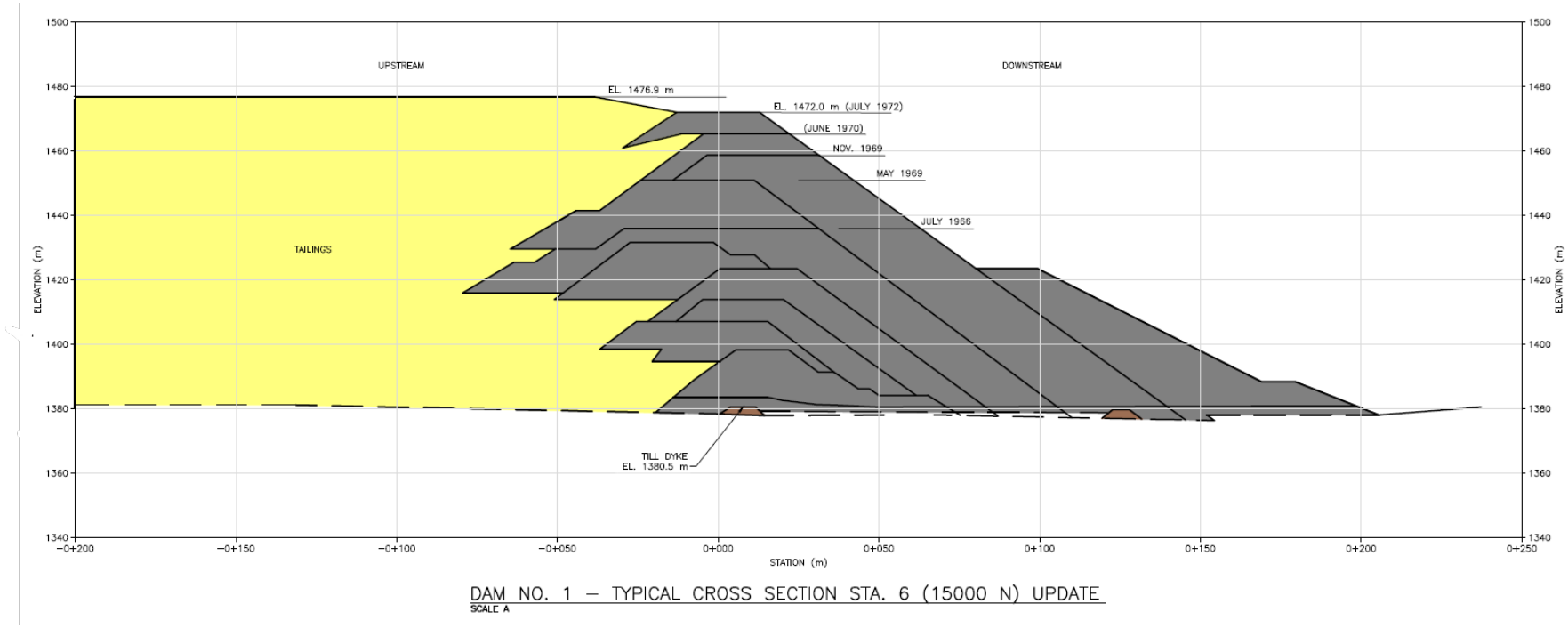
- The R3 Seepage Pond is approximately 150 m downstream of Dam No. 1. The reservoir is retained by a compacted fill dam along the west side. There are no construction or design records available for this dam (KCB 2021).
- Ponded water is discharged through a buried low-level outlet (LLO) at the left abutment. Flows report to the Lower Trojan Pond farther downstream or can be diverted directly to the Highland Mill.
- An open-channel spillway was constructed in 2013 (AMEC 2013) near the north abutment to pass flood events.

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)	1476.9 (top of tailings beach) 1472.0 (top of rockfill)	1475.0	1371.8[2]
Minimum Crest Width (m)	25.0	9.0	3.0
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 tailings beach crest) 2.2H:1V (from rockfill crest)	2H:1V	3H:1V (typical)
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 is taken as a reference for freeboard calculation as reported in KCB (2022). 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 (Replicated Section from KC 1996)



DAM NO. 1 – TYPICAL CROSS SECTION STA. 6 (15000 N) UPDATE
SCALE A

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

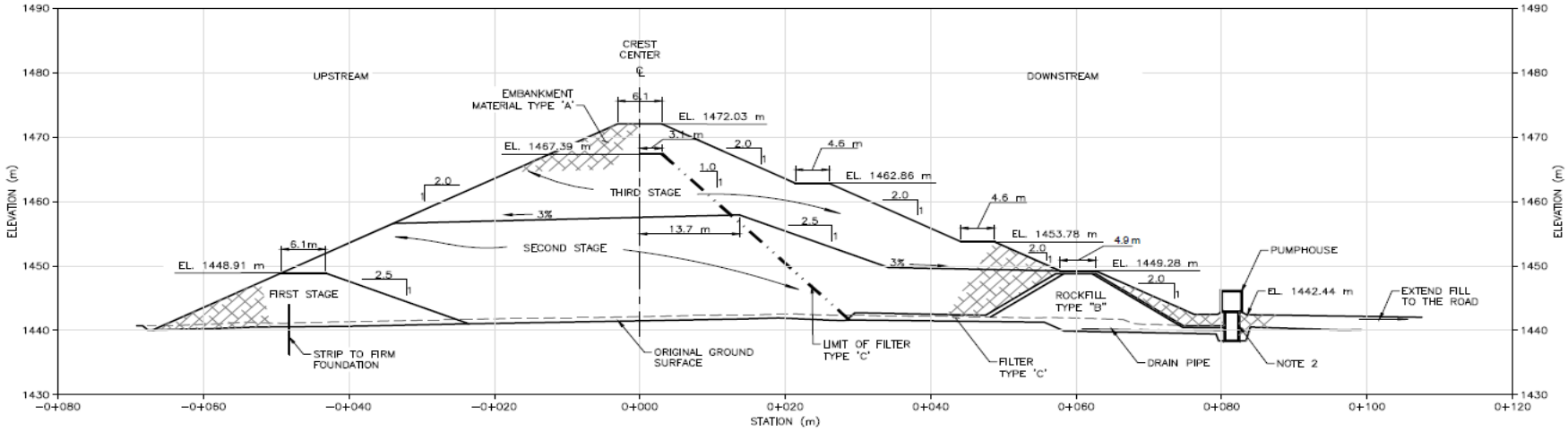
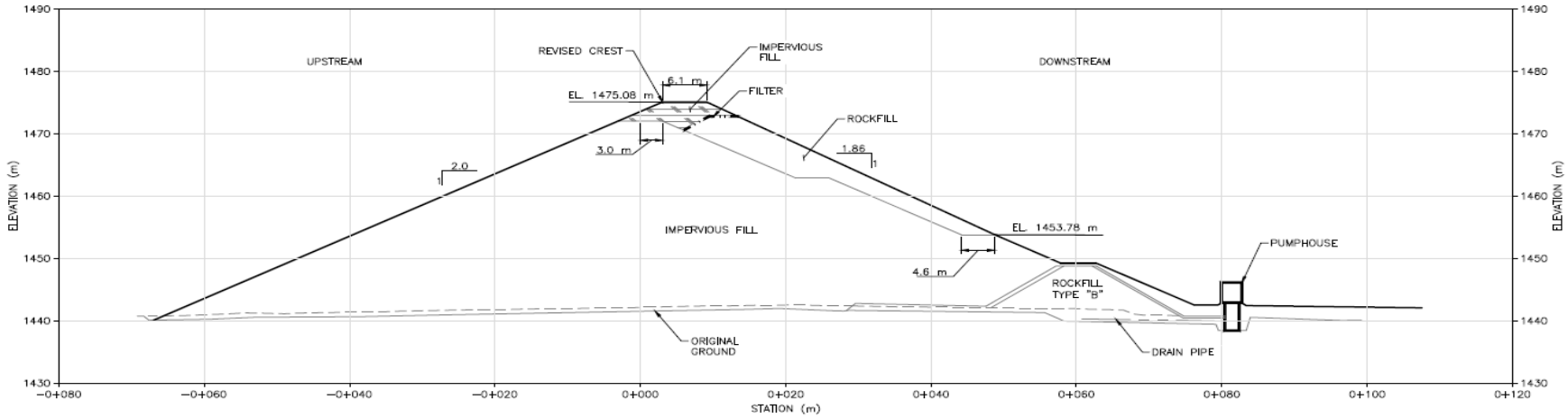


Figure 2.3 Typical Cross Section of the Bose Lake Dam – Construction Phase 4 (Replicated Section from Fellhauer 1980)



3 ACTIVITIES DURING THE REVIEW PERIOD

During the review period, the Bethlehem TSF was maintained within the design basis and conditions assumed in the design. There were no significant remedial or construction activities required or completed during the review period.

Routine maintenance activities were carried out as defined in the OMS Manual (HVC 2022), including clearing vegetation from the spillway channels; this is discussed further in Section 6.

HVC installed a temporary diesel pump and related infrastructure at R3 Seepage Pond to address the recommendation from the 2022 AFPR (KCB 2023), refer to Table 8.1, and also replaced the debris boom to reduce debris build up on the outlets and to reduce the frequency of clearing.

4 WATER MANAGEMENT

4.1 Overview

The flow schematic for the Bethlehem TSF and the nearby Trojan TSF is shown in Figure 5.

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. The Bethlehem TSF water balance is passive (i.e., no active management by HVC).

4.2 Climate

HVC provided climate data from the Shula Weather Station[5] for the review period (October 2022 to September 2023) to KCB. The station is in the base of the Witches Brook drainage, approximately 2.5 km south of the Bethlehem TSF at El. 1208 m.

Climate reviews for the Bethlehem TSF in recent AFPRs have been made based on data from the L-L Weather Station near the Highland TSF. However, the Shula Weather Station was upgraded in March 2022 with new equipment (e.g., sensors, modem, power supplies) and is now used as the reference station for the Bethlehem TSF climate review. The Historical Average Lornex Synthetic Record data (Golder 2021) was used for comparison to average climate trends at the HVC Mine Site. The climate data for the review period from the Kamloops Pratt Road Weather Station (Environment and Climate Change Canada station 116C8P0), approximately 60 km NE of the Shula Station at El. 729 m, was used for a comparison to regional trends.

Table 4.1 summarizes the monthly precipitation during the review period for the referenced climate stations and data sets. The Historical Average Lornex Synthetic Record data, and the Shula Weather Station data, have been adjusted based on the appropriate Bethlehem-Trojan Area temperature and precipitation adjustment factors provided in the site-wide Surface Water Quantity Existing Conditions report (Golder 2021). The monthly precipitation record for the reporting period is shown in Figure 4.1. Overall observations regarding precipitation trends at the Bethlehem TSF during the review period are as follows:

- Precipitation followed a monthly precipitation pattern similar to the Lornex historical averages and Kamloops Pratt Road weather station, but annual precipitation was 9% below the historical average.
- Precipitation at the site was 50% or less of the historical average value during October, January, March and April. November, February and June recorded precipitation more than 15% above the historical average. This precipitation trend is consistent with values measured at the Kamloops Pratt Road weather station as well.

[5] The data provided was raw data, and HVC have advised that the routine quality assurance/quality control review has not been completed at the time of this assessment.

Observations related to high-precipitation storm events based on the Shula Weather Station data for the review period are as follows:

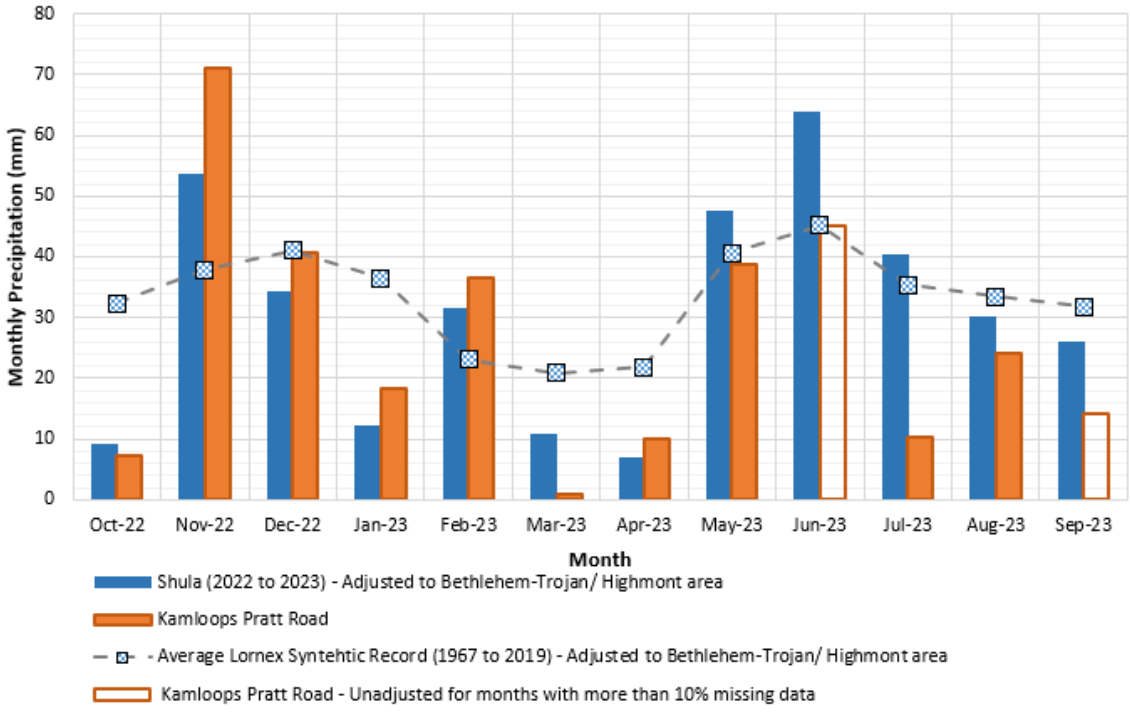
- No rainfall events were recorded during the review period greater than the 10-year return period annual rainfall event: 40 mm in 24 hours (Golder 2021).
- The three largest recorded precipitation events occurred on June 19, 2023 (20.0 mm); July 12, 2023 (23.4 mm); and August 31, 2023 (21.6 mm):
  - A simultaneous flow increase was observed in the flow data from Guichon Creek above Tunkwa Lake Diversion flow station (ID: 08LG056) following the largest precipitation event on July 12th. The flow station is approximately 15 km north-west of the Shula Weather Station.

Table 4.1 Monthly Precipitation for the Review Period (October 2022 to September 2023)

Month	Availability of Data (%)		Precipitation (mm)		
	Shula Weather Station	Kamloops Pratt Road Weather Station	Shula Weather Station Data (Corrected)(1)	Historical Average Lornex Synthetic Record (Corrected)(1)	Kamloops Pratt Road Weather Station
Oct 2022	100	100	9	32	7
Nov 2022	100	100	53	38	71
Dec 2022	100	100	34	41	41
Jan 2023	100	100	12	37	18
Feb 2023	100	93	32	23	37
Mar 2023	100	100	11	21	1
Apr 2023	100	100	7	22	10
May 2023	100	94	47	41	39
Jun 2023	100	80	64	45	45
Jul 2023	100	100	40	35	10
Aug 2023	100	100	30	33	24
Sep 2023	100	63	26	32	14
Review Period Total	–	–	365	400	318

Notes:
1. Monthly precipitation recorded at the Shula Weather Station and Historical Average Lornex Synthetic Record were corrected based on adjustment factors to the Trojan TSF provided in Golder (2021).

Figure 4.1 Monthly Precipitation Summary: October 2022 to May 2023



Seasonal snowpack depth is not measured at the Shula Weather Station. Instead, HVC monitors snowpack with monthly measurements at the Highland Valley Snow Survey Station (Station No. 1C09A). Table 4.2 summarizes historical snowpack averages and the snowpack measurements during the review period in snow-water equivalent (SWE). Snowpack measurements, in SWE, are also plotted on Figure 4.2, in SWE, along with temperature data from the Shula Weather Station. Based on this information, KCB notes the following:

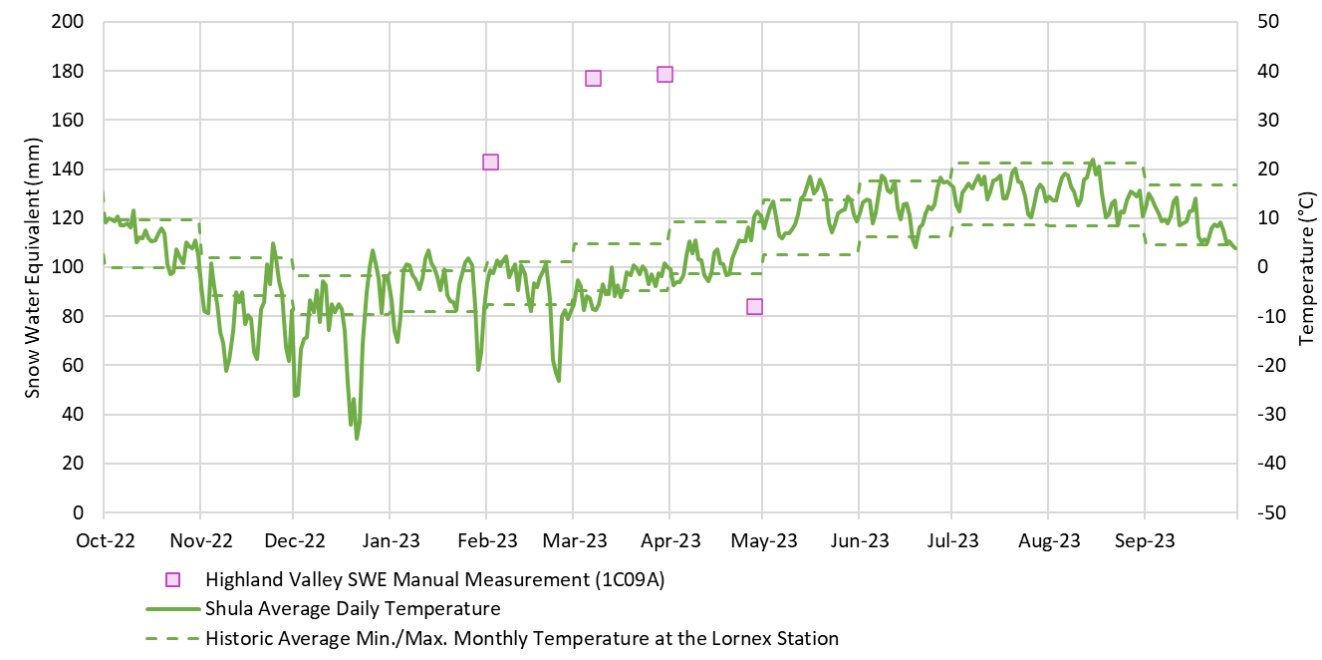
- The daily temperatures recorded at the Shula Weather Station between October 2022 and September 2023 are generally within the historic climate normals from Lornex Climate Station (1981 to 2010); however, there are some colder than average periods (of short-duration) recorded from November to March.
- All snowpack measurements were above historic climate normals, with the maximum measured snowpack over the review period (179 mm) approximately equivalent to a 10-year return period snowpack (169 mm) as reported by Golder (2020).
- Snowmelt began in April and continued into June. This is consistent with the snowmelt trends presented in the Spring Extreme Events and Wind Analysis report (Golder 2020) and coincides with measured temperatures that did not rise consistently above freezing until early April.
- Consistent with previous site observations, temperature, not precipitation, is the primary factor that drove snowmelt during the review period. Snowmelt began in April when precipitation was only 32% of the historic average.

Table 4.2 Historical Snowpack Averages and 2023 Snowpack Depths (mm SWE)

Survey Period	Years of Record[1]	Historic Average Snowpack Depth (mm SWE)	2023 Snowpack Depth[2] (mm SWE)	Percent Change Relative to Historic Average
January 1st	11	50	Not Surveyed	N/A
February 1st	33	83	143	+72%
March 1st	62	94	177	+87%
April 1st	60	102	179	+75%
May 1st	60	29	84	+187%
May 15th	25	2	Not Surveyed	N/A
June 1st	8	0	Not Surveyed	N/A

Notes:
1. Data prior to 1966 were not included as the station was moved to its current location in 1965.
2. Measured at the Highland Valley Snow Survey Station (1C09A) near the Bethlehem TSF.

Figure 4.2 Measured Temperature and Snowpack: October 2022 to May 2023



Notes:
1. Measured at the Highland Valley Snow Survey Station (1C09A) near the Bethlehem TSF.
2. Daily average temperature data at the Shula Weather Station provided by HVC.
3. The historic Lornex Climate Station minimum and monthly temperature averages from 1981 to 2010 are from ECCC Climate Normals (2023) and are presented as representative of the Shula Weather Station area.

4.3 Water Balance

Under existing conditions, the water balance is entirely driven by climate (Section 4.2). The only outflows are evaporation and seepage. Monitoring records since the facility was reclaimed show that Pond No. 1 and Pond No. 2 levels typically drop on a year-to-year basis, except during years with above average freshet when pond levels rise and then progressively drain over time. Between 2000 and 2010, both Pond No. 1 and Pond No. 2 were reported to be fully drained or store water seasonally. For the first time since 2010, Pond No. 1 fully drained during the review period.

These observations suggest that under normal climate conditions the Bethlehem TSF has a negative water balance (i.e., outflows are greater than inflows).

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 4.3. Flood routing analyses for both facilities were updated (KCB 2022) based on the most recent site-wide hydrology (Golder 2021). The analysis (KCB 2022) concluded the following:

- The Bethlehem TSF spillway can route the adopted design event, Probable Maximum Flood (PMF), which is greater than the IDF (Table 4.3) required under the HSRC (EMLI 2022). At the 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 4.3) required under the HSRC (EMLI 2022).

Table 4.3 Inflow Design Flood Requirements for the Bethlehem TSF

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

Notes:
1. The IDF events meet the requirements under the HSRC (EMLI 2022) 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 reviewed by the TSF QP and the EoR during the review period and an updated version was issued in 2024. The 2022 version of the OMS Manual was current during the review period and is used as the reference document for this AFPR. The changes with the 2024 update were typical for a routine OMS Manual update (e.g., updating emergency contact information and minor modifications to the surveillance program agreed upon with the EoR) and include adding the outlet pipe inspection frequency that will close the outstanding AFPR recommendation (Table 8.1).

The Bethlehem TSF surveillance program, described in the OMS Manual (HVC 2022), is appropriate for an inactive, reclaimed TSF 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 as it is collected during routine weekly meetings by the HVC site team, 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 the surveillance requirements in the OMS Manual (HVC 2022) were met during the review period.

HVC commissioned a Dam Safety Review (DSR) in 2023 in accordance with the frequency (every five years) specified in the OMS Manual (HVC 2022) and required under the HSRC (EMLI 2022). The DSR is scheduled to be submitted to the Ministry of Energy, Mines and Low Carbon Innovation (EMLI) prior to March 31, 2024.

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

Surveillance Activity	Facility / Structure	Minimum Frequency	Responsible Party	Documentation	Frequency Met	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	Completed monthly.
	R3S[4]	Quarterly	HVC		Yes	Completed quarterly.
Event-Driven Inspection	All	Event Driven[2]	HVC		N/A	No event-driven inspection during the review period.
AFPR	All	Annually	KCB		Yes	This report.
Dam Safety Review (DSR)	All	Every 5 years	HVC	Report	Yes	2023 DSR is underway, site visit completed. The regulatory submission deadline is March 31, 2024.
INSTRUMENTATION MONITORING						
Piezometers	Dam No. 1 and Bose Lake Dam	Monthly (When Accessible)	HVC	AFPR report by KCB	Yes	Measured monthly, except when not accessible due to snow cover (February, March, May and June).
Inclinometers	Dam No. 1	Twice per year (min. 5 months apart)	HVC		Yes	Readings were taken in Q3 2022, Q4 2023, and Q2 2023.
Seepage Flow	Dam No. 1	Monthly	HVC	-	N/A	Not required for performance monitoring and removed from surveillance program in 2024 update OMS Manual.
Pond Level	Pond No. 1 and Pond No. 2	Monthly[3]	HVC	Pond level survey database	Yes	Measured monthly, except when not accessible due to snow cover (February) or pond noted as dry.
	R3S	Monthly	HVC	GeoExplorer and HVC visual inspection sheets	Yes	The pond level measurement is automated, but it has also been surveyed in December 2022 and April 2023. The pond level surveys were similar to the pond level transducer data.
SURVEYS						
Survey Monuments	Dam No. 1 and Bose Lake Dam	Annually	HVC	AFPR report by KCB	Yes	Dam No.1 : Completed on July 12, 2023. Bose Lake Dam: Completed on July 20, 2023.
Pipe Condition Assessment	R3S	Every 5 years	HVC	HVC Internal Report	N/A	Planned to be completed by the end of 2024.

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.
4. R3 Seepage Pond = R3S.

5.2 Pond Levels and Freeboard

The pond levels at Bethlehem TSF Pond No. 1 and Pond No. 2 were checked visually every month, except when snow covered, and surveyed when ponded water was observed. Pond levels at R3 Seepage Pond are measured by a transducer connected to an automated data logger. As a routine check of pond level transducer calibration, HVC completed a manual pond level survey at the R3 Seepage Pond, and the measured level was similar to level recorded by the automated transducer.

Observations related to pond levels during the review period:

- There were no surface discharges from the spillways at Bethlehem TSF or R3 Seepage Pond.
- The pond level at Pond No. 1 and Pond No. 2 followed the established seasonal pattern (Figure 5.1), peaking early in the year, related to freshet, and then dissipating during the remainder of the year.
- Since the end of 2020, the level at both ponds has decreased year-over-year.
- For the first time since 2011, no ponding was observed in the main Pond No. 1 area at the start of the review period (i.e., end of 2022). The pond reformed in May 2023, during freshet, and was no longer present by the end of the review period.

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

Annual Change	Change in Pond Level 2022 to 2023	Range of Annual Pond Level Change 2018 to 2023
Peak Pond	–0.1 m	–0.6 m to 0.3 m
Pond at End of Review Period (1)	0.0 m	–1.0 m to 0.1 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 2022 to 2023	Range of Annual Pond Level Change 2018 to 2023
Peak Pond	0.0 m	–0.4 m to 0.2 m
Pond at End of Review Period (1)	–0.1 m	–0.3 m to 0.2 m

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

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 normal and flood conditions[6].

[6] CDA (2007) defines two freeboard requirements for dam safety: the vertical distance between the lowest point of the crest of the dam and the maximum operating pond level, referred to as Normal freeboard; and the vertical distance between crest of the lowest point of the dam and the peak reservoir level during the IDF, referred to as Flood freeboard.

Figure 5.1 Bethlehem TSF Pond No. 1 and Pond No. 2 Levels – 2018 to 2023

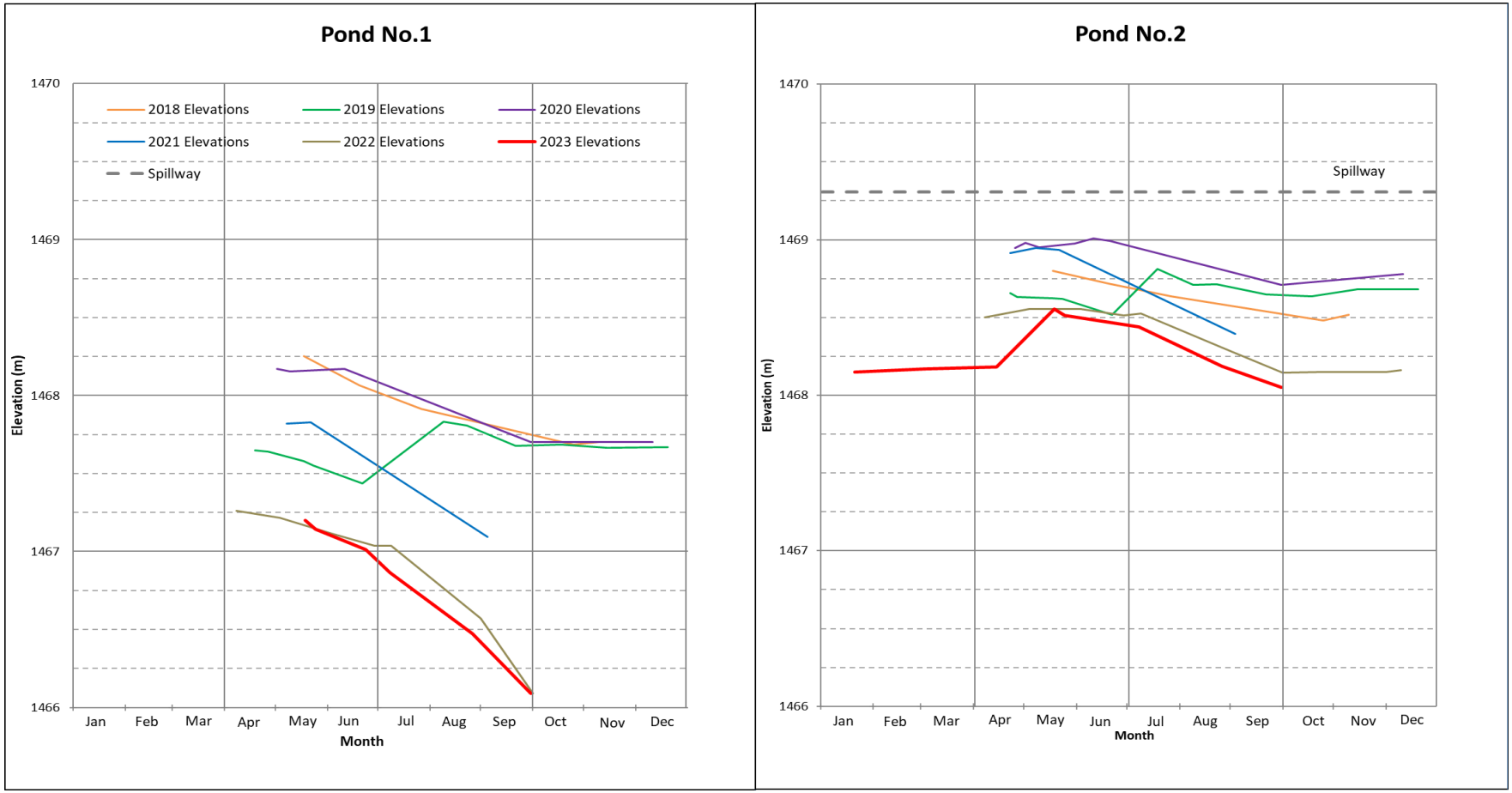


Table 5.4 Freeboard at the Bethlehem TSF and R3 Seepage Pond

Facility	Minimum Freeboard (m)[1]		
	Flood Freeboard Required[2]	Normal Freeboard Required[2]	Observed During the Review Period[3]
Bethlehem TSF	2.2	1.3	4.80
R3 Seepage Pond	0.5	0.5	0.95

Notes:
1. Refers to the minimum vertical distance between the dam crest and the pond level based on KCB (2022b).
2. CDA (2007) defines two freeboard requirements for dam safety: the vertical distance between the lowest point of the crest of the dam and the maximum operating pond level, referred to as Normal freeboard; and the vertical distance between crest of the lowest point of the dam and the peak reservoir level during the IDF, referred to as Flood freeboard.
3. 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 and some instruments were revised for the 2024 update to the OMS Manual based on typical response over the past 5 years.

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 7 to 9. 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 are in the impoundment area (refer to Figure 7). Neither of these exceedances represents a significant change in behaviour or performance of the structure. Each of these instruments have maintained a relatively consistent response over the past few years and the exceedances are well below piezometric level associated with a dam safety concern. Revised threshold values to reflect recent typical behaviour were incorporated in the 2024 update to the OMS Manual:
  - BP12A (installed in the tailings beach ~350 m upstream of the crest) exceeded the threshold for the review period but only by 0.1 m.
  - P95-6 (installed in the foundation, near the downstream toe) exceeded the threshold for one reading. Seasonal rises have been recorded in the past, but the exceedance was recorded prior to freshet.

- Impoundment Piezometers (Figure 7): 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 8): 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 9): 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 3): 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 13 to Figure 15. 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 13): Overall readings throughout the year were within the historic range but did show a greater drain down during the review period than the previous year, which is consistent with overall drain down of the ponds in the impoundment.
- Crest Area Piezometers (Figure 14): Includes three nested instruments installed in the dam fill and foundation. Similar to piezometers installed in the impoundment, they showed greater drain down during the review period than previous years.
- Toe Area Piezometers (Figure 15): Piezometric levels at these instruments have been relatively consistent over the past eight years and show less seasonal variance over the year than piezometers in the impoundment or installed below the crest.

5.4 Survey Monuments

Surveys of the monuments at Dam No. 1 and the Bose Lake Dam are plotted on Figure 10 and Figure 16, respectively.

During the review period, there were no horizontal threshold value exceedances, and the survey locations from the review period were within the cluster of previous readings and showing no deformation trend. The settlement (vertical) incremental and cumulative values are interpreted to be significantly influenced by reliability of the survey method, as discussed below. These are not used for comparison with vertical thresholds. The overall magnitude of settlement to date, if accurate, is not impacting freeboard (Section 5.2) or other aspects of performance. Although there is increased variance in the readings, the overall settlement trend at Bose Lake Dam continues.

In November 2019, HVC started to use GPS Real-Time Kinematics (RTK) to survey the monuments. The horizontal surveys plotted on Figures 10 and 16 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 10 and Figure 16).

KCB and HVC will consider alternate displacement monitoring methods, specifically related to settlement, as part of a surveillance program review planned for 2024. This review will include a review of INSAR data (20 m centers) that HVC has been completed for the site and to assess whether it would be a preferred alternative to monitor settlement.

5.5 Inclinometers

A single inclinometer (IB16-1) is installed at Dam No. 1. IB16-1 was read twice during 2023, as per the OMS Manual (HVC 2022). No significant deformations in the downstream direction have been observed (Figure 11).

5.6 Seepage

There have been no downstream seepage measurements since January 2021 when the weir downstream of Dam No. 1 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 inspections completed by HVC and no such turbid seepage was observed during the review period.

References to seepage flow monitoring at Bethlehem TSF were removed from the OMS Manual in the update issued in 2024.

5.7 Water Quality

HVC's Water Quality Monitoring and Reporting Plan, approved under the PE-376 effluent permit (MECCS 2023), specifies minimum water-quality sampling requirements at the HVC Mine Site, including downstream of the Bethlehem TSF. A revision to the PE-376 effluent permit was issued to HVC on July 27, 2023. HVC report the only change to the permit that impact operation or compliance at the Bethlehem TSF was the removal of the spillway as an authorized point of discharge.

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 Ministry of Mines prior to March 31, 2024. 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.

With regards to the design of the Bethlehem TSF, there were no surface discharges from the spillway and the primary controls related to seepage (i.e., tailings beach upstream of Dam No. 1, low-permeability fill at the Bose Lake Dam) 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. In addition to the site visit, HVC provided an aerial drone video of the Bethlehem TSF impoundment area to KCB for review. Observations are summarized as follows:

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

- The dam was observed to be in good physical condition with no significant visual change or issues of concern.
- No significant change in the downstream slope erosion was observed compared to the 2022 AFPR (KCB 2023) site visit observations, with one exception. A recent erosion scour developed on July 18, 2023 during a thunderstorm. The erosional feature was caused by concentrated runoff from the crest area. Eroded material deposited and partially blocked the mine road. Material was cleared from the mine road. KCB recommends the area of the crest, where the scour originated, be regraded and a berm established to prevent ongoing progressive erosion. The erosion of the downstream slope does not pose a risk to the overall performance of the dam and should be repaired as part of routine maintenance.
- The tailings beach is well vegetated, and no observations of concern were noted. As discussed in Section 5.2, Pond No. 1 was observed to be drained for the first time since 2011 during the review period.
- 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 based on technical reviews and monitoring, the feature it is not a concern for dam safety.

Bethlehem TSF Bose Lake Dam (Appendix I-B)

- The dam was observed to be in good physical condition with no significant visual change or issues of concern.
- Vegetation growth (e.g., grass, bushes, and small trees) was present at the spillway inlet and along the approach channel (i.e., prior to riprap channel segment). HVC provided photographs to show that this area was cleared as part of routine maintenance after the site visit.
- 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 2022 AFPR (KCB 2023), HVC and KCB concluded that the animal burrows in this area do not have the potential to impact dam performance and do not represent a concern as they are above predicted flood levels.

R3 Seepage Pond Dam (Appendix I-C)

- The dam was observed to be in good physical condition with no significant visual change or issues of concern.

- A low point was observed in the berm on the upstream side of the crest. KCB confirmed that this feature is present in the dam crest survey and has been considered in the freeboard calculation (Section 5.2).
- As recommended in the 2022 AFPR (KCB 2023), a diesel pump was stationed on the dam crest near the right abutment. The pump is in place until the outlet pipeline has been cleared of accumulated debris and maintenance completed. The pump was not in use during the site visit, but HVC reported that the pump was operated, as intended, during freshet when the outlet pipe was partially obstructed.
- HVC replaced the debris boom and upstream vegetation fencing; HVC reports the rate of debris accumulation around the outlet has since reduced.

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.

The Canadian Dam Association (CDA) Dam Safety Guidelines (CDA 2013) provide a dam classification scheme based on the potential consequences of a hypothetical failure that can be used to provide guidance on the standard of care expected of dam owners and designers. The consequence classification is not related to the likelihood of a failure, but rather to the potential impact resulting from a failure if it did occur.

Teck provided the following statement regarding the consequence classification of the facility:

> *Teck is committed to the safe and environmentally responsible management of tailings facilities throughout the mining life cycle to minimize harm to the environment and protect the health and safety of our people and surrounding Communities of Interest. This commitment includes the implementation of the Global Industry Standard on Tailings Management (GISTM) and industry-leading guidelines established by the International Council on Mining and Metals (ICMM), the Mining Association of Canada (MAC) and CDA.*
>
> *For the purpose of assigning a dam classification, the consequences of potential failure modes are assessed as per the CDA guidelines and the requirements of the jurisdictions in which we operate. The GISTM bases consequence classification on credible failure modes only, which may result in a lower stated classification.*
>
> *As part of Teck's commitment to the safety of tailings facilities, Teck has adopted using extreme loading criteria for any new facilities with a credible catastrophic flow failure mode, regardless of consequence classification. Risk assessments are performed for all tailings facilities, with the objective of reducing risks to As Low As Reasonably Practicable (ALARP). In some cases, this results in further risk reduction beyond applicable regulatory requirements and is consistent with the GISTM and industry-leading best practice.*

A "Very High" consequence category, based on the CDA (2013) classification scheme, has been assigned to the Bethlehem TSF. The R3 Seepage Pond has been assigned consequence categories of "Low." There have been no material changes to the facilities, or to the upstream or downstream conditions during the review period that support a modification to the consequence category.

The spillway design flood and the earthquake design ground motion (EDGM) for each of the facilities meet or exceed the equivalent requirements under the HSRC (EMLI 2022).

7.2 Failure Mode Review

7.2.1 General

Potential failure modes and risk assessment 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 and overtop 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 tailings beach and rockfill shell. The design assumes that no ponding is present within 122 m (400 ft) of the dam crest.

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 tailings beach, into the foundation and dam fill, were higher while tailings were spigotted from the dam crest and the operational pond was closer to the rockfill shell than existing conditions.

7.2.3 Bose Lake Dam

Overtopping

The spillway is designed to manage a flood (PMF 24-hour) greater than the IDF (Table 4.3) recommended under the HSRC (EMLI 2022) 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 Design – The design assumes that the pond level is at the invert of the spillway at the onset of the storm; during the review period, the pond level was more than 0.7 m below the invert. This provides additional flood attenuation that is not accounted for in the design and significantly reduces the potential for overtopping. The spillway channel is excavated into glacial till and there are no geohazards in the area that pose a significant risk of fully blocking the spillway.
- Flood Storage – Even if the spillway were to become fully blocked during an extreme flood, the facility can store more than two PMF 24-hour events (0.9 Mm^3) between invert of spillway and freeboard limit.

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 fill to reduce seepage gradients and flows through the dam, 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 IDF requirement under the HSRC (EMLI 2022). The spillway is capable of routing much larger flood events, including the PMF (24-hour), albeit with less than minimum flood freeboard required during the IDF.

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. Similar to the OMS Manual, the EPRP went through a routine update and an update was issued in 2024. The Bethlehem TSF 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 December 5, 2023, participants from HVC's operation team (including site management), and including the TSF QP, participated in a simulated exercise to test the TSF EPRP. The Bethlehem TSF EoR participated remotely in this exercise.

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 2022 through September 2023.

During the review period the two outstanding recommendations from previous AFPRs, both related to the R3 Seepage Pond, were closed (Table 8.1).

One new recommendation was identified during the 2023 AFPR (Table 8.2): regrade the crest to prevent ongoing surface flow over the downstream slope. This does not represent an imminent dam safety concern at the facility but should be done to prevent ongoing erosion.

Table 8.1 Previous Recommendations Related to Facility Performance – Status Update

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 CLOSED*
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 CLOSED*

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.

Table 8.2 2023 AFPR Recommendations Related to Facility Performance

ID No.	Performance Area	Recommended Action	Priority(1)	Deadline (Status)
Dam No. 1				
BD1-2023-01	Maintenance	Regrade the area of the crest where runoff flowed over the downstream slope and establish a berm to prevent continued erosion where the scour originated.	3	Q3 2024

Notes: Refer to Table 8.1 notes.

9 CLOSING

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

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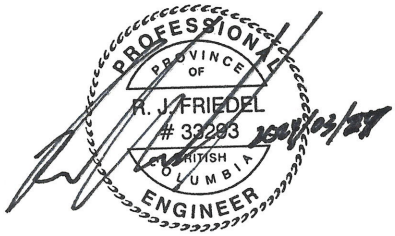

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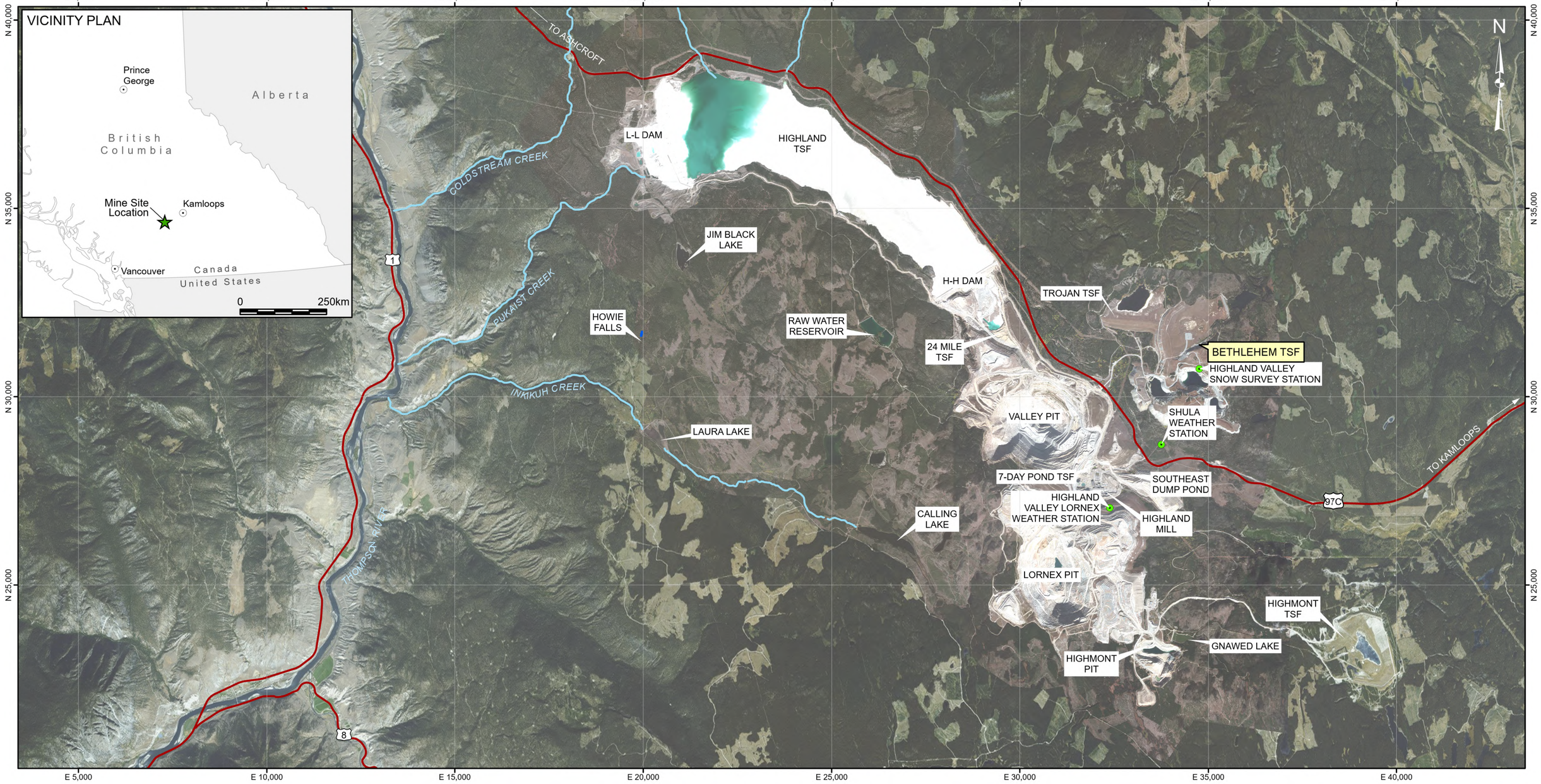
FIGURES



LEGEND

- 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 2012).
4. IMAGERY FROM TECK OBTAINED OCTOBER 22 2023, SUPPLEMENTED WITH IMAGERY FROM ESRI,WORLD IMAGERY.

NOT FOR CONSTRUCTION

SCALE 0 5km

CLIENT: Highland Valley Copper / Teck

PROJECT: BETHLEHEM TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: MINE SITE PLAN

Klohn Crippen Berger

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C62	1

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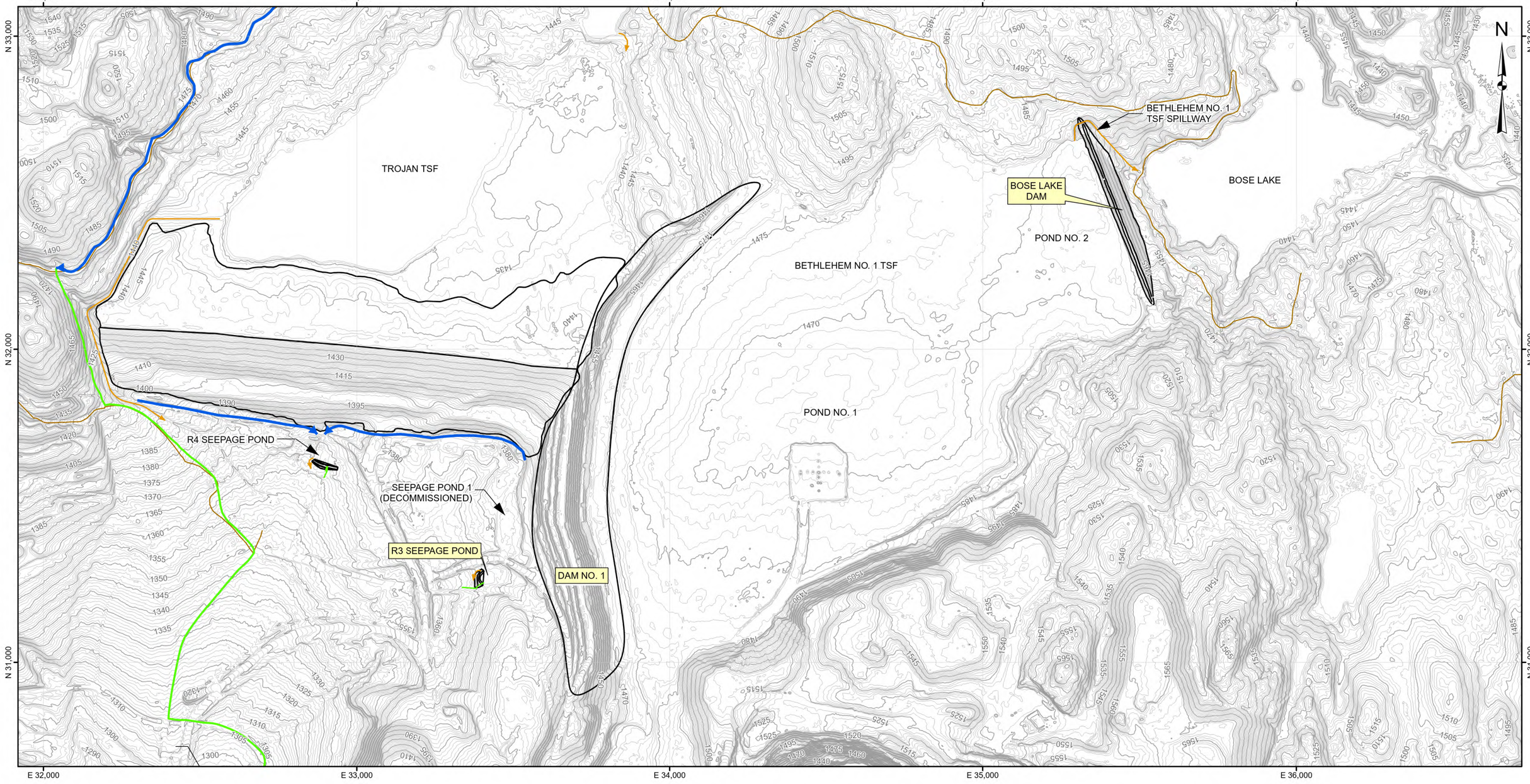

LEGEND

- SPILLWAY
- DITCH
- ABOVE GROUND PIPELINE
- DAM
- ROAD

NOTES:

1. PROJECTION: HVC MINE GRID.
2. TSF = TAILINGS STORAGE FACILITY.
3. TOPOGRAPHY FROM HVC OBTAINED OCTOBER 2023.
4. ROADS FROM THE BC GEOGRAPHIC WAREHOUSE, FOREST TENURES BRANCH, ACCESSED NOVEMBER 2023.

NOT FOR CONSTRUCTION

SCALE 0 500 m

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BETHLEHEM NO. 1 TSF OVERVIEW

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C62	2

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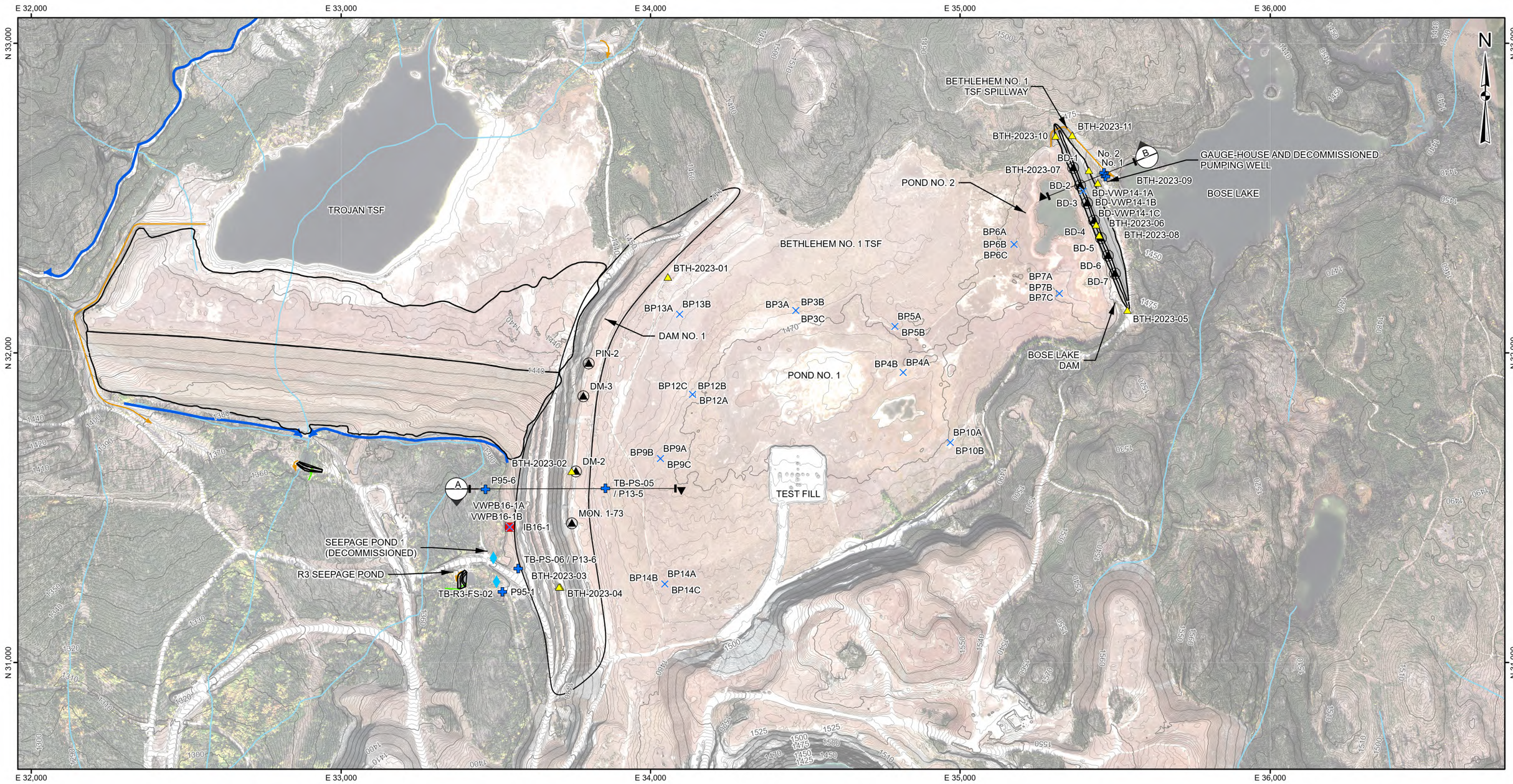

LEGEND

- WAYPOINT (BTH-2023-xx)
- WEIR

ACTIVE INSTRUMENT

- VIBRATING WIRE PIEZOMETER
- STANDPIPE PIEZOMETER
- MANUAL INCLINOMETER
- TOTAL STATION POINT
- SPILLWAY
- ABOVE GROUND PIPE
- BURIED PIPE
- DITCH
- DAM
- CREEK

NOTES:

1. PROJECTION: HVC MINE GRID.
2. TSF = TAILINGS STORAGE FACILITY.
3. IMAGERY FROM TECK OBTAINED OCTOBER 22 2023, SUPPLEMENTED WITH IMAGERY FROM ESRI, WORLD IMAGERY.
4. TOPOGRAPHY FROM HVC OBTAINED OCTOBER 2023.

NOT FOR CONSTRUCTION

SCALE 0 500 m

CLIENT: Highland Valley Copper / Teck

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BETHLEHEM NO. 1 TSF
PLAN

Klohn Crippen Berger

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C62	3

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LEGEND

- WAYPOINT (BTH-2023-xx)
- BURIED PIPE
- SPILLWAY
- DAM

NOTES:

1. PROJECTION: HVC MINE GRID.
2. IMAGERY FROM TECK OBTAINED OCTOBER 22 2023.
3. TOPOGRAPHY FROM HVC, OBTAINED OCTOBER 2023.
4. LOCATION OF BURIED PIPES ARE APPROXIMATE.

NOT FOR CONSTRUCTION

SCALE 0 25m

CLIENT: Highland Valley Copper / Teck

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: R3 SEEPAGE POND DAM
PLAN

Klohn Crippen Berger

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C62	4

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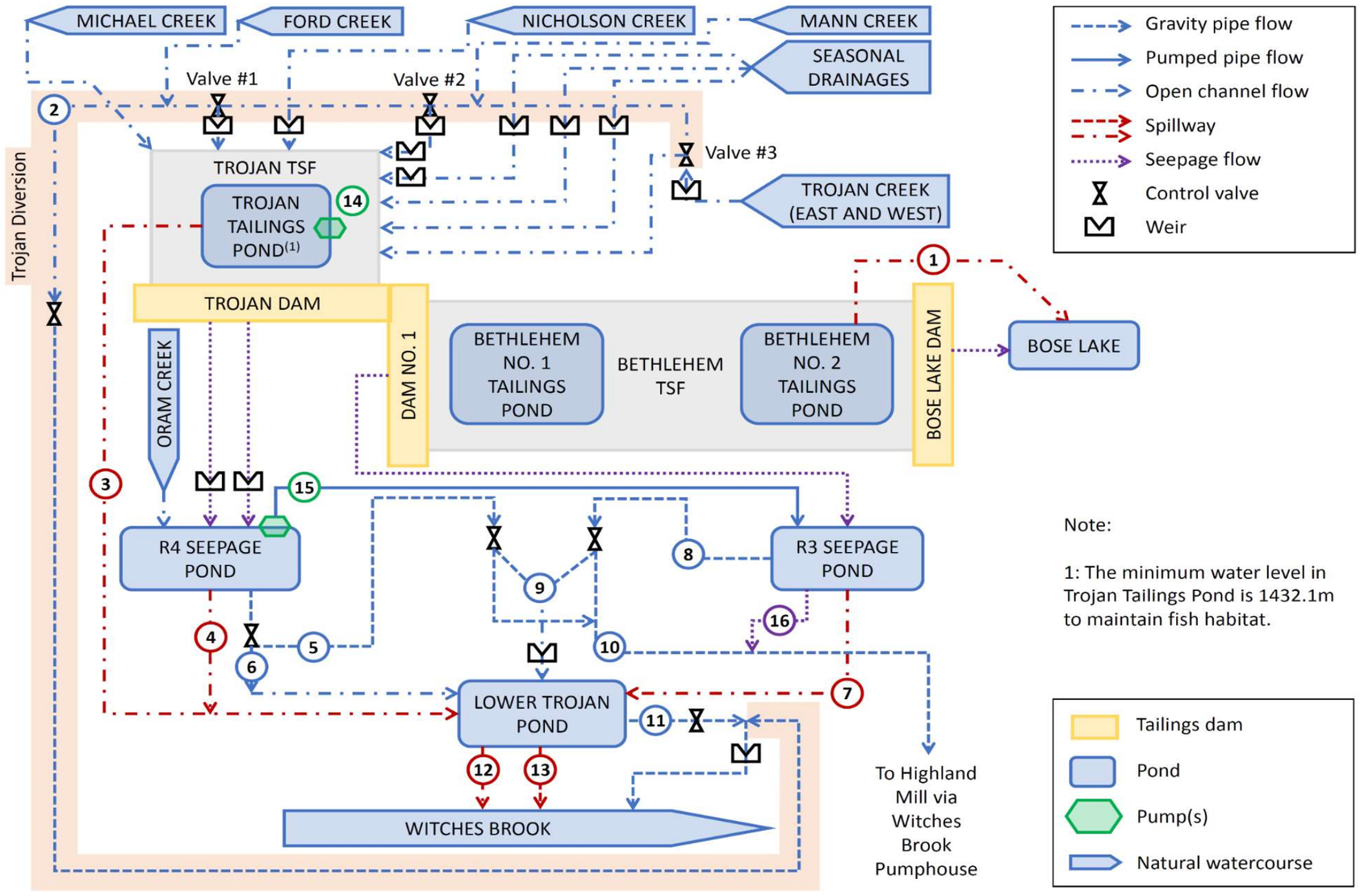


Note:

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

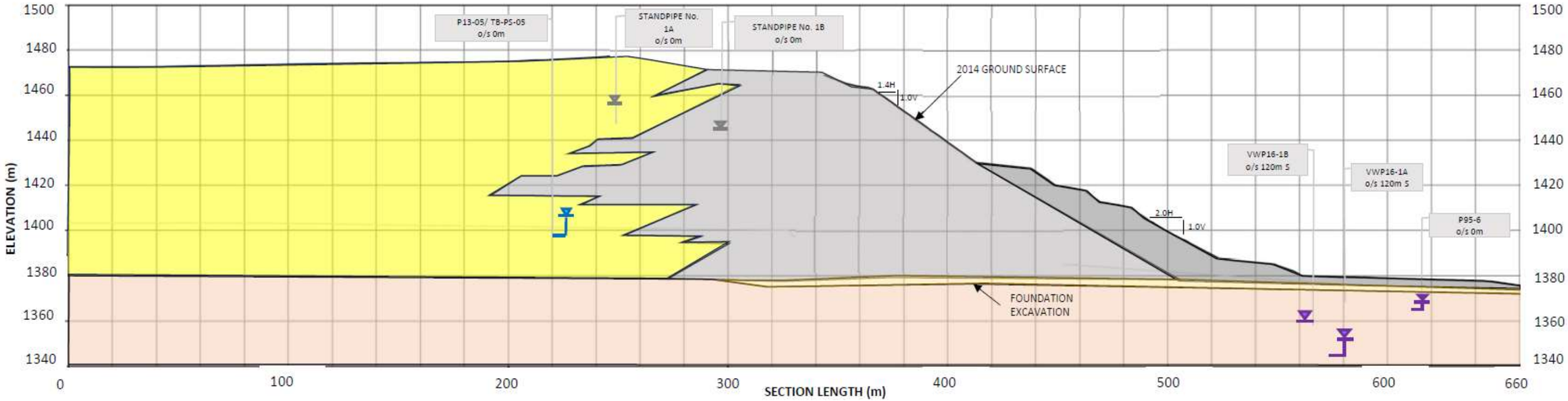
No.	Name
1	Bethlehem No.1 TSF Spillway
2	Trojan Diversion
3	Trojan Spillway
4	R4 Spillway
5	R4 Low-Level Outlet
6	R4 Overflow
7	R3 Spillway
8	R3 Low-Level Outlet
9	R3/R4 Seepage to Lower Trojan Pond
10	R3/R4 Seepage to Northern Collection Line
11	LTD Low-Level Outlet
12	LTD Spillway
13	LTD Overflow
14	Trojan Pump
15	R4 Pump to R3 Pond
16	R3 Overland Collector

CLIENT
Highland Valley Copper / Teck
Klohn Crippen Berger

PROJECT
BETHLEHEM NO.1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

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

SCALE	PROJECT No.	FIG. No.
NTS	M02341C62	5



SECTION A 3 DAM No. 1

NOTES:

1. THE LOCATIONS OF THE INSTRUMENTS OFF THE SECTION ARE APPROXIMATE.
2. INTERNAL ZONING OF THE BETHLEHEM EMBANKMENT WAS BASED ON "BETHLEHEM AND HIGHMONT TAILINGS DAM - LONG-TERM STABILITY ASSESSMENT" (KC 1996).

LEGEND

- TAILINGS/CYCLONED SAND
- DAM ROCKFILL
- TOE BUTTRESS ROCKFILL
- GLACIAL TILL OVERBURDEN
- ROCK UNDERDRAIN
- WATER ELEVATION AT FOUNDATION PIEZOMETER
- WATER ELEVATION AT CYCLONED SAND OR FILL PIEZOMETER
- DRY PIEZOMETER / CPT

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BETHLEHEM DAM NO. 1
INSTRUMENTATION SECTION A

SCALE	PROJECT No.	FIG. No.
NTS	M02341C62	6

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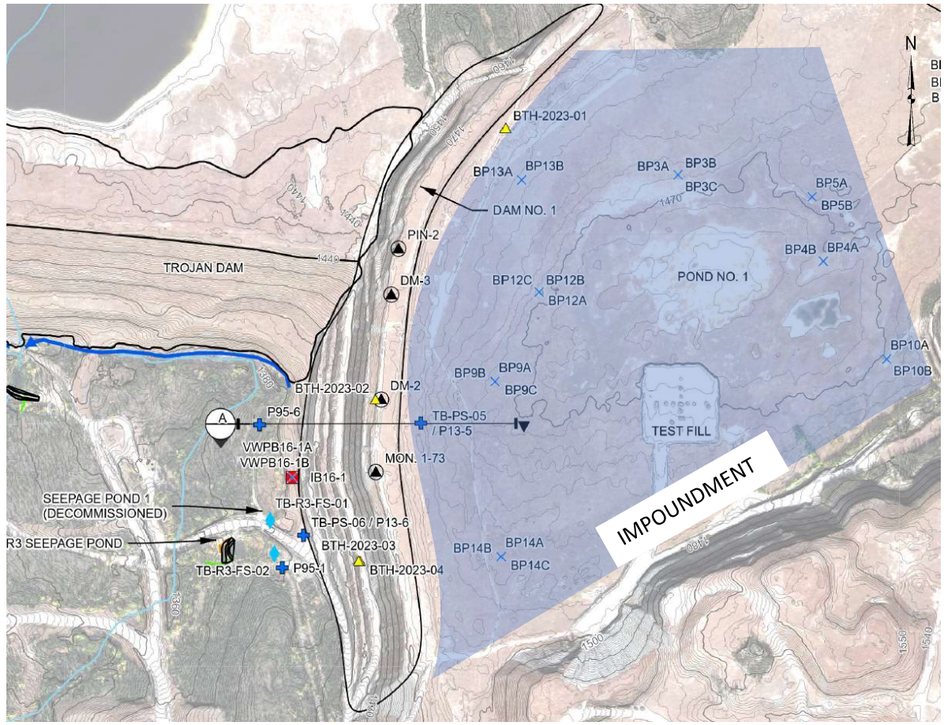
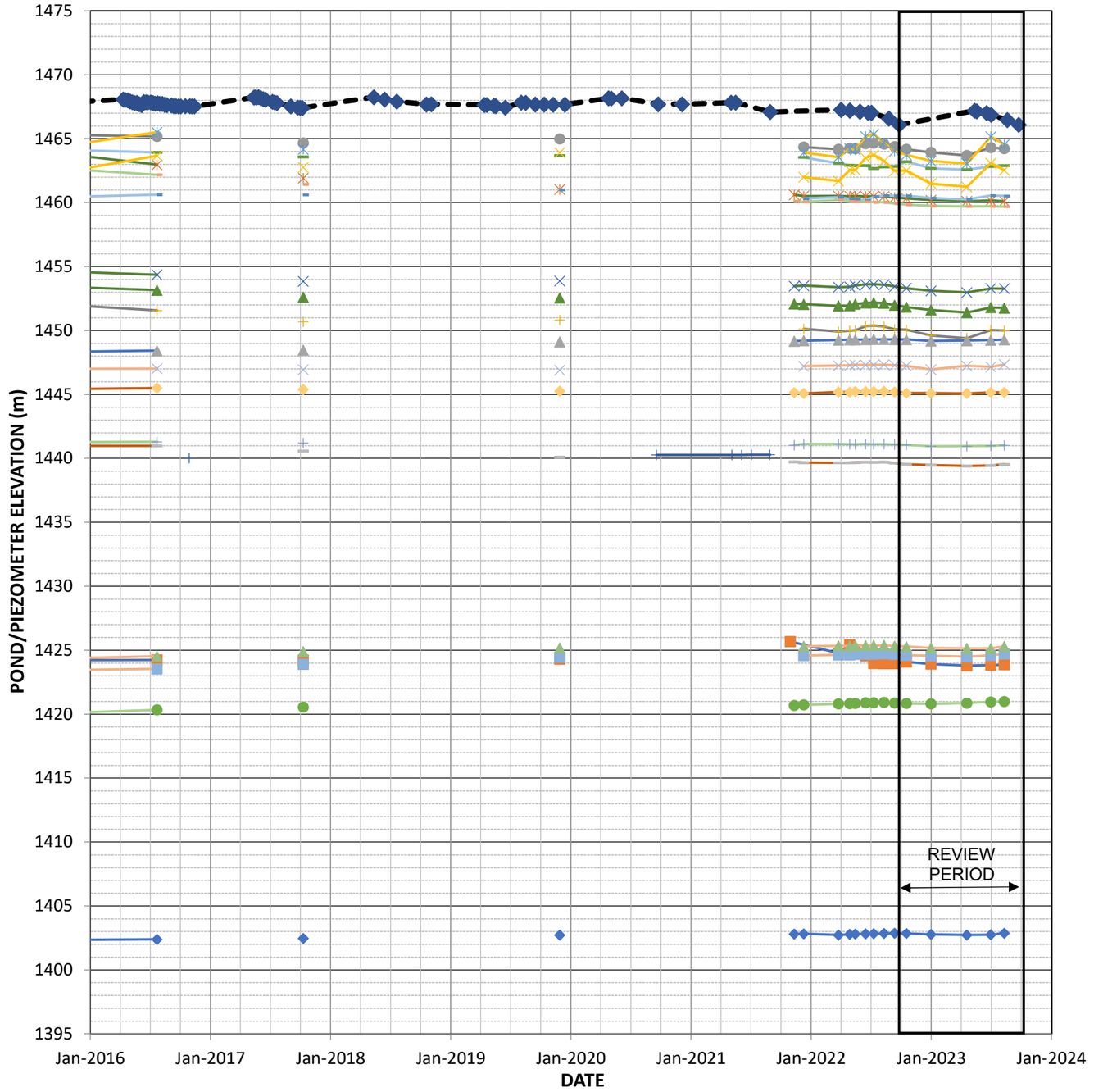


PIEZOMETER ID	2023 NOTIFICATION LEVEL THRESHOLDS VALUE (m)
BP3A	1454.8
BP3B	1455.9
BP3C	1466.6
BP4A	1466.7
BP4B	1454.6
BP5A	1461.6
BP5B	1465.3
BP9A	1403.4
BP9B	1424.9
BP9C	1449.6
BP10A	1465.2
BP10B	1466.8

PIEZOMETER ID	2023 NOTIFICATION LEVEL THRESHOLDS VALUE (m)
BP12A	1420.8
BP12B	1441.8
BP12C	1463.9
BP13A	1441.5
BP13B	1446.0
BP14A	1425.0
BP14B	1425.7
BP14C	1447.9
BP15A	1447.7
BP15B	1451.0
BP15C	1458.6



NOTES:

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

LEGEND:

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

CLIENT: Highland Valley Copper / Teck

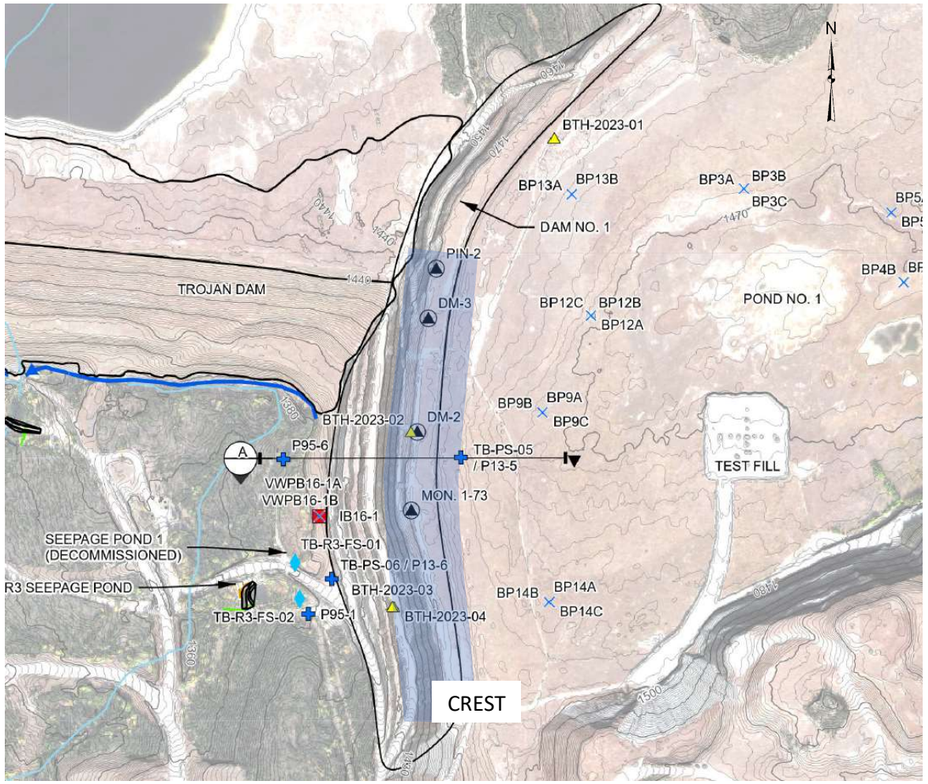
Klohn Crippen Berger

PROJECT: BETHLEHEM NO.1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

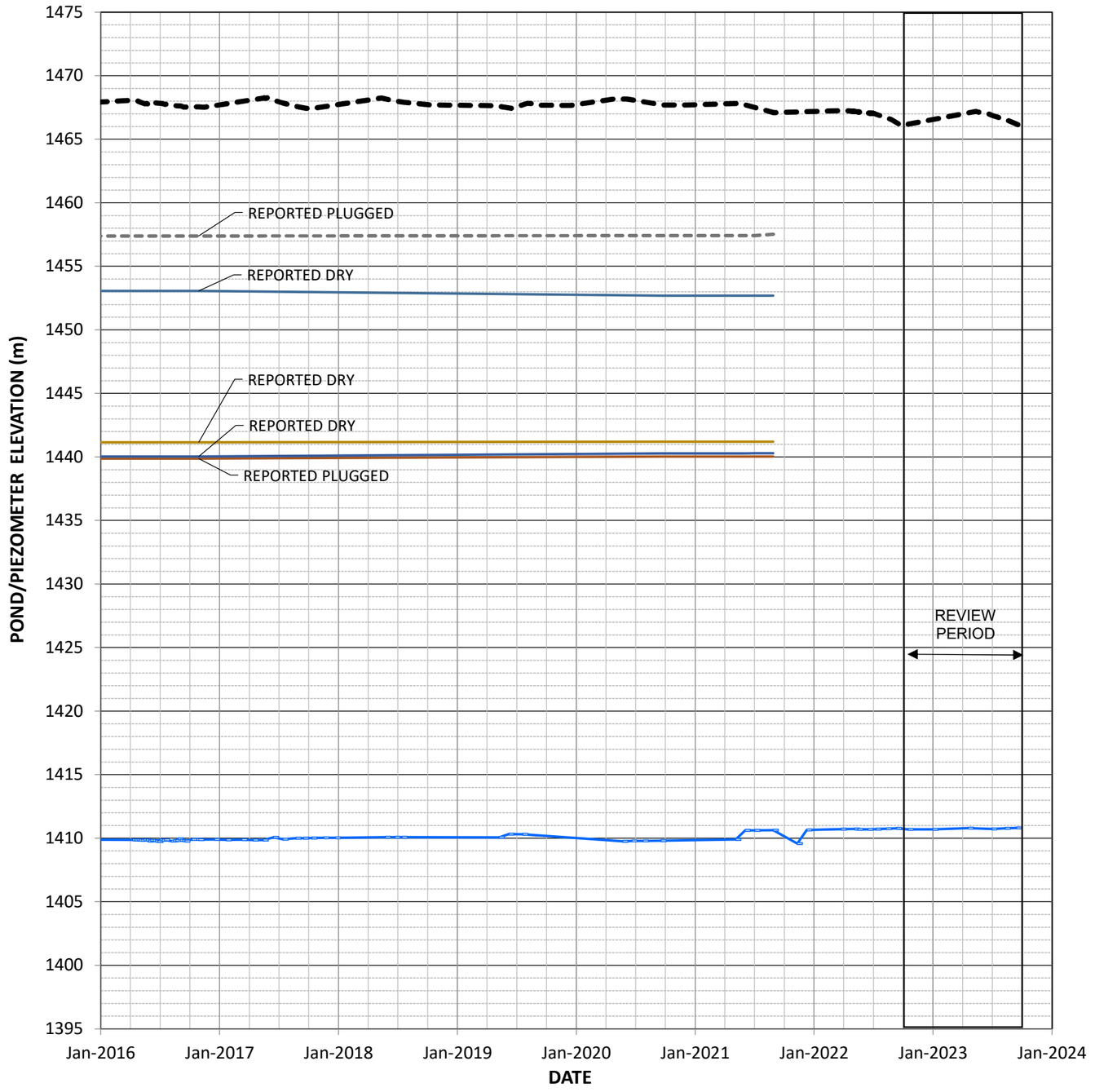
TITLE: DAM NO. 1 PIEZOMETRIC DATA
YEARS 2016 TO 2023
IMPOUNDMENT

PROJECT No. M02341C62

FIG. No. 7



PIEZOMETER ID	2023 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. PIEZOMETER IN TAILINGS BEACH REPORTED AS DRY ARE SHOWN AS THEY INFER THE PIEZOMETRIC LEVEL IS BELOW THEIR TIP ELEVATION. DURING OPERATIONS, THESE PIEZOMETERS MEASURED POSITIVE PRESSURE AND ARE AN INDICATION OF DRAINDOWN THAT HAS OCCURED.

LEGEND:

PIEZOMETERS REPORTED AS DRY (NOTE 1)
- STANDPIPE NO. 1A (TIP El. 1446.6 m)
- STANDPIPE NO. 1B (TIP El. 1440.3 m)
- STANDPIPE NO. 3 (TIP El. 1442.8 m)
- STANDPIPE NO. 4 (TIP El. 1451.8 m)
- STANDPIPE NO. 7 (TIP El. 1439.9 m)

ACTIVE PIEZOMETERS
- 13-SRK-09/P13-5 (TIP El. 1391.2 m TAILINGS BEACH)
- POND NO.1 LEVEL

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO.1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: DAM NO. 1 PIEZOMETRIC DATA
YEARS 2016 TO 2023
CREST

SCALE	PROJECT No.	FIG. No.
NTS	M02341C62	8

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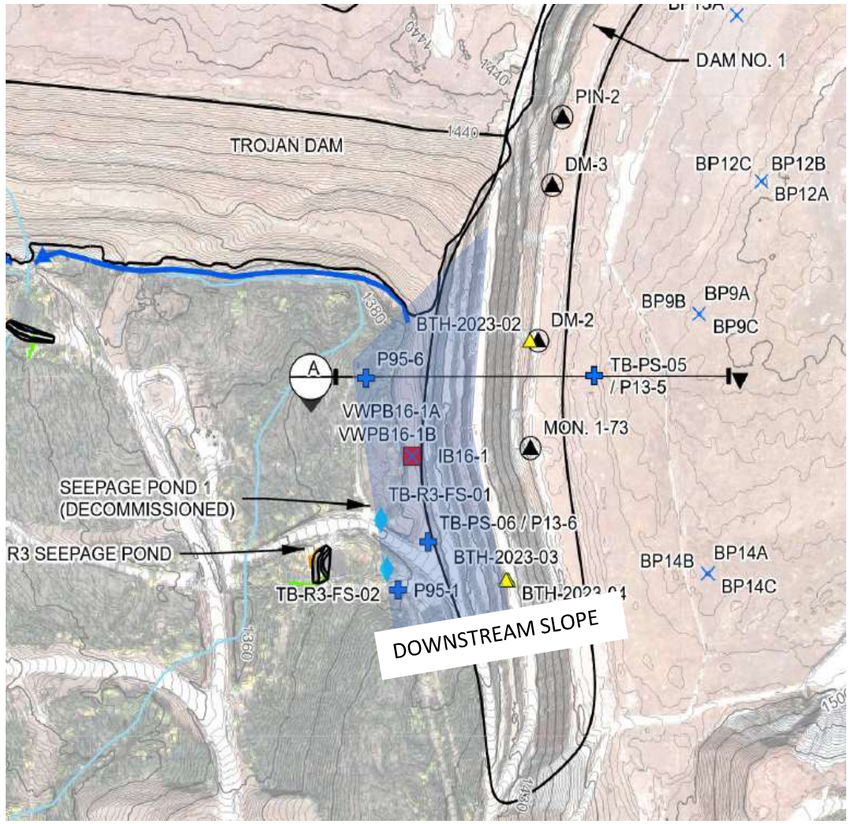
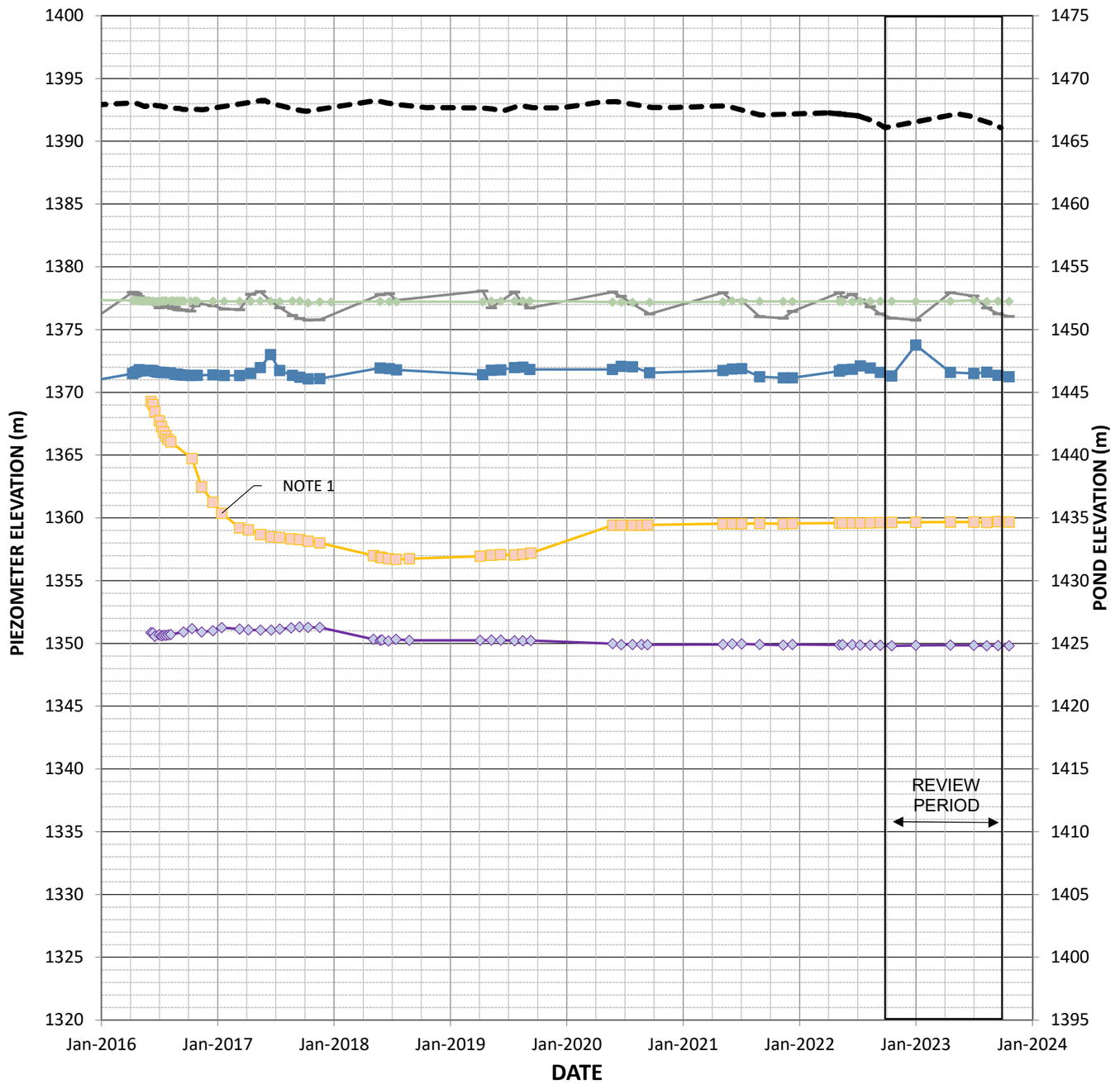


PIEZOMETER ID	2023 NOTIFICATION LEVEL THRESHOLDS VALUE (m)
P95-1	1379.0
P95-6	1373.6
13-SRK-12B/P13-6	1377.9
VWP16-1A	1351.7
VWP16-1B	1369.8



NOTES:

1. VWP16-1B HAS MEASURED NEGATIVE PRESSURES SINCE JANUARY 2017, INDICATING PIEZOMETRIC LEVEL IS BELOW TIP.

LEGEND:

- 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 mGLACIAL TILL)
- VWP16-1A (TIP El. 1346.2 mGLACIAL TILL)
- VWP16-1B (TIP El. 1360.7 m, GLACIAL TILL)
- POND NO.1 LEVEL

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO.1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: DAM NO. 1 PIEZOMETRIC DATA
YEARS 2016 TO 2023
DOWNSTREAM SLOPE

SCALE	PROJECT No.	FIG. No.
NTS	M02341C62	9

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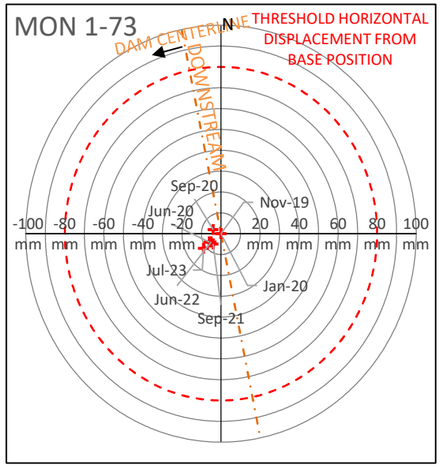

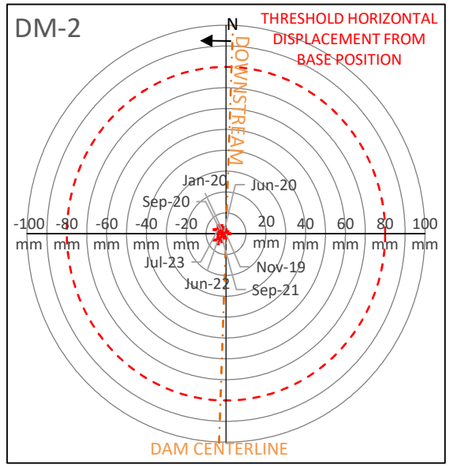

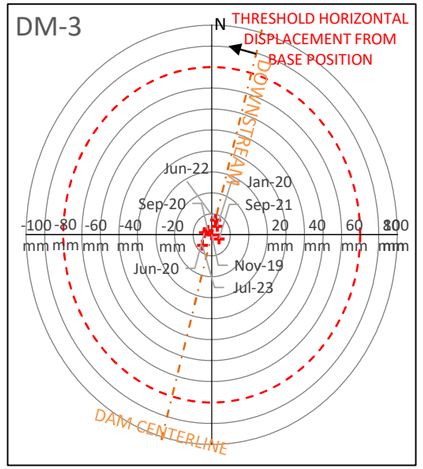

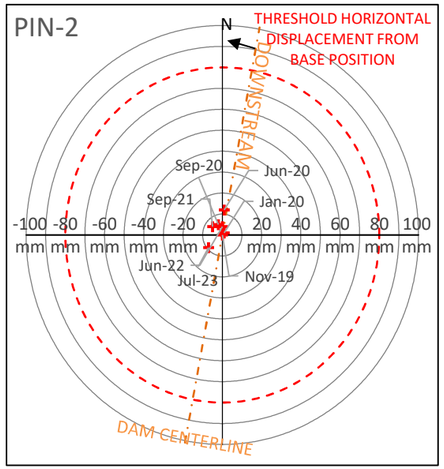

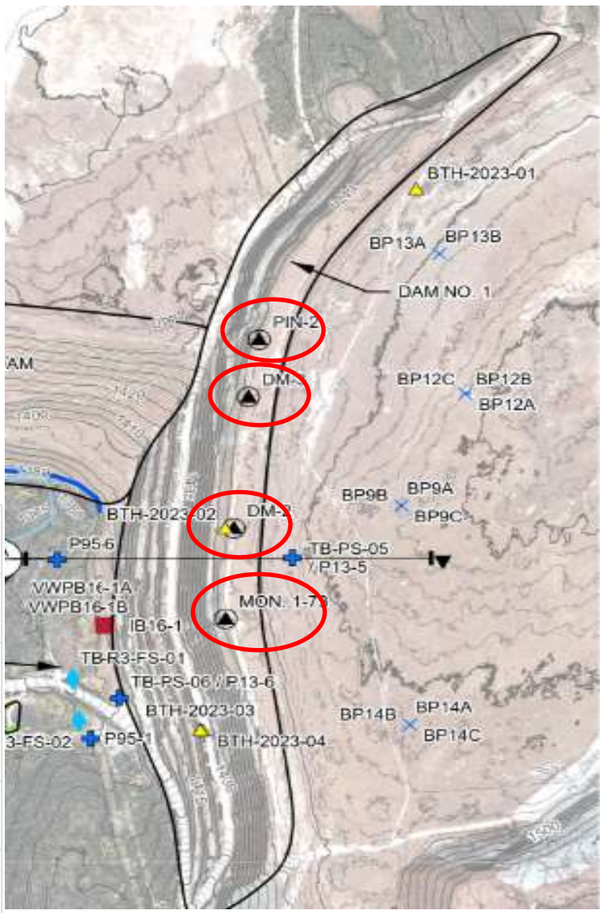

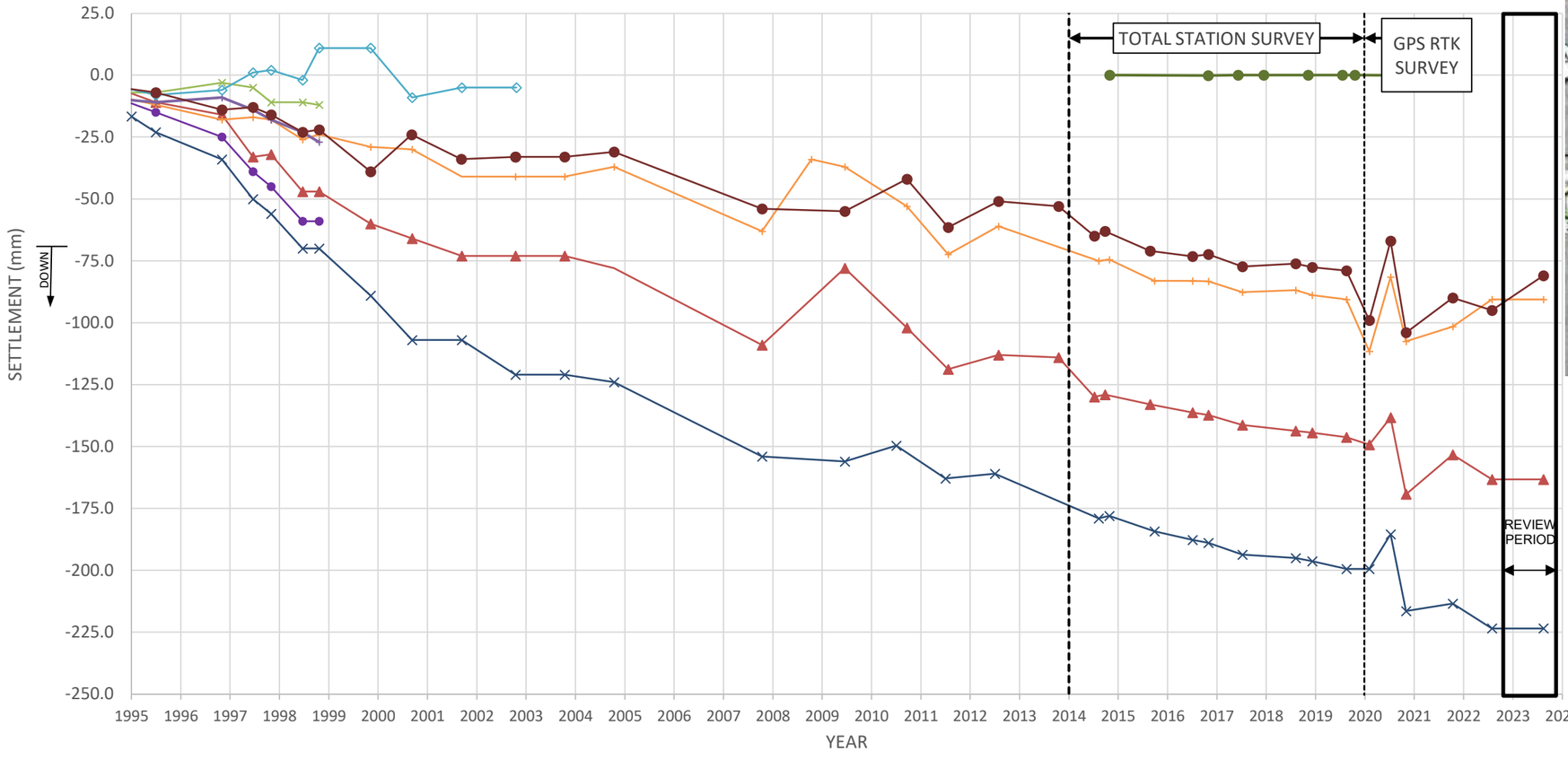

LEGEND:

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

GENERAL 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. 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.

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: DAM NO. 1
SURVEY MONUMENT READINGS

PROJECT No.: M02341C62

FIG. No.: 10

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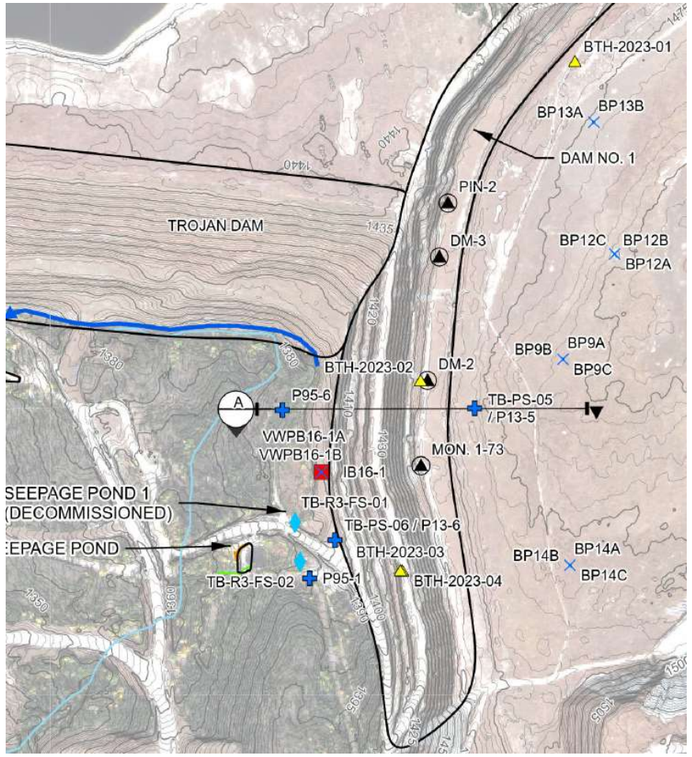
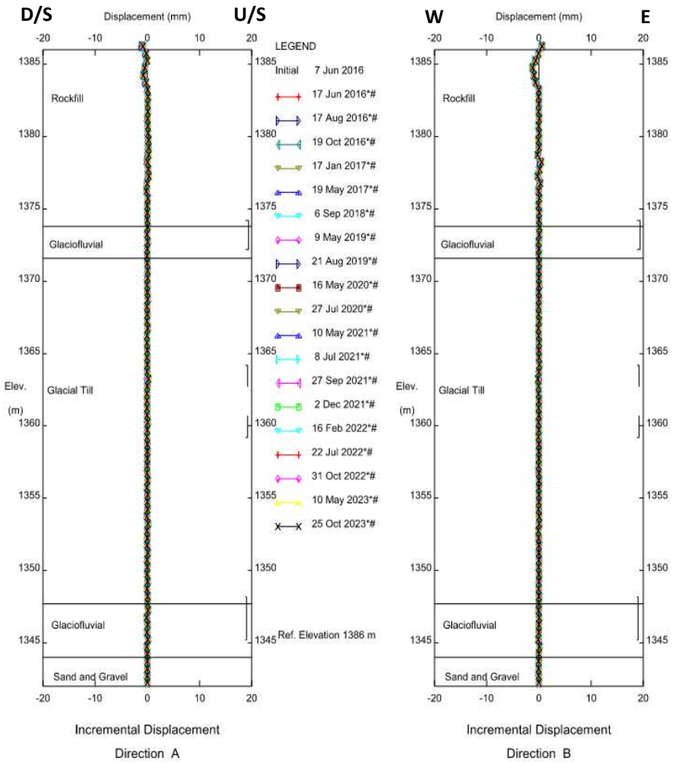
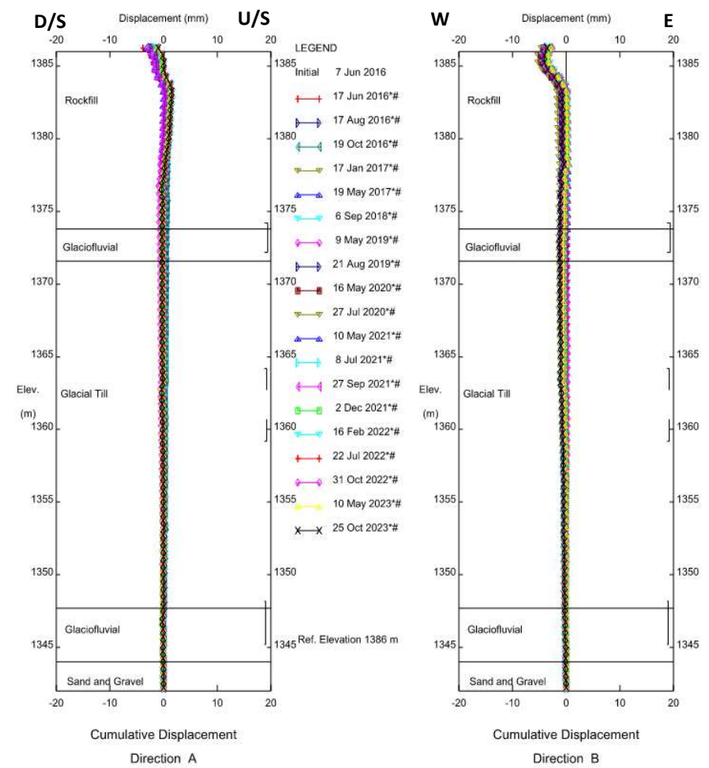
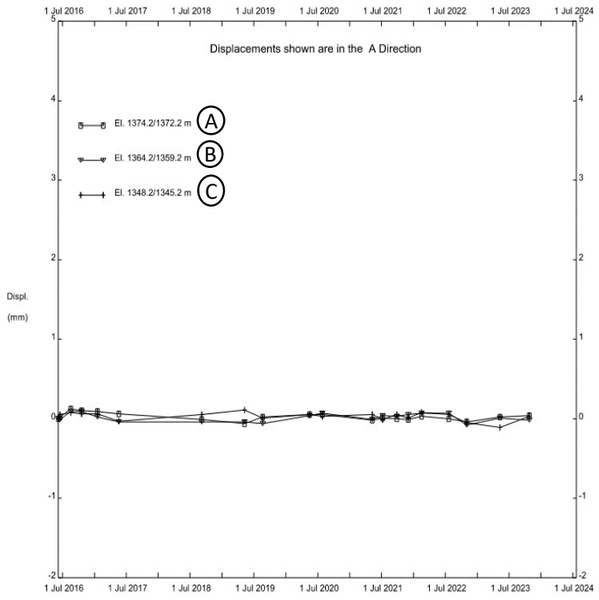


Incremental Displacement Profile



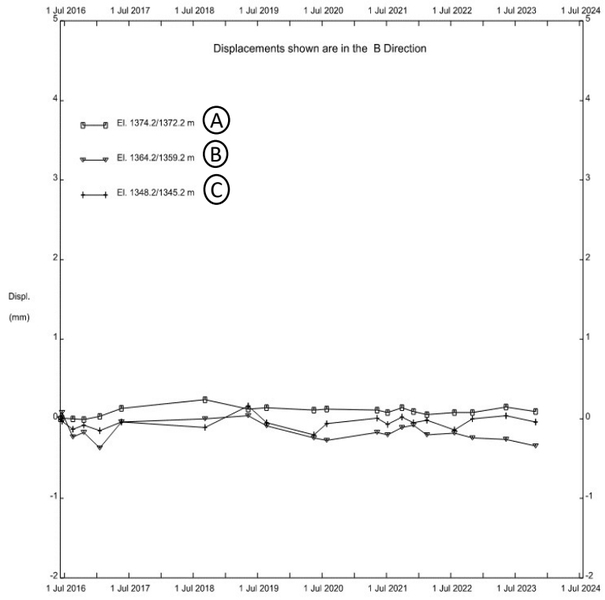
Cumulative Displacement Profile





DATE

CUMULATIVE DISPLACEMENT PROFILE VS. TIME "A" DIRECTION



DATE

CUMULATIVE DISPLACEMENT PROFILE VS. TIME "B" DIRECTION

NOTES:

1) IB16-1 WAS INSTALLED ON APRIL 20, 2016 AND INITIALIZED ON JUNE 7, 2016.

CLIENT
Highland Valley Copper / Teck

Klohn Crippen Berger

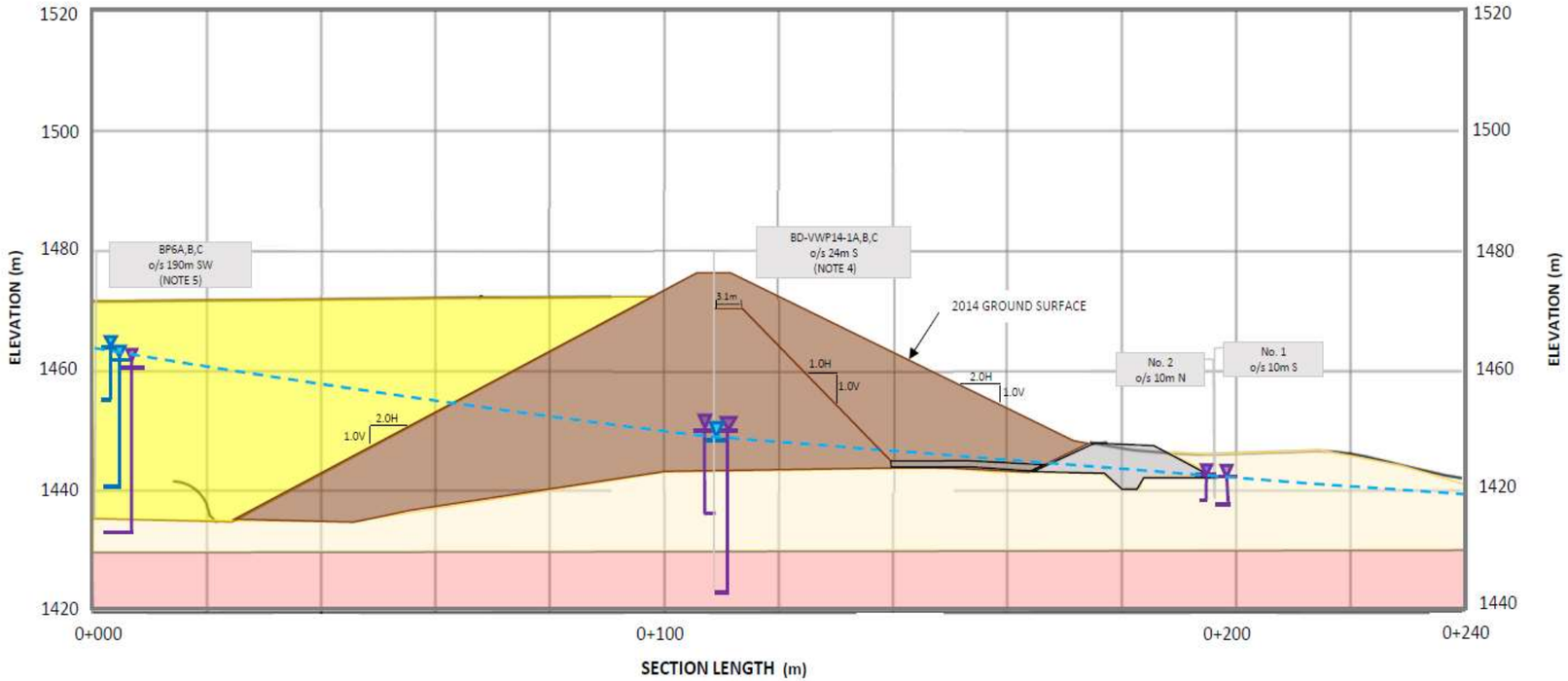
PROJECT
BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE
DAM NO. 1
INCLINOMETER DISPLACEMENT PROFILE
IB16-1

PROJECT No. M02341C62

FIG. No. 11

FILE PATH: Z:\MV\CR\M02341C62-HVC-2023 APR\300 DESIGN\340 DAM MOVEMENT MONITORING\341 INCLINOMETERS\221003 INCLINOMETER PLOTS (BETH AND TROJ).XLSX - 2024-02-27 13:31



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 FROM GEPAC (1972) AND FELLHAVER (1980).

LEGEND

- TAILINGS
- GLACIAL TILL
- ROCKFILL AND DRAIN MATERIAL
- GLACIAL TILL OVERBURDEN
- GRANODIORITE BEDROCK
- WATER ELEVATION AT FOUNDATION PIEZOMETER
- WATER ELEVATION AT TAILINGS
- INFERRED PIEZOMETRIC LINE - EXISITING

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BOSE LAKE DAM
INSTRUMENTATION SECTION B

SCALE	PROJECT No.	FIG. No.
NTS	M02341C62	12

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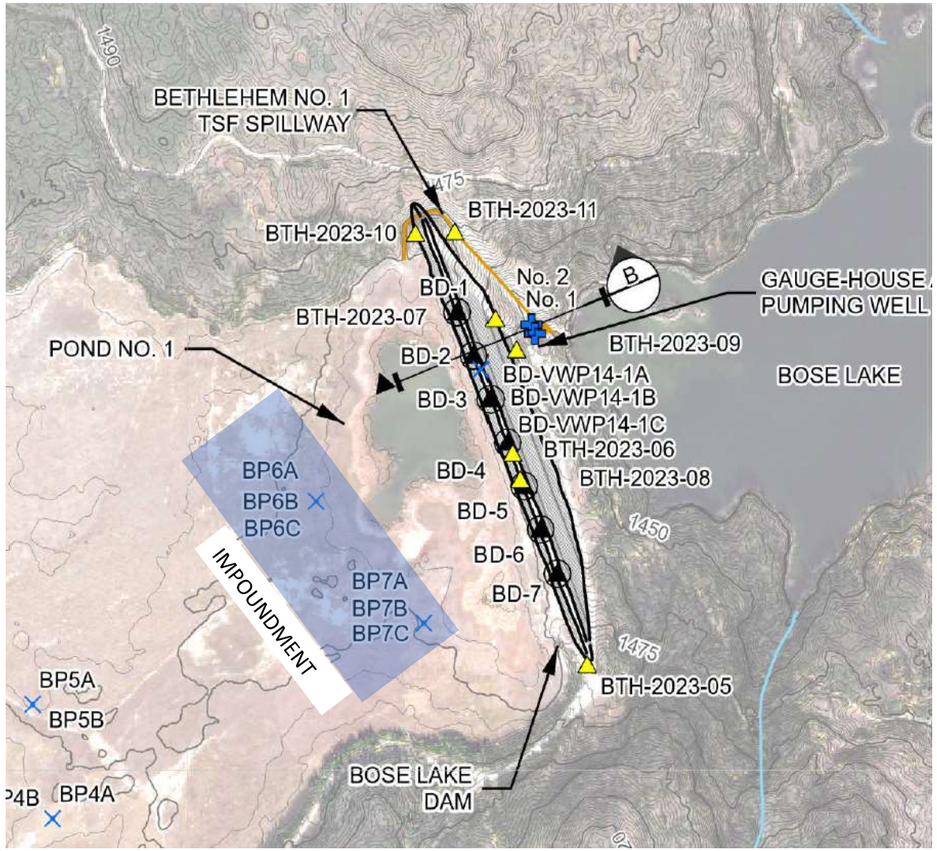

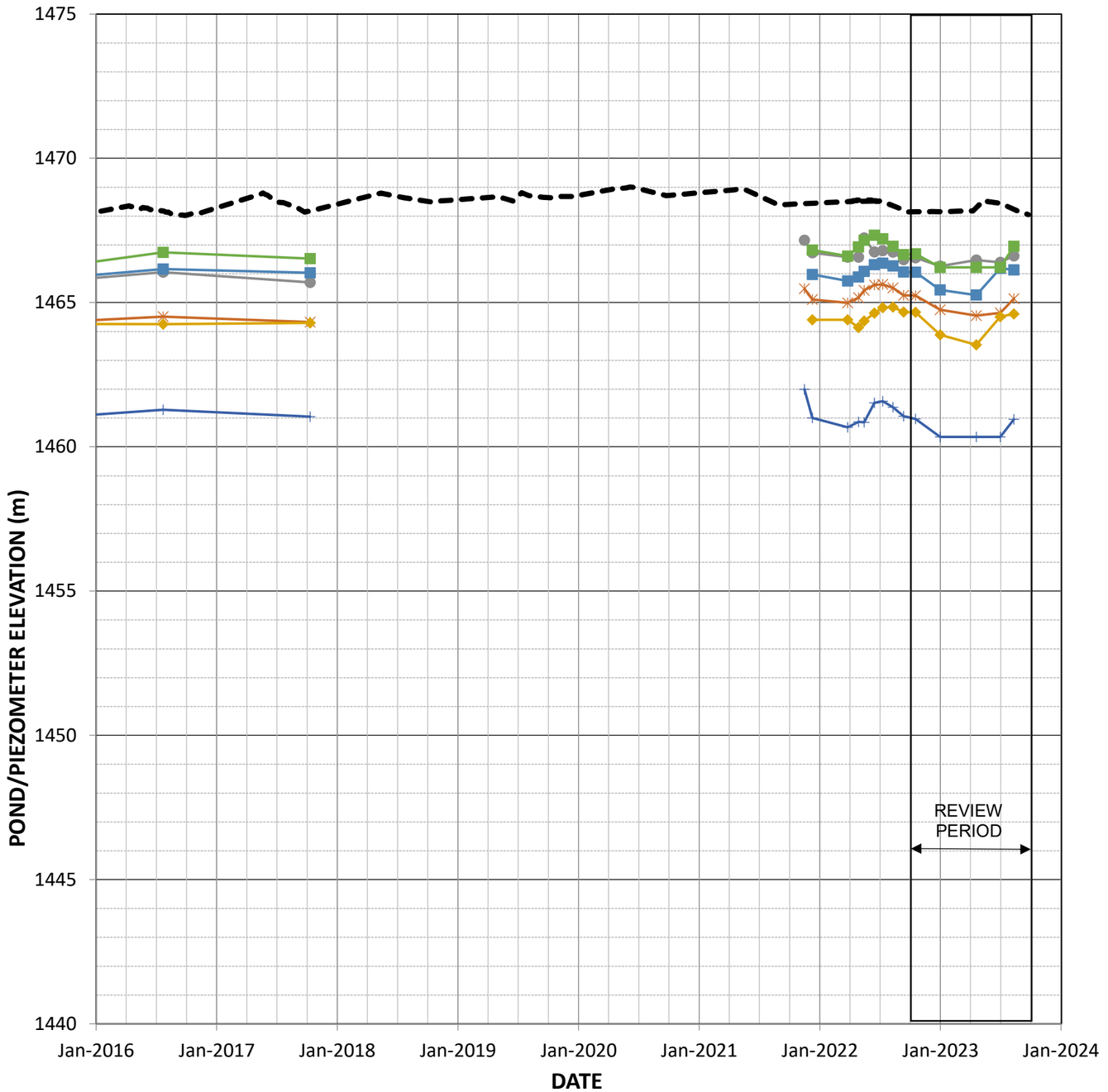

PIEZOMETER ID	2023 NOTIFICATION LEVEL THRESHOLDS VALUE (m)
BP6A	1462.8
BP6B	1466.0
BP6C	1467.3
BP7A	1469.1
BP7B	1469.1
BP7C	1468.3

NOTES:

1. NO READINGS WERE TAKEN IN 2019 or 2020.

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)
- POND NO.2 LEVEL

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO.1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BOSE LAKE DAM PIEZOMETRIC DATA
YEARS 2016 TO 2023
IMPOUNDMENT

SCALE	PROJECT No.	FIG. No.
NTS	M02341C62	13

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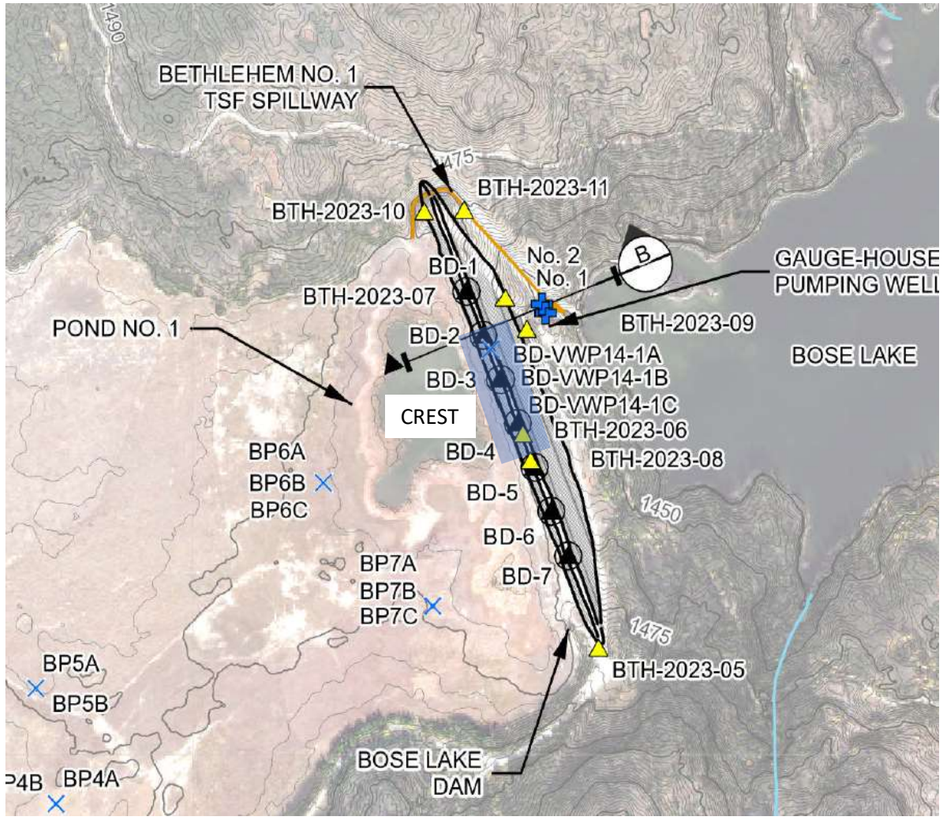
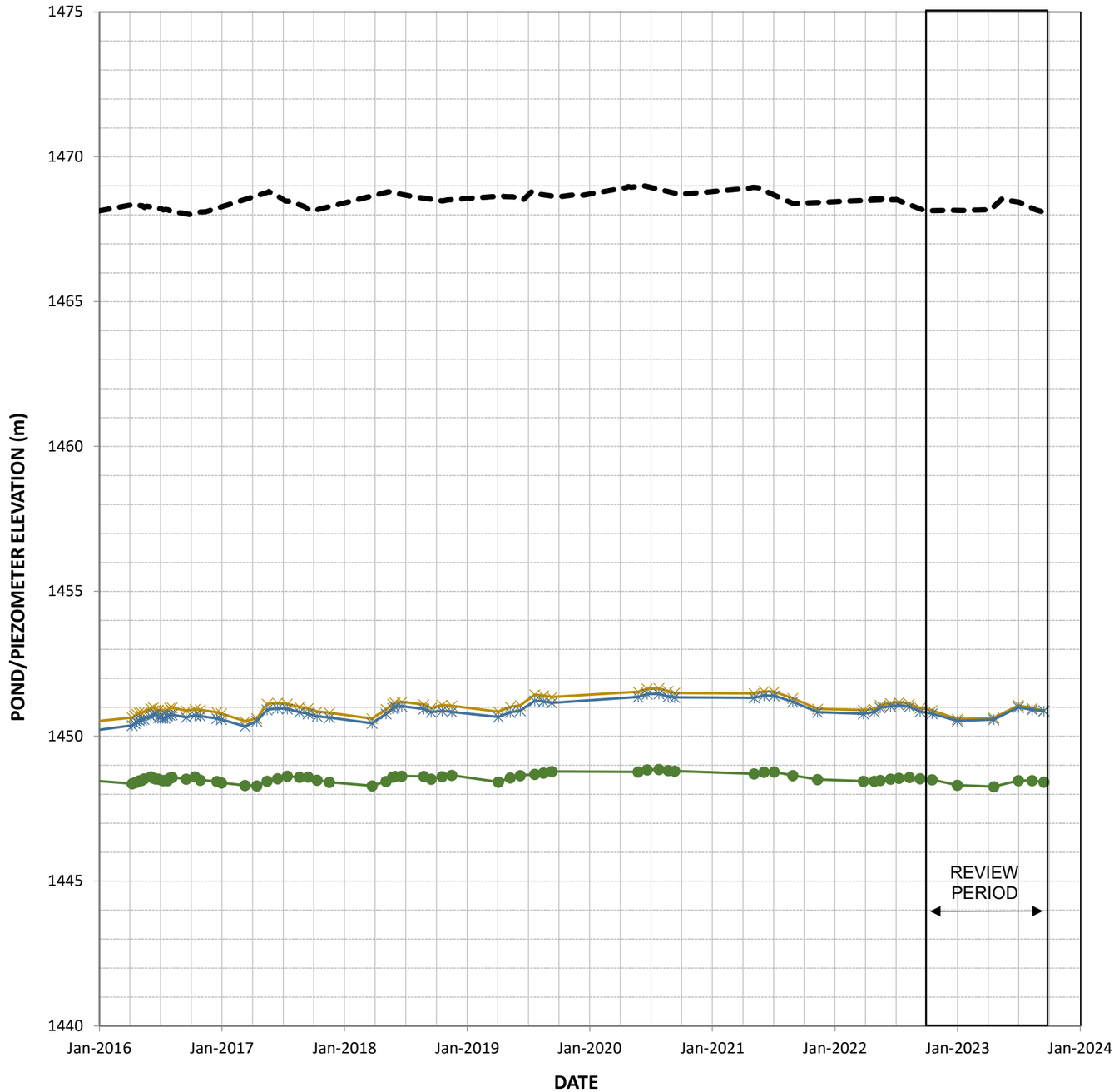


PIEZOMETER ID	2023 NOTIFICATION LEVEL THRESHOLDS VALUE (m)
BD-VWP14-1A	1452.0
BD-VWP14-1B	1451.8
BD-VWP14-1C	1449.9



LEGEND:

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

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO.1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BOSE LAKE DAM PIEZOMETRIC DATA
YEARS 2016 TO 2023
CREST

SCALE	PROJECT No.	FIG. No.
NTS	M02341C62	14

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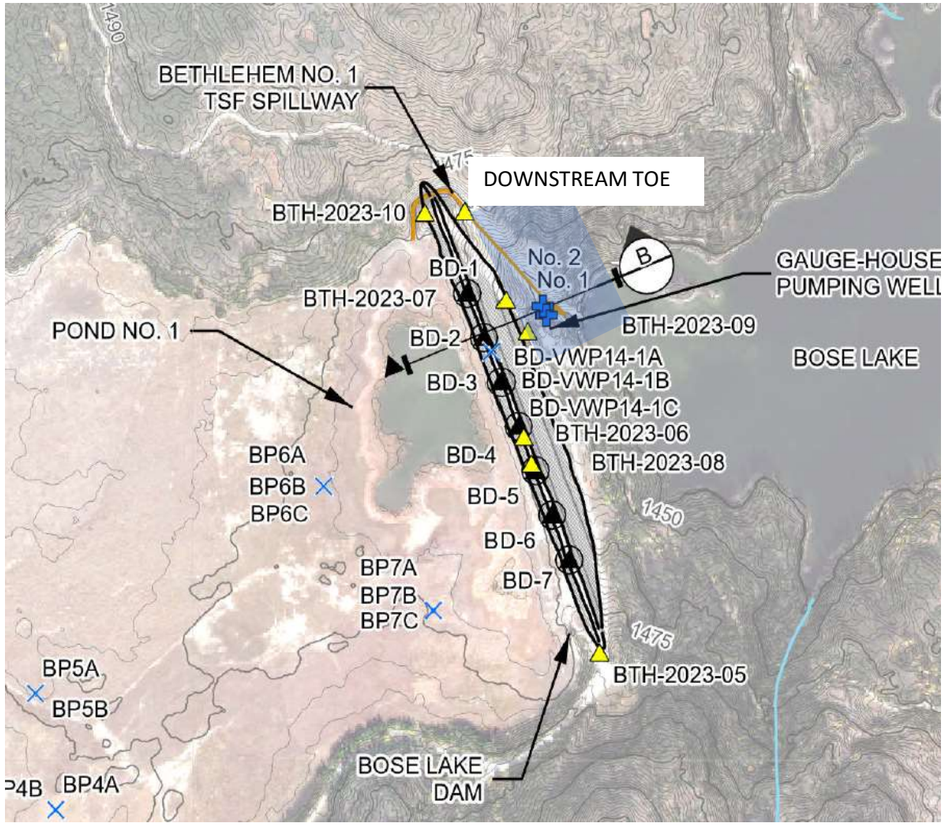
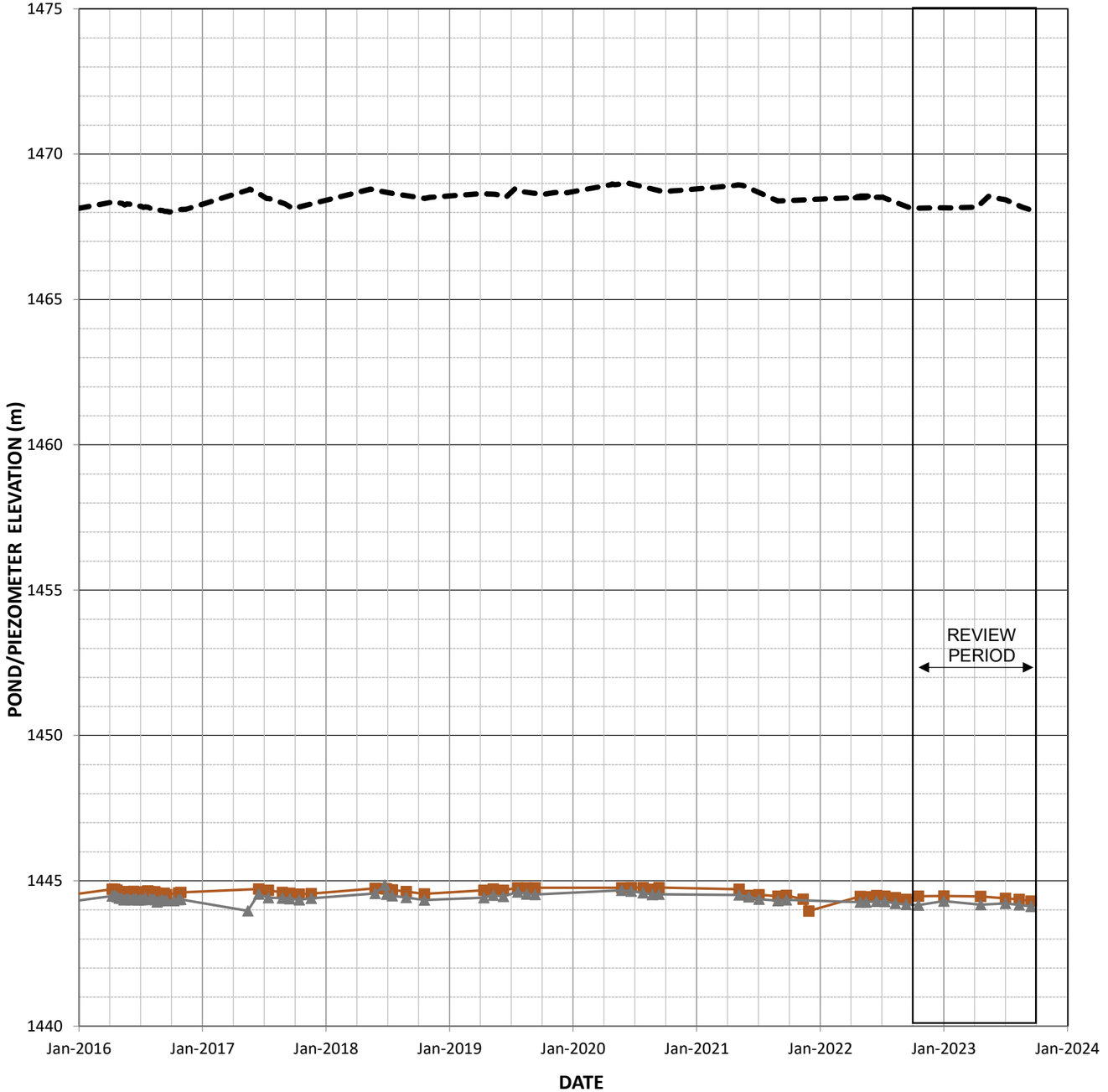


PIEZOMETER ID	2023 NOTIFICATION LEVEL THRESHOLDS VALUE (m)
No. 1	1445.3
No. 2	1445.2



NOTES:

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

LEGEND:

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

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: BETHLEHEM NO.1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: BOSE LAKE DAM PIEZOMETRIC DATA
YEARS 2016 TO 2023
DOWNSTREAM TOE

SCALE	PROJECT No.	FIG. No.
NTS	M02341C62	15

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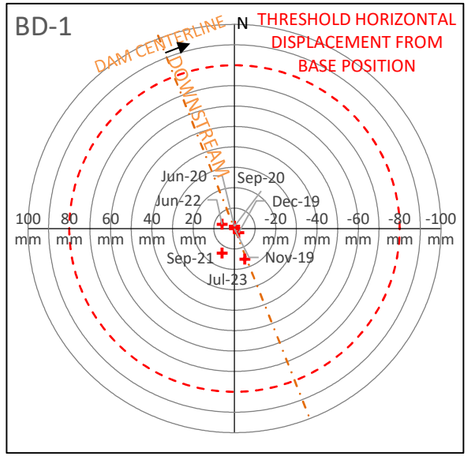
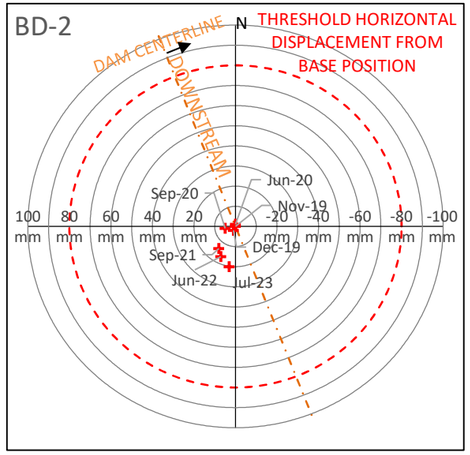
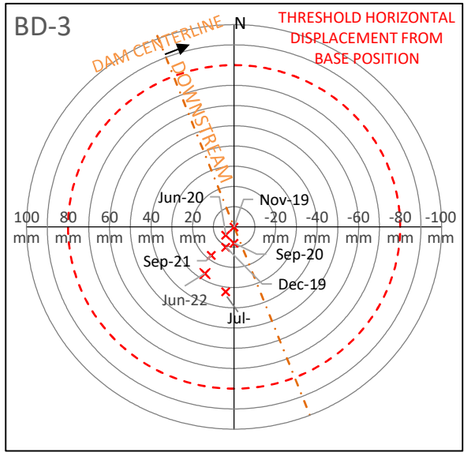
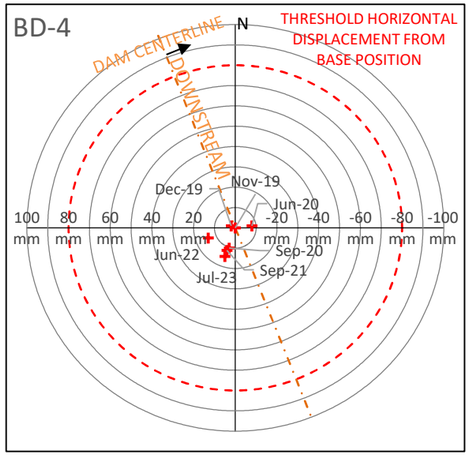
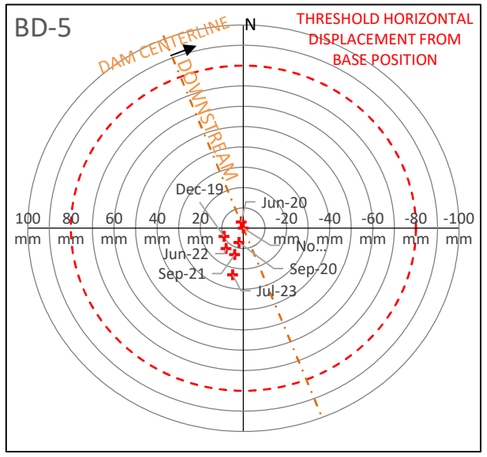
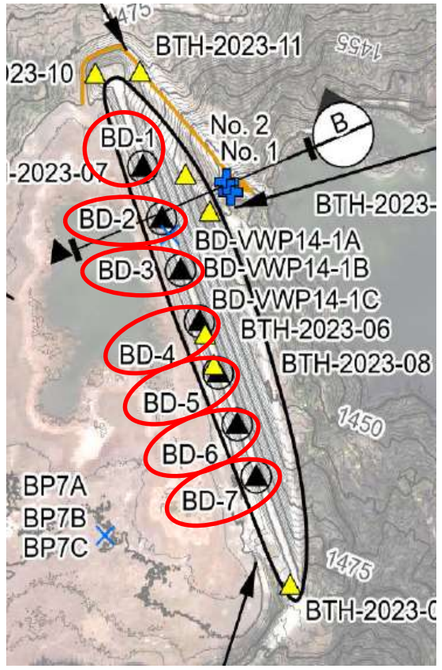


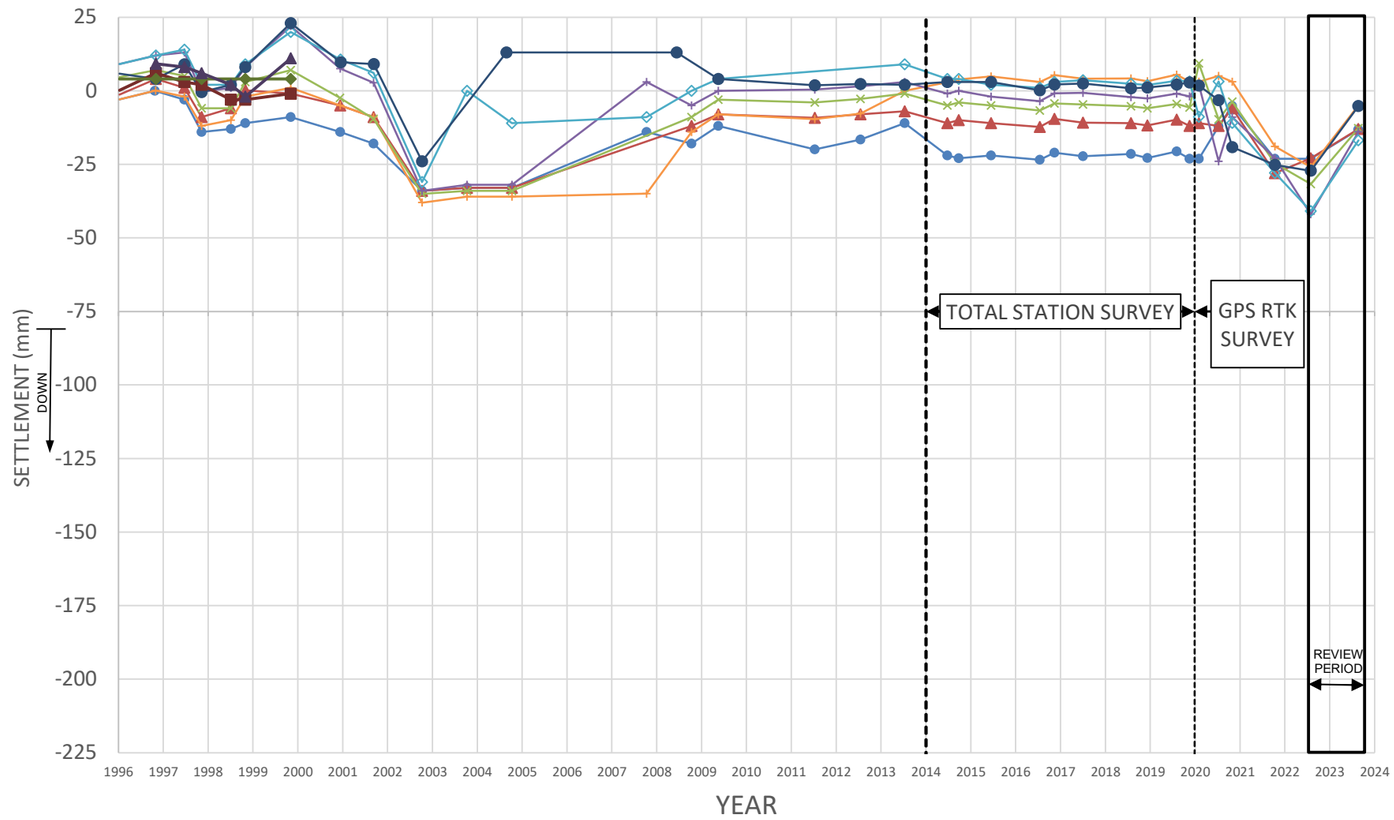


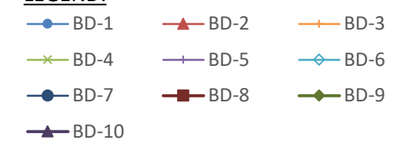


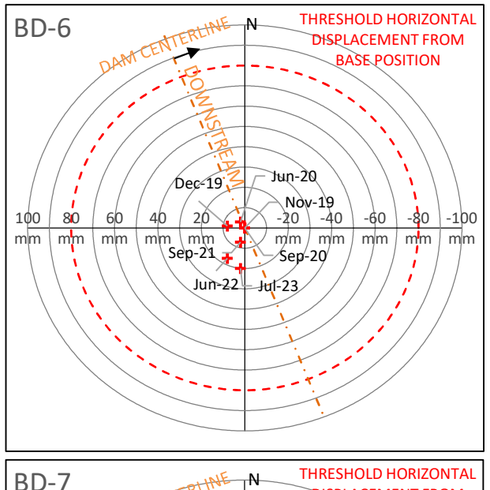


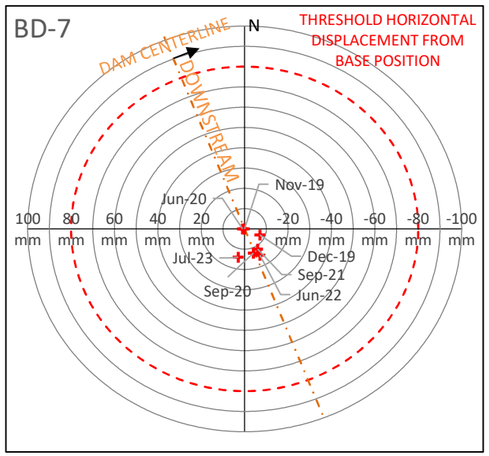












GENERAL NOTES:

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.

CLIENT
Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT
BETHLEHEM NO. 1 TAILINGS STORAGE FACILITY
2023 ANNUAL FACILITY PERFORMANCE REPORT

TITLE
BOSE LAKE DAM
SURVEY MONUMENT READINGS

PROJECT No. M02341C62

FIG. No. 16

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:**	August 10, 2023
Weather:	Rainy	**Inspector(s):**	Rick Friedel, P.Eng. Cheryl Torres, P.Eng.
Freeboard (pond level to dam crest):	10.1 m, based on the July 7th 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 Photo Captions)
Seepage	☐ Yes ☒ No
External Erosion	☐ Yes ☒ No
Cracks	☐ Yes ☒ No (See Photo Captions)
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.
- Runoff from the crest, during thunderstorm in July 18 2023, concentrated and flowed over the downstream slope resulting in an erosion scour. Eroded material deposited material across the mine road, blocking it. The scour does not represent a dam safety risk but crest is to be regraded to prevent progressive erosion.

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). One section of the crest requires regrading to prevent runoff over the downstream slope leading to progressive erosion.

Left and Right Abutments

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

Downstream Slope

Good physical condition and no significant change compared to 2022 AFPR site visit observations (Photo I-A-6). One exception is a recent erosion scour that occurred in July 18, 2023 during a thunderstorm (Photo I-A-8). The damage was caused by concentrated runoff from the crest area. Eroded material deposited and blocked the mine road. This was cleared. KCB recommended the area of the crest where the scour originated needs to be regraded and a berm established to prevent continued erosion. The erosion of the downstream slope does not pose a risk to the overall performance of the dam and should be repaired as part of routine maintenance.

Pre-existing erosion features typically have vegetation growth along the base indicating the ongoing erosion rate, if any, is slow.

Pond No. 1

Pond No. 1, in the center of the impoundment was reported to be dry during the reporting period this was confirmed by the drone survey on September 28, 2023 (Photo I-A-5). The pond area has not been dry during recent periods but was routinely reported as dry, except following freshet, starting in the early 2000s until the freshet of 2011.

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-2023-## refers to 2023 AFPR waypoint shown on Figure 3.
- Photographs were taken during site visit on August 10, 2023 or collected from the aerial drone survey completed by HVC on September 28, 2023.

Photo I-A-1 Overview of reclaimed cycloned tailings beach and impoundment area upstream of Dam No. 1 (BTH-2023-01)

Photo I-A-2 Drone Photo – Vegetated Tailings Beach Upstream of north segment of Dam No. 1 with Trojan TSF in background

Photo I-A-3 Drone Photo – Vegetated Tailings Beach Upstream of mid-segment of Dam No. 1 with Trojan TSF in background

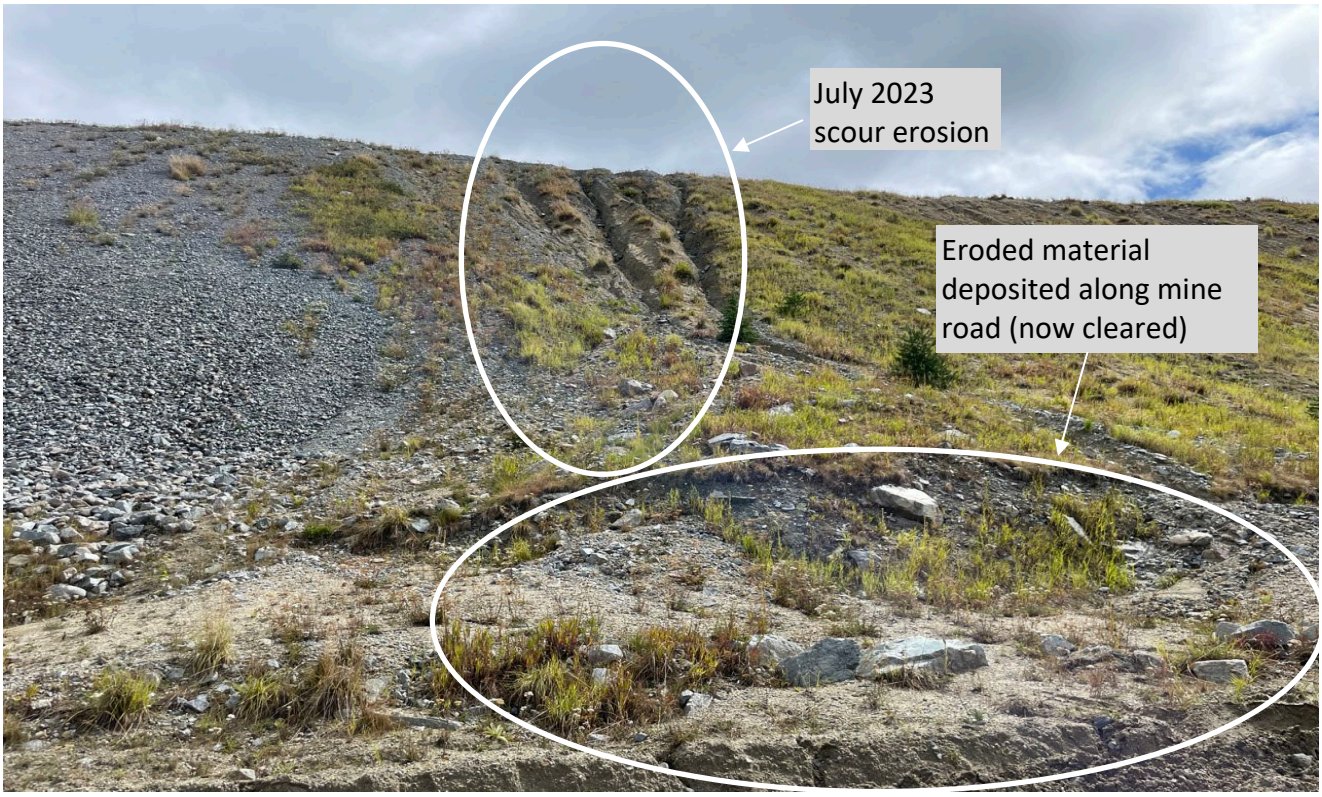
Photo I-A-4 Drone Photo – Vegetated Tailings Beach Upstream of south segment of Dam No. 1 with Trial Pad area in foreground

Photo I-A-5 Drone Photo – Pond no. 1

Photo I-A-6 Upper portion of downstream slope with reclamation cover. (BTH-2023-02)

Photo I-A-7 Overview of downstream slope from mine road. Vegetation cover is well established. Previous erosion areas, covered by rockfill, are holding up well (BTH-2023-03)

Photo I-A-8 Erosion scour that formed during July 2023 thunderstorm when runoff from crest flowed over downstream slope. Regrading of the crest to prevent ongoing erosion has been recommended. (BTH-2023-04)



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:**	August 10, 2023
Weather:	Rainy	**Inspector(s):**	Rick Friedel, P.Eng. Cheryl Torres, P.Eng.
Freeboard (pond level to dam crest):	6.56 m, based on the July 7th 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. No signs of seepage, excessive scour, or displacement were observed along abutments or mine roads that run along dam toe (Photo I-B-3 and Photo I-B-4).

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 lower portion of the dam slope is vegetated (Photo I-B-3 to Photo I-B-5).

Upstream Slope and Tailings Beach

Good physical condition. The tailings surface immediately upstream of the dam is well vegetated. There were no visual issues of concern or indication of recent flooding observed (Photo I-7 to Photo I-B-9).

Pond No. 2

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 and Photo I-B-10).

Spillway Channel and Outlet

Good physical condition and consistent trapezoidal shape. Some vegetation growth (grasses and bushes) was observed along the approach channel (Photo I-B-11). This was cleared as part of routine maintenance after the site visit as shown on Photo I-B-12, provided by HVC. No major obstructions or signs of deterioration were observed at the inlet, along the spillway channel or of the culverts that pass flow below the public road downstream of the dam toe (Photo I-B-13 to Photo I-B-15). The debris boom is secured in place with no observed signs of damage.

Seepage Collection System

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

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 is present and the majority of water discharges as seepage into the spillway channel or lost as evaporation.

SITE VIST PHOTOGRAPHS

LEGEND:

- BTH = Bethlehem Tailings Facility.
- BTH-2023-## refers to 2023 AFPR waypoint shown on Figure 3.
- All photographs taken during the site visit on August 10, 2023.

Photo I-B-1 Overview of dam crest from right abutment (top photo) and from middle of the dam (bottom photo). (BTH-2023-05 and BTH-2023-06)

Photo I-B-2 Overview of dam crest and downstream slope from the crest at the right abutment. (BTH-2023-08)

Photo I-B-3 Left abutment and downstream slope, looking north, with no observation of erosion scours or damage. (BTH-2023-07)

Photo I-B-4 Left abutment and downstream slope, looking south, with no observation of erosion scours or damage. (BTH-2023-07)

Photo I-B-5 Overview of downstream slope and toe area from crest looking downstream from approximately middle of dam crest. (BTH-2023-08)

Photo I-B-6 Decommissioned pumping well and discharge point of underdrain. (BTH-2023-09)

Photo I-B-7 Drone Image – Pond No. 2 and beach upstream of Bose Lake Dam

Photo I-B-8 Overview of Bethlehem No. 2 Tailings Pond and tailings beach. (BTH-2023-08)

Photo I-B-9 Overview of upstream beach, looking towards dam. No sign of erosion or depression was observed. (BTH-2023-08)

Photo I-B-10 Drone Image – Pond No. 2 and spillway inlet area

Photo I-B-11 Spillway inlet and approach channel. Channel is vegetated with grass and bushes. Clearing of vegetation is managed as part of routine maintenance. (BTH-2023-10)

Photo I-B-12 Spillway inlet and approach channel after vegetation clearing.

Photo I-B-13 Spillway channel at transition point between inlet and riprap-lined segment, looking towards north. (BTH-2023-10)

Photo I-B-14 Spillway channel between inlet and riprap-lined segment, after vegetation clearing was completed, photo provided by HVC after site visit.

Photo I-B-15 Riprap lined portion of spillway channel looking towards Bose Lake. (BTH-2023-11)

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:**	September 07, 2023
Weather:	Sunny	**Inspector(s):**	Rick Friedel, P.Eng. Harmit Mehta, EIT.
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.
- A low point was observed in the berm on the upstream side of the crest. This berm is included in the freeboard calculation and KCB recommended the dam survey be checked to confirm this feature is captured and reflected in the freeboard calculation.

SITE VISIT OBSERVATIONS

Crest

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

A low point was observed in the berm on the upstream side of the crest (Photo I-C-7). This berm is included in the freeboard calculation and KCB recommended the dam survey be checked to confirm this feature is captured and reflected in the freeboard calculation.

A diesel pump was stationed on the dam crest near the right abutment (Photo I-C-1). The pump is in place until the outlet pipeline has been cleared of accumulated debris and maintenance completed. The pump was not operating during the site visit but did during freshet when the outlet pipe was partially obstructed.

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 site visit (Photo I-C-1).

Low-level Outlet

The inlet outlet pipe was free of obstruction (Photo I-C-3). HVC replaced the debris boom and upstream vegetation fencing. Both have appeared to reduce accumulation of debris around the outlet.

Spillway

Good physical condition and free of obstruction (Photo I-C-4). No visual signs of riprap degradation (Photo I-C-5 to Photo I-C-6). There was not flow through the spillway during the review period.

Seepage

None observed.

SITE VISIT PHOTOGRAPHS

LEGEND:

- BTH = Bethlehem Tailings Facility.
- BTH-2023-## refers to 2023 Annual Facility Performance Report waypoint shown on Figure 5.
- All photographs taken during the site visit on Sep 7, 2023.

Photo I-C-1 Overview of R3 Seepage Pond. (BTH-2023-12)

Photo I-C-2 R3 Seepage Pond dam crest, no cracking or no sign of distress was observed. (BTH-2023-13)

Photo I-C-3 View of outlet pipe, debris mesh and new debris boom. Clear water was flowing at the time of the site visit. (BTH-2023-14)

Photo I-C-4 View of spillway inlet. Pipeline is related to temporary diesel pump stationed on crest. (BTH-2023-15)

Photo I-C-5 Spillway channel and road crossing at right abutment. (BTH-2023-16)

Photo I-C-6 Spillway channel, looking downstream from crest. (BTH-2023-16)

Photo I-C-7 Low point of the berm along upstream side of dam crest. KCB recommended the dam survey be checked to confirm this feature is captured and has been accounted for in the freeboard calculation. (BTH-2023-17)