Klohn Crippen Berger

Teck Highland Valley Copper Partnership

2021 Annual Facility Performance Report

Highmont Tailings Storage Facility

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March 2022

March 29, 2022

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

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

Dear Mr. Bale:

2021 Annual Facility Performance Report
Highmont Tailings Storage Facility

We are pleased to submit the 2021 Annual Facility Performance Report for the Highmont Tailings Storage Facility, for the period from October 2020 through September 2021.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Pablo Urrutia, P.Eng.
Engineer of Record, Representative
Senior Geotechnical Engineer, Associate

PU/AG:cd

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2021 Annual Facility Performance Report

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EXECUTIVE SUMMARY

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (HVC) to complete the 2021 Annual Facility Performance Report[1] (AFPR) of the Highmont Tailings Storage Facility (TSF) for the period of October 2020 to September 2021. We have also reported on some key events that occurred during the reporting period of this document.

The Highmont TSF, located 8 km southeast of the operating mill, is a reclaimed, inactive facility built in 1980 and operated until 1984. The Highmont TSF is owned by HVC and considered to be in the Closure – Active Care Phase based on the Canadian Dam Association (CDA 2019) definition.

The Highmont TSF Structures

The review covers the following structures, which comprise the Highmont TSF:

- Highmont TSF dams (North, East and South): The TSF retaining structures, composed of glacial till starter dams which were raised with rockfill by the centerline method. Filter zones separate retained tailings and rockfill.
- Seepage recovery pond dams (S1, S2, S3, S5, and S8 Ponds): ponds downstream of the Highmont TSF dams that collect mine-affected =for reclaim back to the impoundment with no off-site discharge. The seepage pond dams are constructed of compacted glacial till with a drainage blanket downstream of a seepage cut-off.

The Highmont TSF has been inactive for more than 35 years. The surface of the dam has been reclaimed and the pond level has been lowered. No significant dam safety incidents have occurred at the facility, including while the facility was active (i.e., while tailings were being deposited). Under the current configuration, the piezometric levels and gradients through the tailings and dam fill are lower than during operation, and the downstream slope has been regraded to a shallower angle (~2.3H:1V to 2.5H:1V), which increased the factor of safety against slope failure and internal erosion.

During the review period, key staff[2] were as follows:

- Mr. Bryan Bale, P.Eng. (HVC Chief Engineer - Tailings) acted in the role of Responsible Tailings Facility Engineer (RTFE) / TSF Qualified Person; and
- Mr. Pablo Urrutia, P.Eng. was the Engineer of Record (EoR), as a representative of KCB.

Activity During the Review Period

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

[1] Past Annual Facility Performance Reports were referred to as Dam Safety Inspections (DSI).
[2] Following the definitions in the Global Industry Standard on Tailings Management (GISTM 2020).

Other than routine maintenance activities, as defined in the Operation, Maintenance and Surveillance (OMS) Manual (HVC 2019), such as clearing weirs of vegetation, there were no major repairs or construction activities completed during the review period.

August Forest Fires

The site was under a temporary evacuation order from August 12 to 17, 2021 due to forest fires in the region. Prior to the evacuation, HVC and KCB prepared a modified monitoring program that prioritized surveillance activities. The forest fires did not reach the site, and there was no impact to the Highmont TSF. While the site was under evacuation order, HVC was able to maintain a small site presence to manage essential site operations (e.g., water management).

November Regional Flooding

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

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

Surveillance Program

The current OMS Manual (HVC 2019) and the Emergency Preparedness and Response Plan (EPRP) (HVC 2019) are suitable for the facility. The OMS Manual was reviewed by HVC and KCB in 2021 with the updated version planned for issue in early 2022.

The Highmont TSF surveillance program is appropriate for an inactive, reclaimed tailings facility which includes:

- visual inspection;
- measured behaviour from piezometers, pond level readings, and survey monuments installed at the facility;
- a Trigger-Action-Response-Plan (TARP); and
- review of surveillance information, once available, by HVC during weekly dam safety meetings and annually by the EoR.

During the review period, surveillance activities were completed as per the OMS Manual (HVC 2019) with one exception: quarterly measurements of seepage flows from the S5 Pond were measured in Q1 2021, only, due to HVC staff turnover. However, visual qualitative monitoring of seepage was included in routine inspections and no unusual conditions were noted.

Highmont TSF Performance

The behaviour of the facility remained consistent with historical patterns; 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 variation in climate. Key observations from the Highmont TSF performance review completed as part of the AFPR are:

- Piezometer thresholds at Highmont TSF have been set based on historic performance and trends:
  - One piezometer (P-E) exceeded the threshold for the first (i.e., Notification) level of the TARP. This piezometer response marginally exceeded its threshold (by ~0.28 m) and is not related to performance or design compliance concerns.
  - All piezometers are measuring levels below those assumed in design analyses.
  - A subsequent reading of P-E, about two months after the exceedance was recorded, was 1.65 m below the instrument threshold.
- No downstream horizontal deformation trends are present, based on survey monuments.
- There are no indications of unacceptable behaviour at the dams, based on visual inspections by the HVC dam inspector, the EoR, and others working in the area.
- Pond levels and seasonal fluctuations were similar to historical trends and less than the larger freshet events from 2017 and 2018. Pond level rise during freshet was typical, despite precipitation being below average, which suggests freshet was primarily driven by snowmelt.
- Minimum freeboard measured at the Highmont TSF during the review period was 6.1 m, which greatly exceeds the freeboard required during the Inflow Design Flood (IDF) to accommodate wave run-up and wind (0.3 m).

Design Basis

Consequence classification is not part of HVC's tailings management governance, and they have instructed KCB not to include it when reporting on the Highmont TSF. Potential consequences from credible failure modes are managed through a rigorous risk management process. To support this approach, HVC is in the process of adopting design loading for earthquake and flood scenarios equivalent to an Extreme consequence classification (CDA 2019) for all tailings facilities. This approach has the following benefits:

- It meets or exceeds the Health, Safety and Reclamation Code (HSRC) (EMLCI 2021a) requirements.
- It aligns with Teck's goal to eliminate any risk for loss of life.
- It is consistent with the Global Industry Standard on Tailings Management (GISTM 2020), which supports evolving beyond the conventional consequence classification system.

Highmont TSF is already designed to manage the Probable Maximum Flood (PMF) with adequate freeboard. The design earthquake for the facility), a 2,475-year return period seismic event, is based on HSRC (EMLCI 2021a) but the Highmont TSF dams can accommodate the extreme loading event (i.e., 10,000-year).

Recommendations

Table 1 summarizes dam safety recommendations that were identified during past AFPRs, and their current status. During the review period, one of the four recommendations from previous AFPRs was closed (shown in *italics*). HVC has scheduled the completion of the other three outstanding recommendations for 2022. Out of the 29 outstanding recommendations from the most recent DSR (SRK 2019), 27 were addressed during the review period, and the remaining 2 are scheduled for completion in 2022.

Table 2 summarizes three new recommendations identified during the 2021 AFPT for the Highmont TSF and one new recommendation identified for the S3 Pond. The recommendations were ranked as Priority 3 or Priority 4.

- The recommendations at the Highmont TSF are related to modifications to the existing surveillance program, and for HVC to review the risk of spillway channel maintenance during floods less than the IDF.
- The recommendation for S3 Pond is to resolve uncertainty regarding potential liquefaction of foundation, during the earthquake design ground motion (EDGM).

Table 1 Previous Recommendations Related to Facility Performance – Status Update

ID No.	Performance Area	Recommended Action	Priority[1]	Recommended Deadline
HD-2017-01	Flood Management	HVC should modify the spillway channel to pass the peak spillway design outflow beneath the access road or regrade the road surface so that water that flows over the road will report to the downstream spillway channel.	3	Q4 2020 (Open – HVC Revised Target Date Q2 2022)
HD-2018-02	*Flood Management*	*Update flood routing assessment for Highmont TSF and associated seepage ponds based on the most recent site wide hydrology information for consistency and to confirm compliance.*	*3*	*Q3 2019 (CLOSED)*
S2-2019-01	Flood Management	S2 Pond spillway channel profile has been changed due to the temporary access over the channel. Original channel profile/capacity should be restored.	3	Q1 2020 (Open – HVC Revised Target Date Q4 2022)
S5-2018-02	Flood Management	To accommodate the temporary blocking of the S5 Pond spillway during freshet, raise the dam crest so that the IDF (100-year 72-hour duration) can be stored within the reservoir, assuming no pumping is required. (Take into consideration, HD-2018-02)	2	Q3 2021 (Open – HVC Revised Target Date Q2 2022, following results from HD-2018-02) Status Update: HVC is planning to level dam crest low point to El. 1452.2 m to increase flood attenuation capacity in the facility. Additional pumping capacity required to manage IDF has been included in OMS Manual. Although, this system still relies upon pumping, IDF requirements will be met so recommendation can be closed after crest is levelled-up.

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 2021 Recommendations Related to Facility Performance

ID No.	Applicable Reg. or OMS Reference	Recommended Action	Priority[(1)]	Recommended Deadline
Highmont TSF				
HD-2021-01	Surveillance	KCB recommends HVC update the OMS Manual monitoring frequency to monthly for piezometers P-E, P-G and P-K, to assess recent change trend in piezometric levels.	3	Q2 2022
HD-2021-02	Surveillance	HVC should shift the Highmont TSF transducer (currently in the spillway channel) to the upstream (i.e., impoundment side) of the spillway culverts, so that the transducer measures a reliable pond level for reliable tracking of freeboard during flood events and is independent of whether there is flow out the gate or not.	4	Q4 2022
HD-2021-03	Design	During the 2022 risk assessment review, assess whether current controls are appropriate to manage localized scour/erosion damage to the spillway channel, downstream of the dam toe. Alternatively, assess if additional controls to reduce maintenance for flood events greater than ~200-year return event are required.	4	Q4 2022
Seepage Recovery Ponds				
S3-2021-01	Physical Stability	Due to uncertainty related to potential liquefaction of foundation, HVC to develop and implement risk controls to confirm adequate performance of the S3 Pond dam during the design seismic event (2,475-year return period).	3	Q4 2022

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 exclusive use of Teck Highland Valley Copper Partnership (Client) for the specific application to the 2021 Dam Safety Support Project, and it may not be relied upon by any other party without KCB's written consent.

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. KCB makes no warranty, express or implied.

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.

TABLE OF ABBREVIATIONS

AFPR	Annual Facility Performance Report
CDA	Canadian Dam Association
DSR	Dam Safety Review
EMLCI	Energy, Mines, and Low Carbon Innovation
EoR	Engineer of Record
EPRP	Emergency Preparedness and Response Plan
FOS	Factor of safety
GISTM	Global Industry Standard on Tailings Management
HVC	Teck Highland Valley Copper Partnership
IDF	Inflow Design Flood
KCB	Klohn Crippen Berger Ltd.
OMS	Operation, Maintenance and Surveillance
PMF	Probable Maximum Flood
QP	TSF Qualified Person
RTFE	Responsible Tailings Facility Engineer
TARP	Trigger-Action-Response-Plan
TSF	Tailings Storage Facility

1 INTRODUCTION

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (HVC) to complete the 2021 Annual Facility Performance Report[3] (AFPR) of the Highmont Tailings Storage Facility (TSF) on the Highland Valley Copper Mine (HVC Mine) site. The Highmont TSF is an inactive facility constructed in 1980 and operated from 1980 to 1984. The AFPR includes the performance review of the retaining dams and seepage recovery pond dams, summarized in Table 1.1 and shown on Figures 1 and 2, for the review period from October 2020 through September 2021.

Table 1.1 Highmont TSF Structures

Facility	Structure	Function
Highmont TSF	North Dam	Retain tailings around perimeter of the impoundment
	East Dam	
	South Dam	
Highmont Seepage Recovery Ponds	S1 Pond Dam	Stores seepage from Highmont TSF downstream of the North Dam
	S2 Pond Dam	Stores seepage from Highmont TSF downstream of the North Dam
	S3 Pond Dam	Stores seepage from Highmont TSF downstream of the South Dam
	S5 Pond Dam	Stores seepage from Highmont TSF downstream of the East Dam
	S8 Pond Dam	Stores seepage from Highmont TSF downstream of the North Dam

The Highmont TSF has been reclaimed and HVC continues ongoing surveillance of the site including instrumentation monitoring, environmental sampling, visual inspections and maintenance activities. Under this level of site presence, the Highmont dams are considered to be in the active care closure phase as defined by the Canadian Dam Association (CDA 2019).

The AFPR scope of work consisted of:

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

The site visit was completed by KCB representatives Mr. Pablo Urrutia, P.Eng. and Mr. Delton Breckenridge on July 29, 2021. During the site visit, the weather was sunny and smoky, but this did not impede the site visit.

[3] Past Annual Facility Performance Reports were referred to as Dam Safety Inspections (DSI).

During the review period, Mr. Bryan Bale, P.Eng. (HVC Chief Engineer - Tailings) acted in the role of Responsible Tailings Facility Engineer (RTFE) / TSF Qualified Person, and Mr. Pablo Urrutia, P.Eng. was the Engineer of Record (EoR), as a representative of KCB. These roles are consistent with the definition in the Global Industry Standard on Tailings Management (GISTM) (GISTM 2020).

HVC has three primary permits for the Highmont TSF, as listed below:

- Permit M11 – Approving Work Systems and Reclamation Program. Department of Mines and Petroleum Resources, dated January 20, 1970, last amended (regarding Highmont) on July 16, 1998.
- Permit PE 376 (09) – Issued under the provisions of the Waste Management Act. British Columbia Ministry of Water, Land, and Air Protection, dated January 7, 1971 and last amended on May 29, 2003.
- Permit No. M55 – Reclamation Permit. Department of Mines and Petroleum Resources dated July 17, 1979 and amalgamated with Permit M11 on July 16, 1998 (EMPR 2019).

2 FACILITY DESCRIPTION

2.1 Overview

The HVC Mine Site is located near Logan Lake, approximately 45 km south of Kamloops, in the British Columbia Interior. The Highmont TSF is located 8 km southeast of the operating mill; refer to Figure 1. The facility was operated from 1980 to 1984 and stores an estimated 27.5 Mm^3 of tailings. Under existing conditions, a pond is present continuously in the impoundment, albeit of reduced size relative to operations. Layout of the Highmont TSF is shown on Figure 2. Typical geometry and dimensions of the dams are summarized in Table 2.1.

Highmont TSF

- The Highmont dams comprise compacted glacial till starter dams which are founded on competent granodiorite bedrock or shallow glacial till and glaciofluvial sand and gravel outwash deposits overlying bedrock (refer to Figure 2.1).
- Dam crest raises were done following the centreline method with a glacial till core zone and a downstream rockfill zone. The dams were designed and built with 1.5H:1V downstream rockfill slopes, which were later shallowed as part of reclamation (~2.3H:1V to 2.5H:1V).
- Under existing conditions, at the normal range of pond levels, the minimum beach width is more than 290 m along the East Dam crest, more than 360 m along North Dam crest, and more than 370 m along the South Dam crest.

Seepage Recovery Ponds

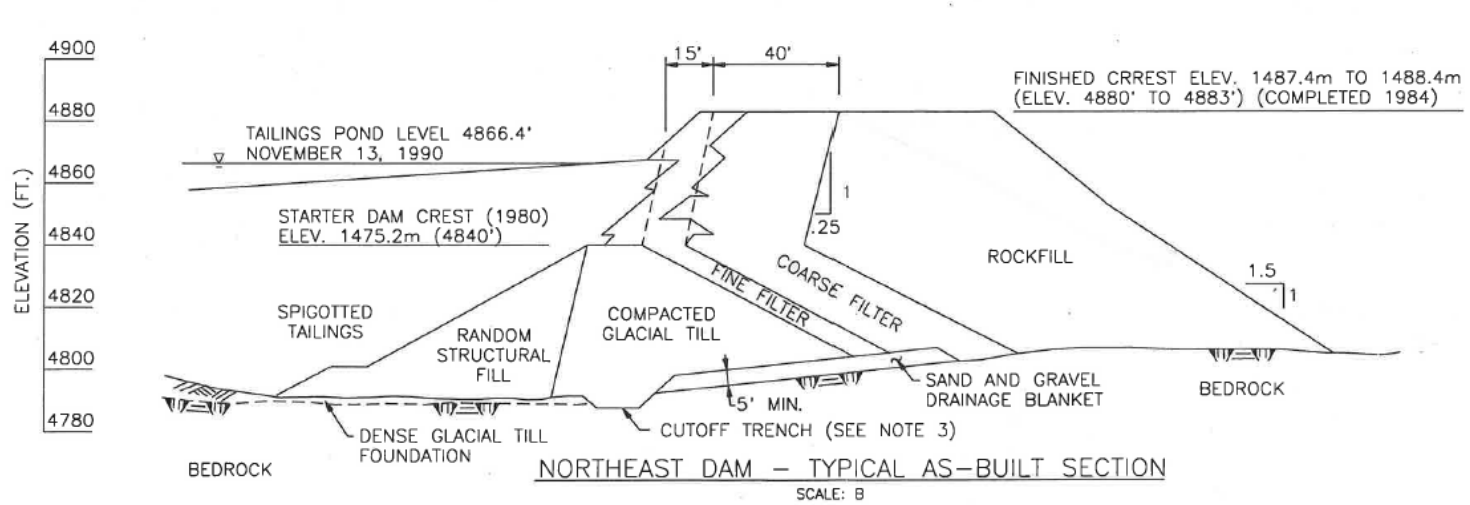
- Historically, there were seven seepage recovery ponds located around the perimeter of the Highmont TSF (S1, S2, S3, S4, S5, S8 and S9) to collect seepage from the TSF and runoff from the local area. The dams at S4 and S9 have been decommissioned by breaching.
- The dams are constructed of compacted glacial till with a drainage blanket downstream of the seepage cutoff, and with a sand and gravel erosion blanket on the upstream and downstream faces. The dams are founded on glacial till (refer to Figure 2.3, and Figure 2.4).
- In general, water from the seepage recovery ponds is diverted to the Highland Mill for reclaim via S1 Pond (refer to Figure 2.3). Details of pumping operations, pipelines and other water management structures in these ponds are discussed in Section 4.1.

Table 2.1 Summary of Approximate Dam Geometry

Dam	Dam Raise Construction Method	Crest Elevation (m)	Maximum Height (m) [2]	Crest Length (m)	Minimum Crest Width (m)	Downstream Slope	Upstream Slope
Highmont Dams							
North Dam	Centreline	1487	35	1200	30	2.5H:1V	n/a
East Dam	Centreline	1487	30	1200	15	2.3H:1V	n/a
South Dam	Centreline	1487	35	1300	9	2.3H:1V	n/a
Seepage Recovery Pond Dams							
S1 Pond Dam	n/a	1445	9.1	60	10	2H:1V [3]	3H:1V
S2 Pond Dam	n/a	1459	4	140	4	2.2H:1V [3]	3H:1V
S3 Pond Dam	n/a	1459	3.4	150	4	3H:1V	3H:1V
S4 Pond Dam	Decommissioned by breaching						
S5 Pond Dam	n/a	1451.2 to 1452.2	6.3	340	3	1.7H:1V [4]	3H:1V
S8 Pond Dam	n/a	1452	5	120	9	2H:1V	Unknown
S9 Pond Dam	Decommissioned by breaching						

Notes:
1. Dimensions are estimated from 2014 LiDAR data unless otherwise noted.
2. Height measured as the vertical distance between downstream toe and crest.
3. The downstream slope is steeper than the 2.5H:1V in the design report (KL 1980a). However, as per KCB (2015b), the existing condition of the dams meet design FOS criteria, required by HSRC, for global slip surfaces which would result in an uncontrolled release of the reservoir (Section 7.3.2).
4. The downstream slope is steeper than the 2.5H:1V in the design report (KL 1980a). However, the S5 Pond Dam has performed well since the most recent raise in 2015, with no reported observations of structural instability (e.g., cracking, slumping) which is expected for a structure comprised of compacted fill founded on Glacial Till.

Figure 2.1 Typical Cross Section of Highmont TSF North Dam (KC 1996)



Note: KCB (1996) divided the North Dam into Northwest and Northeast dams, hence the "Northeast Dam" label in Figure 2.1.

Figure 2.2 Cross Section of Highmont TSF North Dam Existing Conditions used for Stability Assessment

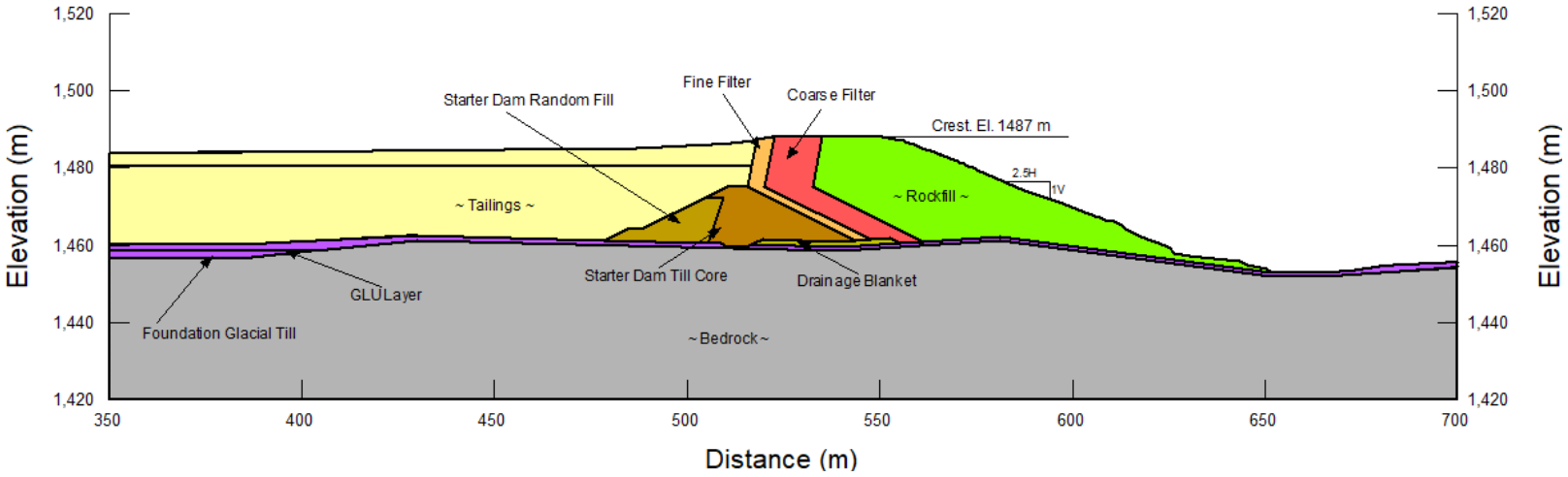


Figure 2.3 Typical Cross Section of S1 Seepage Recovery Pond Dam (KL 1980b)

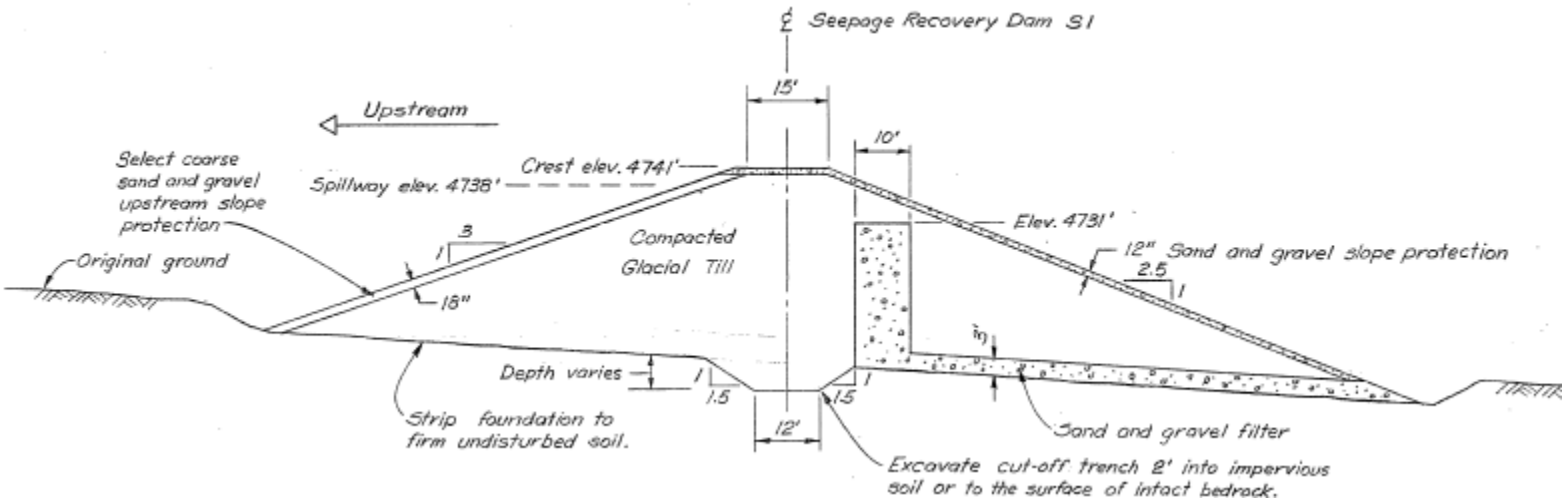
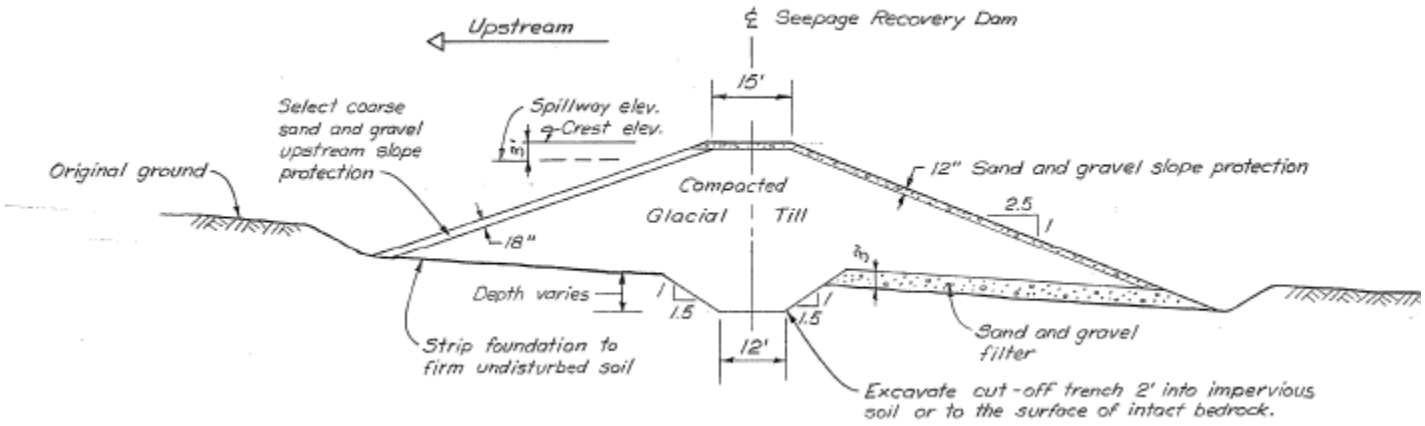


Figure 2.4 Typical Cross Section of S2, S3, and S5 Seepage Recovery Pond Dams (KL 1980b)



3 ACTIVITIES DURING REVIEW PERIOD

During the review period, the Highmont TSF was maintained within the design basis and specified operational conditions of the approved design.

Other than routine maintenance activities, as defined in the OMS Manual (HVC 2019), (e.g., vegetation removal from spillways, vegetation removal from Seepage Pond 3 weir), there were no major repairs or construction activities completed during the review period.

4 WATER MANAGEMENT

4.1 Overview

The flow schematic for Highmont TSF is shown in Figure 6.

4.2 Climate

HVC provided climate data from the L-L Dam Weather Station (El. 1186.0 m), for the 2021 AFPR review period, for KCB to review. KCB adjusted the L-L Dam Weather Station data and Historical Average Lornex Synthetic Record data to the Highmont/Bethlehem and Trojan Area, using the adjustment factors provided in Golder (2021). The adjusted data over the review period was then compared to typical average values, refer to Appendix II-A. In addition, KCB downloaded the Kamloops Pratt Road station (El. 729.0 m) climate data from Environment Canada and was provided the Shula Weather Station (El. 1208 m) data by HVC, to review and compare precipitation trends against the L-L Dam Weather Station data. The Kamloops Pratt Road Weather Station was used for comparison rather than the Kamloops Airport Station (El. 345.3 m) as the elevation at the Pratt Road Station is closer to L-L Dam Weather Station (El. 1186.0 m).

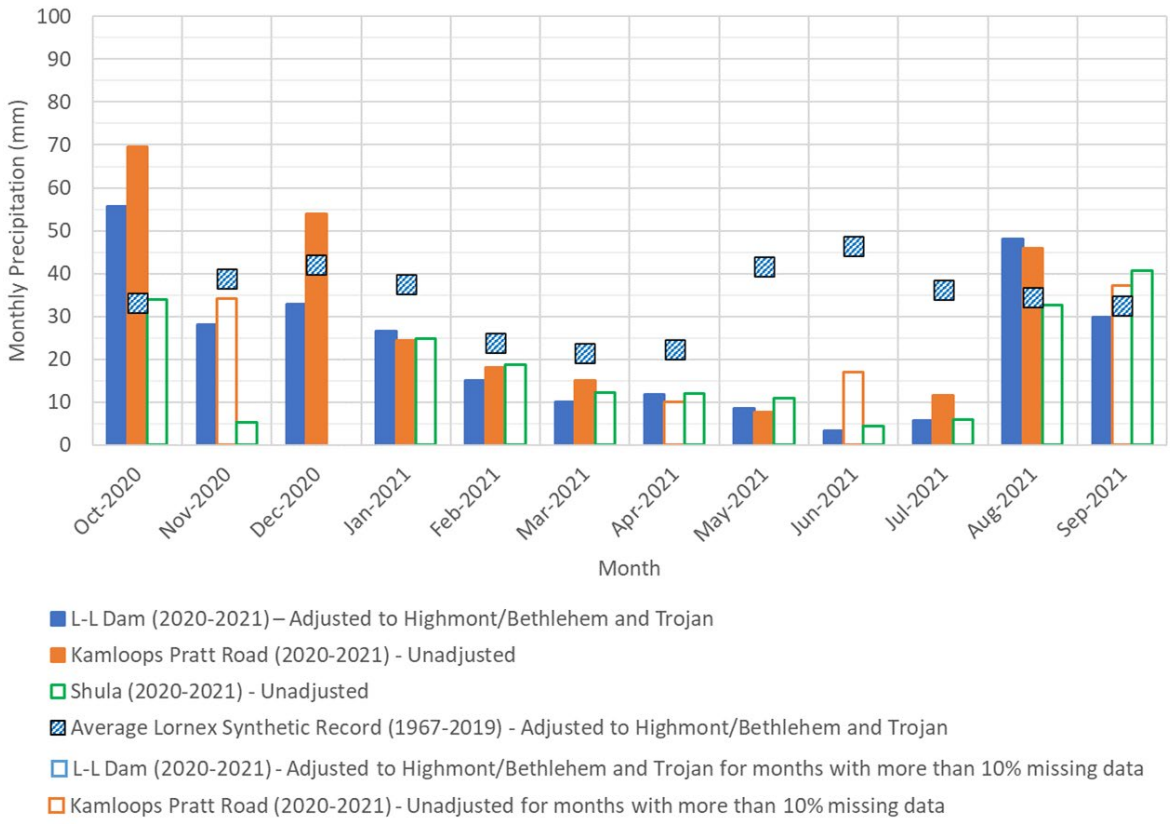
The monthly precipitation record for the reporting period is shown in Figure 4.1. The following observations are noted for the reporting period:

- All storm events during the review period were less than the 10-year return period rainfall event (40 mm in 24 hours). The largest 24-hour rainfall events measured at the L-L Dam Weather Station during the review period, were: 23.7 mm on October 23, 2020; 16.2 mm on December 21, 2020; and 18.5 mm on August 16, 2021.
- In Figure 4.1, all months, except for October 2020 and August 2021 reported 9% to 93% decreases relative to average precipitation. October 2020 precipitation increased 67% relative to the historic normals; August 2021 precipitation increased 40%.
- The L-L Dam Weather Station database included some gaps in 2020 measurements. HVC managed to improve the monitoring program and, as Figure 4.1 indicates, there were no data gaps in the 2021 measurements. In addition, consistency in trends between the Kamloops Pratt Road Station, the Shula Weather Station data for 2021, and the L-L Weather Station provides confidence in the L-L Weather Station data.
- Snowpack depth measurements, from the Highland Valley Station (El. 1268 m), indicate snow melted during April 2021, and was gone by May 1st. In comparison, the HVC site-wide water balance assumes 30% of snowmelt occurs in March and 70% in April (Golder 2020a).
- Figure 4.2 shows a comparison between snow water equivalent (SWE) and temperature at the HVC site from January to June 2021. The following observations are inferred from these data:
  - The daily temperature recorded between January and June 2021 is within the historical monthly average records (between 2000 and 2019).

- The snowpack was depleted over a period of three weeks (April 9 to April 29), which is a quicker rate than the forecast snowmelt pattern from the HVC site-wide water balance, which is based on Golder (2020a).
- The rise in temperature above 0°C in April coincides with the snowmelt period manually recorded at the Highland Valley station.
- Rain was not a major factor in 2021 snowmelt, as the maximum daily precipitation recorded close to the snowpack depletion period is less than 6 mm/day.

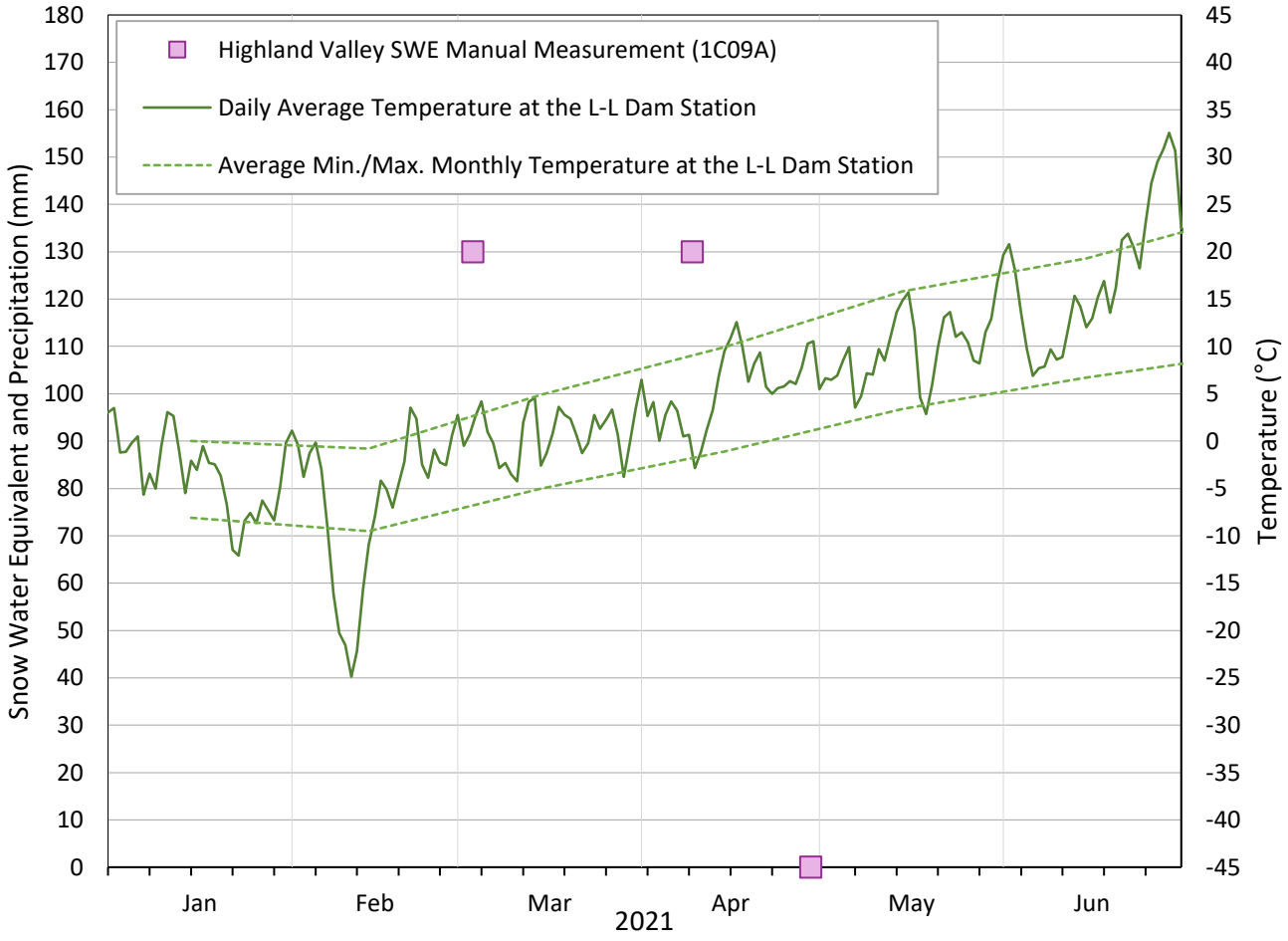
- Seasonal rise and fall of pond levels is associated with freshet. In 2021, pond levels dropped in May, coincident with completion of snowmelt, which is consistent with historic trends (Figure 5.1). Rainfall measured from March through May, when pond levels were rising, was approximately 35% of the historical average during that same period which suggests the majority of the 2021 freshet was related to snowmelt.

Figure 4.1 Monthly Precipitation During Review Period



Note:
1. The Shula weather station data used for this comparison only included monthly values (i.e., no daily data) and thus, KCB was not able to assess the completeness of the dataset.

Figure 4.2 Temperature Records and Measured Snowpack between January and June 2021



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

4.3 Water Balance

HVC manages and tracks the annual water balance for the Highmont TSF. Table 4.1 summarizes annual inflows and outflows, provided by HVC, and Figure 4.3 plots the Highmont Pond volume from 2015 through 2021. The water balance is based on simplified modelling results and therefore the values should be treated as indicative only.

The balance indicates a small reduction in pond volume during 2021 (i.e., outflows > inflows) which is consistent with pond levels at the end of 2021 which were slightly lower but similar to levels at the end of 2020 (Section 5.3).

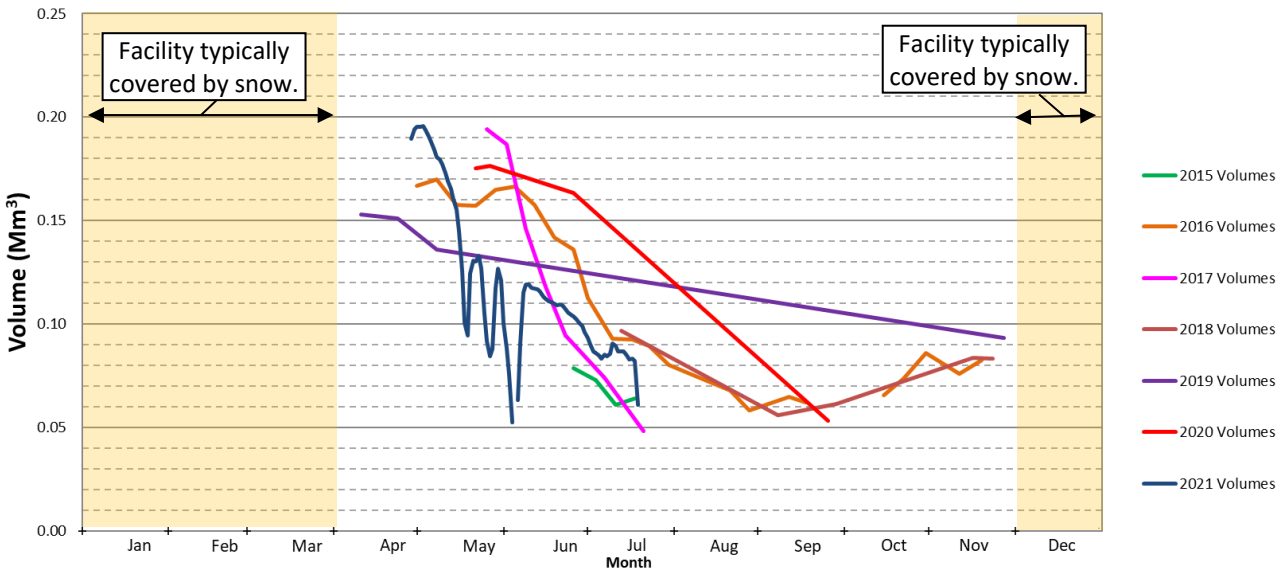
During the review period, there were no surface water discharges from the Highmont TSF directly to the environment. Mill water reclaim (through S1 Pond), evaporation, and entrainment are the major sources of water loss. Inflows to the seepage recovery ponds are stored and/or directed to the Highmont TSF or S1 Pond (Figure 6). Annual climate fluctuations have the greatest influence on the Highmont TSF pond volume changes. Pond volumes are typically decreasing except during freshet (Figure 4.3). The magnitude of freshet typically has the greatest impact on annual pond volume change.

Table 4.1 Annual Water Balance for Highmont TSF

Item	Volume in 2021[(1)] (m^3)
Inflows	
Direct precipitation and Runoff	188,100
Groundwater	16,800
Total inflow:	*204,900*
Outflows	
Seepage	106,000
Evaporation	104,800
Total outflow:	*210,800*
Balance	
Balance (inflow minus outflow)	-5,900

Notes:
1. Values received from HVC have been rounded to the closest 100 m^3.

Figure 4.3 Highmont TSF Pond Volumes – 2015 to 2021



Note:
1. Volumes not shown for pond elevations less than the pond elevation during 2014 Lidar survey (El. 1480.2 m).
2. 2021 volumes were calculated based on water levels measured at the Highmont TSF Spillway transducer. Refer to Section 5.3 for further discussion on the limitations of this data.

4.4 Flood Management

The flood management structures at the Highmont TSF, applicable design criteria and flood details are summarized in Table 4.2.

Flood routing updates, based on the most recent hydrology (Golder 2021), were completed for the Highmont TSF and seepage recovery ponds in early 2022. This closes recommendation HD-2018-02 made by KCB (2019), and several recommendations made by SRK (2019) in the most recent DSR. The conclusions from the study, as well as additional discussion regarding each structure, is presented below.

Highmont TSF

Highmont TSF can safely route the probable maximum flood (PMF) and meet the minimum flood freeboard required by the Health, Safety and Reclamation Code (HSRC) (EMLCI 2021a). This exceeds the HSRC requirement for this facility of routing the inflow design flood (IDF) (1/3 between 1000-yr and PMF).

Based on historical records, pond levels at Highmont TSF have not exceeded the normal freeboard requirements updated in the 2022 assessment (KCB 2022a).

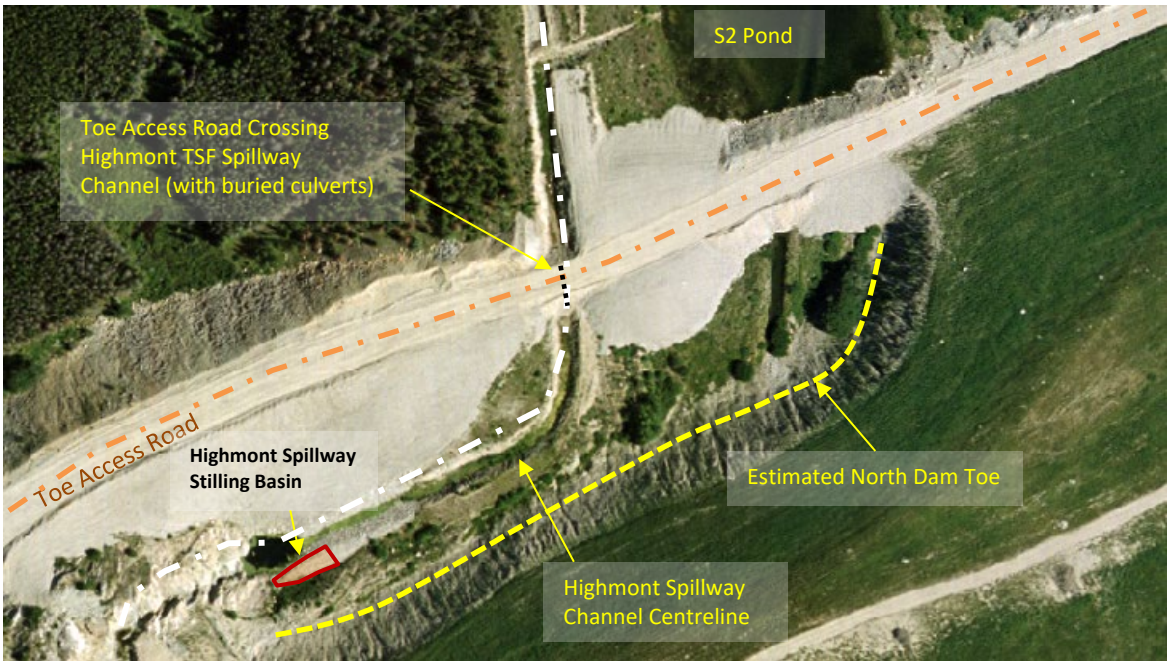
Highmont TSF Spillway Downstream of Dam Toe

KCB (2022a) reviewed the Highmont TSF riprap sizing and concluded the following:

- At the time of design and construction, the riprap design criteria for the Highmont TSF Spillway was aligned with industry requirements and design standards (200-yr return period). The original design intent for the structure, as stated in KC (1994) was:
  - the spillway control sections are designed to pass the PMF; and
  - downstream from the control sections, some damage to the spillway channel under the PMF would be expected, and subsequence maintenance works could be required.
- Design standards have continued to evolve. KCB (2022a) assessed the spillway D_{50} riprap requirements under the IDF and PMF and concluded that the majority of the Highmont TSF spillway erosion protection is adequately sized to convey the updated IDF and PMF peak flows. However, there are two segments of the channel (stilling basin and downstream of North Dam toe access road) where the riprap could be compromised during the IDF and PMF (Figure 4.4). This is consistent with KC (1994).
- Potential scouring of the stilling basin area does not pose a risk to the Highmont TSF dam as the stilling basin is set back about 40 m from the dam, which is built of rockfill and thus not susceptible to damage from pooling water. Local scouring of the glacial till, between the dam toe and the stilling basin, may occur during the IDF and PMF, and could have a measurable impact on the toe of the dam that could require maintenance by HVC.

- KCB has made a recommendation herein (Table 8.2.) for HVC to determine, during the 2022 risk assessment review, if current controls are appropriate to manage localized scour/erosion damage to the spillway channel or whether additional controls are required (e.g., increased rip rap size or modifications to the channel) for flood events greater than ~200-year return event.

Figure 4.4 Potential Flood Zone Along North Dam Toe Due to Access Road



Seepage Recovery Ponds

- S1 Pond, S2 Pond and S8 Pond: These three facilities can safely route their inflow design floods (IDFs) and meet the minimum flood freeboard required by HSRC (EMLCI 2021a); refer to Table 4.2.
- S3 Pond: This facility can manage the IDF (Table 4.2) based on the following operating conditions which are stated in the ongoing review of the OMS Manual:
  - a pump trigger elevation set to 1456.5 m; and
  - a total pumping rate capacity of 50 L/s.
- S5 Pond: Based on the most recent flood routing (KCB 2022a), the following are required for the S5 Pond to manage the IDF (Table 4.2):
  - pump trigger elevation set to 1450.8 m;
  - total pumping rate capacity of 100 L/s; and
  - S5 Pond dam crest at El. 1452.2 m.

- HVC has already included the S5 Pond pump operational controls (trigger elevation and required pumping rate capacity) in the ongoing OMS Manual update, which includes mobilizing a pump and stationing it at S5 Pond to increase flood routing capacity. This pump is demobilized from the site during winter when flood risks are significantly reduced. In addition, HVC has scheduled the work to level up the S5 Pond crest from it's current configuration (crest between El. 1451.2 m and 1452.2 m) to 1452.2 m in Q2 2022.

Table 4.2 Inflow Design Flood Requirements for Highmont TSF and Seepage Recovery Ponds

Facility	Routed or Stored (Outflow)	Spillway Type	Inflow Design Flood (Note 1)	Design Event (Note 2)	Pumping Rate Required During Design Event (Note 2)	Peak Design Flood Level (m) (Note 2)	Peak Design Outflow (Note 2)
Highmont TSF	Routed	Open channel	1/3 between 1000-yr and PMF	24-hour PMF (Spring ROS = 310 mm)	N/A	1483.1	13,200 L/s
S1 Pond	Routed	Open channel to pipe	Between 100-yr and 1000-yr	100-yr, 24-hour (Spring ROS = 116.7 mm)	25 L/s (To Highmont TSF)	1444.0	400 L/s
S2 Pond	Routed	Open channel	Between 100-yr and 1000-yr	100-yr, 24-hour (Spring ROS = 116.7 mm)	10 L/s (To S8 Pond)	1458.3	170 L/s
S3 Pond	Stored	None (plugged)	1/3 between 1000-yr and PMF	1/3 between 1000-yr and PMF, 72-hour (Spring ROS = ~321 mm)	50 L/s (To Highmont TSF)	1459.3	10 L/s
S5 Pond	Stored	None (plugged)	Between 100-yr and 1000-yr	100-yr, 24-hour (Spring ROS = 116.7 mm) (Note 3)	100 L/s (To Highmont TSF)	1451.7	50 L/s
S8 Pond	Routed	Pipe Outlet	100-yr	100-yr, 72-hour (Spring ROS = 116.7 mm)	10 L/s (To S1 Pond)	1451.3	150 L/s

Notes:

1. As discussed in Section 7.1, Teck have instructed KCB to no longer report on consequence classification, as defined by CDA (2019), for tailings storage facilities. The IDF for Highmont TSF and seepage recovery ponds were originally defined to meet equivalent requirements under HSRC (EMLCI 2021a).
2. Per KCB (2022a).
3. KCB (2022a) recommends that the design event for S5 Pond be updated to the 72-hour duration 100-year event, rather than 24-hours, as the facility relies on pumping only for flood management.

5 REVIEW OF MONITORING RECORDS AND DOCUMENTS

5.1 Monitoring Plan Compliance

The Operation, Maintenance and Surveillance (OMS) Manual (HVC 2019) was reviewed during the review period and a revised document is planned to be issued in early 2022. This was a routine update to the OMS Manual which included revisions to align with the most recent industry guidance documents (MAC 2019).

The Highmont TSF surveillance program is appropriate for an inactive, reclaimed tailings facility which includes visual inspection, measured behaviour, routine performance reviews, and a Trigger-Action-Response-Plan (TARP). The TARP includes four levels which represent conditions of potentially increasing concern ranging from a routine engineering review, design assumption deviation up to initiation of the ERP. At Highmont, there were no exceedances of any level of the TARP during the review period, except for one piezometer (P-E) which exceeded its threshold value (refer to Section 5.4). Instrumentation triggers, which notify HVC if a TARP level has been exceeded, were reviewed and updated by the EoR, where appropriate, as part of this AFPR.

HVC compliance with the surveillance program in the OMS Manual is summarized in Table 5.1. The site was under a temporary evacuation order from August 12th to 17th, 2021 due to forest fires in the region. Prior to the evacuation, HVC and KCB prepared a modified monitoring program that prioritized surveillance activities, while it was safe for people to do so. The forest fires did not reach site and there was no impact to the Highmont TSF. While the site was under evacuation order, HVC was able to maintain a small site presence to manage essential site operations (e.g., water management). Appropriate monitoring was maintained throughout this period.

Table 5.1 Monitoring Activities

TSF Monitoring	Facility	Minimum Frequency[1]	Responsible Party	Documentation	Frequency Compliance[1]	Notes for the Review Period
Inspections						
Routine Visual Inspection[2]	Highmont Dams	Every 2 Months	HVC	HVC Inspection Reports	Yes	-
	S1, S2, S3,and S5 Seepage Recovery Ponds	Monthly	HVC	HVC Inspection Reports	Yes	-
	S8 Seepage Recovery Pond	Quarterly	HVC	HVC Inspection Reports	Yes	-
Event-Driven Inspection	All	Event-Driven[3]	HVC	HVC Inspection Reports	N/A	No event-driven inspections were triggered during 2021.
Annual Facility Performance Report	All	Annually	KCB	Summary Report by KCB	Yes	This report.
Dam Safety Review	All	Every 5 years	HVC	Report	N/A	Next DSR is due in 2023.
Instrumentation Monitoring						
Piezometers	Highmont Dams Spillway, S1, and S2 Seepage Recovery Ponds	Quarterly	HVC	Annual Facility Performance Report	Yes	-
Seepage flow instruments	S1, S3, S5,and S8 Seepage Recovery Ponds	Quarterly	HVC	Annual Facility Performance Report	No	S5 Pond inflow was only measured in January.
Pond level	All	Monthly	HVC		Yes	HVC monitors the levels in spillway in real time (see Section 5.2).
Surveys						
Dam Crest	Highmont Dams	Annually	HVC	Annual Facility Performance Report	Yes	
Survey monuments	Highmont Dams	Annually	HVC		Yes	

Notes:
1. Frequency of routine surveillance activities were modified in 2020 due to site resource restrictions required to meet COVID 19 provincial health regulations, as discussed in Section 5.1.
2. Visual inspections include observations of unusual condition and/or dam safety concerns (e.g., settlement, sinkholes, slope sloughing, erosion, seepage, piping, etc.)
3. 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.
   - Rainfall event greater than the 10-year, 24-hour duration storm; 39.9 mm (Golder 2020b).

5.2 Routine Visual Inspections

The purpose of routine visual inspections is to identify conditions that might indicate changes in dam performance. Routine visual inspections at the Highmont TSF were documented in compliance with the frequency specified in the Highmont OMS Manual. No unusual conditions were identified at Highmont TSF and seepage recovery ponds, during routine visual inspections, that triggered remedial action.

5.3 Pond Level and Freeboard

The Highmont TSF pond level was not surveyed during the review period and was only visually checked during routine inspections. HVC has a transducer installed at the Highmont TSF spillway channel, near the inlet and downstream of the road-crossing culverts, to monitor pond levels (refer to Figure 5.1). The transducer is installed at elevation 1479.46 m, whereas the culverts invert is at about El. 1480.2 m. When the Highmont TSF pond is at or above the culvert's invert (El. 1480.2 m), and the spillway gate is closed, the transducer measurement is representative of the Highmont TSF pond level due to the hydraulic profile of the water surface in the channel. When there is flow through the gate, the water level in the channel may drop and it may no longer be equivalent to the pond level. KCB recommends that the transducer be shifted to the upstream side (i.e., impoundment side) of the spillway culverts, so that:

- the transducer measures a reliable pond level for reliable tracking of freeboard during flood events; and
- The transducer readings are independent of whether there is flow out the gate or not (see Table 8.2).

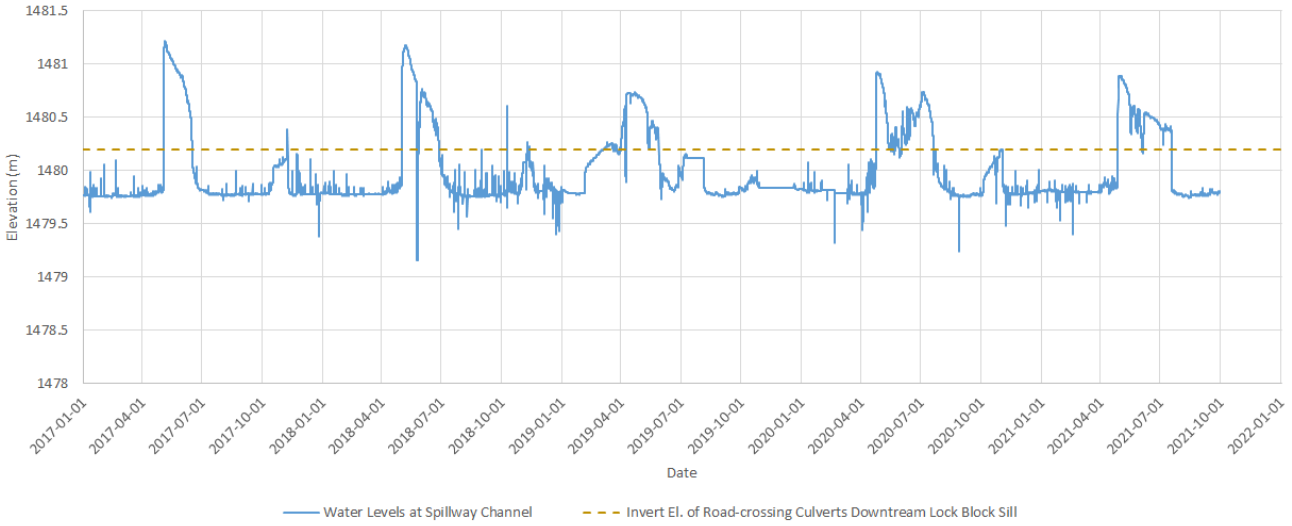
The fluctuation in water level at spillway channel was about 1.5 m during the review period (Figure 5.1). Annual historical fluctuations are as shown in Table 5.2.

Table 5.2 Change in Highmont TSF spillway channel Water Elevation

Annual Change	Change in Pond Level 2020 to 2021	Range of Annual Pond Level Change 2015 to 2020
Peak Water Level	0.0 m	-0.4 m to 0.4 m (avg. 0.1 m)

Notes:
1. 2017 review period is from November 30, 2016 .

Figure 5.1 Water Elevations at Highmont TSF Spillway Channel – 2017 to 2021



The minimum freeboard[4] measurements taken during the review period are summarized in Table 5.3. Table 5.3 also summarizes the minimum freeboard required, as per HSRC, under flood and non-flood conditions, as well as the minimum available freeboard during the IDF based on flood routing (KCB 2022a). Target flood freeboard requirements were met at all facilities during the review period. KCB (2022a) closed 16 outstanding recommendations from the DSR (SRK 2019).

Target flood freeboards adopted for tailings and water retaining structures were set to meet or exceed minimum freeboard calculated based on wave run-up as described in CDA (2013). HVC has defined alert levels which, if exceeded, trigger escalating action to mitigate flooding-related risks (e.g., increased monitoring, active measures to drawdown pond level). These alert levels are integrated with the site-wide emergency response plan, where appropriate. Pond alert levels for the Highmont TSF and seepage recovery ponds were reviewed and updated based on current conditions; all alert levels are defined in the revised OMS Manual (HVC 2019).

[4] The vertical distance between the pond level and the low point of the dam crest.

Table 5.3 Freeboard for Highmont TSF and Seepage Recovery Ponds

Dam	Freeboard (m)			
	Required during IDF [1]	Predicted During Peak Design Flood Level [2]	Required Normal Freeboard (m) [3]	Minimum Observed During the Review Period [4]
Highmont TSF	0.2	3.9	1.1	6.1
S1 Pond	0.3	1.0	0.4	2.0
S2 Pond	0.4	0.7	0.6	2.0
S3 Pond	0.3	See Note 5	0.6	1.8
S5 Pond	0.3	See Note 5	0.4	1.0
S8 Pond	0.3	0.7	0.3	1.8

Notes:
1. Per KCB (2022a) in accordance with CDA guidelines (2013, 2019).
2. Per KCB (2022a).
3. Per KCB (2022a) in accordance with CDA guidelines (2013). Normal freeboard is defined as "the difference in elevation between the lowest elevation of the top of the dam and the maximum reservoir operating level" (CDA 2013) and applies under non-flood conditions.
4. Based on maximum recorded pond elevation during the review period.
5. Refer to flood management discussion in Section 4.4.

5.4 Piezometers

The current suite of instruments is considered sufficient for the Highmont TSF. Piezometric levels since 2011, instrument Notification Level[5] thresholds, as well as maximum and minimum piezometric levels during the review period are reported in Appendix II-B.

Piezometer measurements during the review period show similar seasonal patterns as previous years. A summary of key observations for this reporting period are as follows:

- Most 2021 piezometric levels show that groundwater levels in the impoundment are highest near the middle of the beach and fall towards the Highmont TSF perimeter dams and the pond (except for P-E, P-G and P-K, and for S2-4, see next bullets). This pattern has been persistent for the instrumentation record for the existing condition.
- P-E, P-G and P-K are installed in the tailings beach near the East Dam's left abutment (Figure II-B-3). 2021 readings at these three piezometers suggest a rising trend from the pond (P-K) towards the dam (P-E). P-E exceeded threshold value by 0.28 m on September 27, 2021. KCB recommends HVC collects additional readings at P-E, P-G and P-K as soon as the instruments are accessible, to identify if this is an ongoing trend (see Table 8.2). In the meantime, KCB revised the P-E threshold to notify whether the increase is sustained in 2022. This trend does not represent a stability concern for the dam as:
  - a subsequent reading on December 3, 2021 was 1.65 m below the 2021 threshold;

[5] Exceedance of Notification Level thresholds trigger EoR review and determination of the appropriate Trigger-Action-Response-Plan (TARP) level. TARP is included in the OMS Manual.

  - the trend appears to be local (i.e., not observed at P-J, P-I, and PW-H, to the south-east, refer to Figure II-B-3; nor at P-D, PW-C, PW-A, and HMPS-01, to the north-west, refer to Figure II-B-4);
  - stability analyses conducted in 2021 indicate that the stability of the Highmont TSF dams is not sensitive to changes in piezometric levels in the tailings beach; and
  - the portion of the tailings beach where the raising trend has been observed is upstream of the bedrock outcrop between the North Dam and East Dam.
- S2-4 registered an outlier reading on September 27, 2021. This reading shows S2-4's piezometric level jumping above S2-3's, which has historically recorded higher levels (Figure II-B-1). S2-4 did not exceed threshold value during the review period. A subsequent reading on December 3rd, 2021 indicated the piezometric level had dropped to more typical elevation for S2-4 (El. 1481.02 m), below S2-3's historic readings.
- Instruments in the northeast corner of the impoundment (PW-A, HM-PS-01, HM-PS-02 and HM-PS-03) continued to show a downward trend after the peak levels in 2018. The relative drop from 2020 to 2021 was less than that observed from 2018 to 2019, and from 2019 to 2020.

The stability review conducted by KCB in 2021 to address DSR recommendation HD-001 and HD-002, and which included sensitivity analyses to the piezometric levels in the Highmont TSF tailings beach and dams, concluded that the dams are not sensitive to changes in piezometric levels in the tailings beach (where piezometers are currently installed). Slope stability factor of safety (FOS) compliance is sensitive to large changes in piezometric level conditions (>8 m) in the rockfill downstream shell of the Highmont TSF dams; however, the likelihood of such piezometric level rise within the rockfill shell is considered implausible given its high permeability. As part of continual improvement and to support long term passive-closure decision-making, KCB suggests HVC consider installing additional piezometers in the foundation and at the base of the rockfill downstream shell to characterize piezometric conditions and monitor seasonal fluctuations.

5.5 Survey Monuments

The location of survey monuments at the Highmont North, East and South Dams are shown on Figure 3, Figure 4, and Figure 5, respectively. In November 2019, HVC started to use GPS Real Time Kinematic (RTK) to survey the monuments which, in comparison to the total station method, show less variance (i.e., error) in the horizontal plane but increased variance in elevation. Survey results using the RTK method are shown on Figure II-B-6.

The baseline location for each monument using the RTK method is offset from the total station surveys. However, subsequent readings show this is related to the change in survey method and not a deformation trend. The horizontal surveys are plotted for the RTK method only, based on the new baseline location. However, KCB maintained a continuous record of settlement based on incremental change between RTK surveys.

During the review period, there were no threshold value exceedances and the annual survey during the review period was within the cluster of previous readings and showing no prevalent deformation trend. Incremental vertical displacements are a mix of positive (i.e., uplift) and negative (i.e., settlement), which could be due to the vertical accuracy of RTK method. Overall magnitude of settlement to date is not impacting freeboard (Section 1.1) or other aspects of performance. KCB will revise the threshold values for the RKT survey method in 2022.

5.6 Seepage

Seepage flows are monitored upstream of four seepage recovery ponds (S1, S3, S5, and S8 Ponds) at instruments (weirs and pipe and bucket measurements). Locations are shown in Figure 3 to Figure 5 and flow measurements during the review period and earlier (back to 2016) are plotted on Figure II-B-7.

Visual qualitative monitoring of seepage is included in routine inspections and no unusual conditions were noted. Seepage flow measurements at the Highmont TSF were documented in compliance with the frequency specified in the Highmont OMS Manual, except for seepage from the Highmont TSF into S5 Pond where data is limited for the review period (see Section 5.1). During the review period, flow into S5 Pond was measured/estimated only once in January 2021, with a flow rate similar to recent years.

Seepage flow at Highmont TSF is used to collect information and to identify changes from established trends. Absence of suspended solids in seepage was noted and reported during routine visual inspections; this supports that internal erosion is effectively managed.

5.7 Water Quality

Permit PE-376 specifies minimum water quality sampling requirements at HVC, downstream of the Highmont TSF (refer to Appendix III). Water sampling activities and results are reported in the following report, which were provided to KCB for review:

- 2021 Annual Water Quality Monitoring Report (ERM 2022)

The report was signed by a qualified professional in the related field and should be referred to for monitoring data and discussion of results. The Highmont TSF EoR (Mr. Urrutia, P.Eng.) reviewed the documents (ERM 2022) for discussion related to items of compliance with sampling requirements and key observations, which are summarized as follows:

- There are fourteen permitted surface water quality monitoring sites in the Highmont area (Highmont East area), as shown on the site monitoring plan in Appendix III.
- HVC met the required sampling frequency and parameters tested with exceptions at five sites where not all parameters were tested, and one additional site which was not sampled in August due to restricted access related to forest fires, as noted in the report (ERM 2022).

- There are two authorized discharges with permitted performance targets in PE-376 for this site: Sample Site 264 (Seepage Pond S5 SRB Pond Outlet) and Sample Site 279 (Seepage Pond S8 SRB Pond Outlet). However, there was no discharge to the environment during 2021. Highmont TSF seepage water from S5 Pond and S8 Pond was reclaimed back to the Highmont TSF system as shown in Figure 6.
- S4 Pond and S9 Pond are also permitted to discharge to the environment, but do not contain permitted water quality limits in PE-376.

Permit PE-376 specifies minimum water quality sampling requirements at HVC, including downstream of the Highmont TSF (refer to Appendix III). Water sampling activities and results are reported in the following report, which were provided to KCB for review:

- 2021 Annual Water Quality Monitoring Report (ERM 2022)

The report was signed by a qualified professional in the related field and should be referred to for monitoring data and discussion of results. The Highmont TSF EoR (Mr. Urrutia, P.Eng.) reviewed the documents (ERM 2022) for discussion related to items of compliance with sampling requirements and key observations, which are summarized as follows:

- There are fourteen permitted surface water quality monitoring sites in the Highmont area (Highmont East area), as shown on the site monitoring plan in Appendix III.
- HVC met the required sampling frequency and parameters tested with exceptions at five sites where not all parameters were tested, and one additional site which was not sampled in August due to restricted access related to forest fires as noted in the report (ERM 2022).
- There are two authorized discharges with permitted performance targets in PE-376 for this site: Sample Site 264 (Seepage Pond S5 SRB Pond Outlet) and Sample Site 279 (Seepage Pond S8 SRB Pond Outlet). However, there was no discharge to the environment at these locations during 2021. Highmont TSF seepage water from S5 and S8 was reclaimed back to the Highmont system as shown in Figure 6.

Highmont seepage ponds S4 and S9 are also permitted to discharge to the environment, but do not contain permitted water quality limits in PE-376.

6 SITE VISIT OBSERVATIONS AND PHOTOGRAPHS

Copies of the site visit checklists, photographs and a summary of observations made during the AFPR site visit are included in Appendix I. No issue in terms of dam safety was observed. A summary of general observations and comments during 2021 AFPR site visit is as follows:

- Highmont TSF: Impoundment, dam crest and downstream slopes appear similar to conditions observed during previous site visits. Closure covers continue to perform well on downstream slopes.
- Highmont TSF Spillway Channel: There is vegetation growth in the Highmont spillway channel (downstream of approach channel and rock chute) which needs to be cleared as part of routine maintenance before freshet, including vegetation obstructing culverts crossing the dam.
- Vegetation was observed during the site visit at the Highmont TSF Spillway Diversion channel, the S2 inlet and inlet channel. Vegetation is periodically removed by HVC as part of routine maintenance.
- S2 Seepage Recovery Pond: the profile of the S2 Pond spillway, near its inlet, has been changed due to the temporary access built over the channel. Bushes and small trees were present at the spillway inlet and need to be removed as part of routine maintenance by HVC.
- S1 Seepage Recovery Pond: The Low-level Outlet pipe trash rack was clear of large debris. KCB suggests algae build-up on the trash rack be cleared as part of HVC routine monitoring and maintenance.
- S5 Seepage Recovery Pond: The two overflow pipes at the Pumping Sub-cell were partially blocked at intake, and a potential animal burrow was identified. KCB suggests clearing-out vegetation from the spillway channel and backfilling potential animal burrow during routine maintenance works.

7 ASSESSMENT OF DAM SAFETY

7.1 Review of Potential Downstream Consequences

Consequence classification is not part of HVC's tailings management governance, and they have instructed KCB not to include it when reporting on the Highmont TSF or supplementary structures. Potential consequences from credible failure modes are managed through a rigorous risk management process. HVC provided the following regarding the change:

> *Consequence Classification has traditionally been used to select appropriate design criteria for tailings facilities. The use of Consequence Classification comes from the Water Dams industry and have components that do not align with Mining's safety culture – a culture that Teck fully embraces. Traditional and existing Consequence Classification schemes have a typical five level of hypothetical consequence that includes the potential for human fatality right down to the second lowest level. For Teck, any fatality would be of extreme consequence. Further, per the GISTM, designing for closure and the perpetual timeframe for the tailings facilities means adopting extreme loads (e.g., GISTM recommends both 1:10,000 earthquake and precipitation events) which render any other classification unnecessary. Finally, the use of hypothetical failures that are not based on credible modes, or lack thereof, for a given facility creates a false narrative that hampers effective and transparent community discussions and confusing discussions with regulators and investors.*

To support this approach, HVC are in the process of adopting design loading for earthquake and flood scenarios equivalent to an Extreme consequence classification (CDA 2019) for tailings facilities. This approach:

- meets or exceeds HSRC (EMLCI 2021a) requirements;
- aligns with Teck's goal to eliminate any risk for loss of life; and
- is consistent with the GISTM (2020), which supports evolving beyond the conventional consequence classification system.

The Highmont TSF is currently designed to safely route the extreme flood event (i.e., PMF). The stated design earthquake for the facility is based on HSRC (2,475-year) but the structures can accommodate the extreme loading event (i.e., 10,000-year).

HVC utilize a similar approach to manage potential credible failure modes for management of the seepage recovery ponds that supplement operation of the Highmont TSF.

The conditions and land use downstream of the Highmont TSF and seepage recovery ponds were reviewed by HVC and KCB on April 15, 2021 and no significant changes were identified.

7.2 Status of 2018 Dam Safety Review Recommendations

A DSR of the Highmont TSF was started in 2018 by SRK Consulting (SRK), with the final report issued in March 2019 (SRK 2019), which concluded the facility is well-managed with a high level of technical stewardship and appropriate operating procedures.

The DSR included 29 recommendations related to the Highmont TSF, many of the recommendations are similar (e.g., update flood routing to most recent hydrology) but are repeated for each structure. Two of the recommendations (ID S3-001 and ID S5-005) were assigned a Priority Level[6] of 2; both have been closed. The remaining recommendations were assigned a Priority Level of 3 or 4 which represent issues that should be resolved to meet compliance requirements or best practice but alone do not represent a dam safety concern.

HVC and KCB updated the 2020 workplan in August 2021 to address the DSR recommendations (Appendix IV). In total, 27 of the 29 recommendations have been closed-out. Work to address remaining two open recommendations is in progress, and is scheduled for completion in 2022.

The site visit for the most recent dam safety review (DSR) (SRK 2019) was completed in 2018. HSRC requires a DSR be undertaken every five years for tailings dams; therefore, the next DSR is scheduled for 2023.

7.3 Failure Modes Review

HVC's long-term goal for all tailings storage facilities is to reach landform status, so that the structures can be declassified as a "dam". KCB fully supports HVC towards achieving this long-term goal and their adoption of the GISTM (2020) for tailings management.

Management and status of failure modes, and related controls, which have the greatest influence on design and performance are summarized herein. All potential failure modes are reviewed and characterized in the facility risk assessment (AMEC 2019), which was reviewed and updated by HVC and KCB during the review period.

7.3.1 Highmont TSF Dams

Overtopping

To manage overtopping risks, the Highmont TSF is designed to route the PMF through its spillway (Table 4.2). This exceeds the minimum IDF recommended under HSRC (1/3 between 1000-year and PMF). Under the existing operating conditions, there are additional controls and factors which significantly reduce the potential for overtopping:

- Beach width: even during a peak PMF flood level, the pond would be well setback from the dam crest (minimum 290 m) by the tailings beach.

[6] Refer to Table 8.1 for summary of Priority Levels.

- Freeboard: under the existing condition the Highmont TSF has maintained a freeboard in excess of 6 m (since 2015) under normal and freshet conditions. Even under peak PMF flood level, the minimum freeboard between the pond and low point of the perimeter crest would be 4.6 m. This far exceeds the minimum freeboard required to accommodate wave run-up and wind (~0.4 m).
- The Highmont TSF is monitored by a comprehensive surveillance program as described in the OMS Manual (HVC 2019). There are preventative action plans, with TARP triggers established, which can be implemented to avoid overtopping.

With such robust and redundant controls and level of surveillance, the potential for overtopping under the existing condition is negligible.

Internal Erosion and Piping

Over its service life and the more than 35 years post-reclamation, there has been no evidence of turbid water (i.e., sediment laden), seepage breakout on the face of the embankment, or signs of subsidence of the embankment or abutments. This indicates the existing design controls are effectively managing this potential failure mode. In addition, the downstream drainage blanket was designed to satisfy filter criteria (KCB 2015a) and the dam foundation, consisting primarily of fine grained glacial deposits, have demonstrated to be sufficiently internally stable and able to prevent flushing of dam fill fines.

Slope Stability – Static and Seismic Loading

The Highmont TSF dams have been demonstrated to be stable under normal operating conditions during its service life and, under its existing configuration, over the more than 35 years post-reclamation. In addition, KCB completed a stability assessment of the Highmont TSF dams in 2021 which concluded that calculated FOS values for the structure meet the CDA (2019) guidelines for static ($\geq$ 1.5), pseudo-static ($\geq$ 1.0), and post-earthquake stability ($\geq$ 1.2), and comply with requirements of HSRC (EMLCI 2021a).

The key design controls related to dam stability are the combination of:

- appropriate dam slopes (shallowed to ~2.3H:1V to 2.5H:1V as part of reclamation), built out of compacted glacial till (starter dams) and raised following the centreline method with a glacial till core zone and a downstream rockfill zone;
- a competent foundation consisting of granodiorite bedrock or shallow glacial till and glaciofluvial sand and gravel outwash deposits overlying bedrock;
- under the current configuration, the piezometric levels and gradients through the tailings and dam are lower than during operations which, in addition to shallowing of slopes as part of reclamation, increase the factor of safety against slope failure; and
- the Highmont TSF dams do not have any brittle failure modes (i.e., no risk of developing a sudden failure) that could result in breach of the structure or loss of containment.

The structure has not been exposed to the Earthquake Design Ground Motion (EDGM) in its current configuration. However, the current dam configuration meets FOS criteria required by HSRC (EMLCI 2021a) under the EDGM (2,475-year return period earthquake) and can even accommodate the deformation calculated under a 10,000-yr seismic event. The stability of the dam under seismic conditions is also not considered to be a critical dam safety issue due to the competent glacial till foundation, compacted nature of the downstream dam fill, and relatively low ground motions associated with seismic events in the British Columbia Interior.

7.3.2 Seepage Recovery Pond Dams

Overtopping

- S1 Pond, S2 Pond, S3 Pond, and S8 Pond manage the risk of overtopping by safely routing the IDF, required under HSRC, through a spillway, pumping or storing as described in Section 4.4.
- S5 Pond requires HVC to level the S5 Pond dam crest low spots from El. 1451.2 m to El. 1452.2 m (planned for Q2 2022). This, in addition the existing operational controls included in the OMS Manual, is sufficient to route the IDF required by HSRC; refer to Section 4.4.

Internal Erosion and Piping

- All Ponds: The absence of suspended solids noted in observed seepage water during routine inspections over the service life of the seepage pond dams suggests failure by internal erosion is effectively managed by the existing design and operational controls. In addition, seepage recovery ponds' dams have been designed to incorporate a drainage blanket that satisfies filter criteria with the dam fill and glacial till foundation (KL 1980b).

Slope Stability – Static and Seismic Loading

- S1 Pond, S2 Pond, and S8 Pond: Stability analyses under static, pseudo-static, and post-earthquake loading, indicate the FOS for slip surfaces through dam fill and foundation are greater than the minimum FOS required by HSRC (KCB 2015b).
- S3 Pond: The retaining dam at S3 Pond meets FOS criteria for normal loading conditions and no issues of instability have been noted during the service life (KCB 2015b). A portion of the dam was built on an alluvial sand and gravel deposit (KL 1980b) but no information regarding the in-situ density of this material is available. Therefore, it cannot be demonstrated that this unit is not liquefiable under the EDGM (2,475-year return period earthquake). KCB (2022b), intended to address recommendation S3-001 from the DSR (SRK 2019), completed a screening stability analysis and concluded that if this unit does liquefy the dam may become unstable under the EDGM (KCB 2022b):
    - Even if this risk is present, the following is relevant when considering the potential risk of failure for existing conditions:

- Due to unique conditions of this facility, typically operated with a low reservoir level and the presence of cut-off trench under the S3 Dam, a risk-based approach can be used to mitigate the risk of pond breach if slopes were to fail resulting from the liquefaction of the sand and gravel unit underlying the dam (KCB 2022b).
- For these controls to be effective, the reservoir level has to be operated at a maximum elevation of 1456.5 m.

◆ A new recommendation has been made herein (Table 8.2) for HVC resolve the S3 Pond Dam potential seismic-induced stability concern under the EDGM. Two approaches are recommended:

- Managing the facility following a risk-based approach maintaining a low pond elevation at or below elevation 1456.5 m (similar to current normal operating levels), which can only be exceeded temporarily during freshet. This risk-based-approach management, included already in the ongoing OMS Manual update, has to be maintained until additional risk controls have been implemented (see next bullet).
- Developing and implementing additional risk controls, such as physical controls, operational controls, a combination of both, site investigation to further understand potential foundation liquefaction uncertainty under the EDGM, or decommissioning of the facility.

▪ S5 Pond: The S5 Pond Dam berm has performed well since the most recent raise in 2015, with no reported observations of structural instability (e.g., cracking, slumping). This is consistent with other structures built of compacted fill with similar side slopes (~1.7H:1V) and height (about 6 m) on competent glacial till foundation.

7.4 Emergency Preparedness and Response

The emergency preparedness and response plan (EPRP) for the Highmont TSF forms a part of the OMS Manual. The EPRP was updated by HVC and reviewed by the EoR during the review period.

As part of the update, HVC contacted off-site emergency response resources to ensure that all contact information was current. The EPRP includes a list of preventative measures to take in response to potential unusual or emergency conditions. The EPRP is appropriate for the existing structure and is linked to the site-wide emergency response plan.

On January 18, 2022, participants from HVC's operation team (including site management), the HVC QP, and the EoR tested the EPRP using a hypothetical scenario at tailings facility on-site.

8 SUMMARY

Based on the review of measured performance and observations summarized herein, KCB conclude the Highmont TSF performed as expected, and within design requirements, during the review period from October 2020 through September 2021. There have been no significant changes to the condition of the structure during the review period.

Dam safety recommendations identified during past AFPRs, and their current status, are summarized in Table 8.1. During the review period, one of the four recommendations from previous AFPRs was closed. Completion of the other three outstanding recommendations has been scheduled by HVC for 2022.

During the 2021 AFPR, three new recommendations were identified for the Highmont TSF and one new recommendation was identified for S3 Pond (Table 8.2). The recommendations were assigned a Priority 3 or 4. The recommendations at the Highmont TSF are related to modifications to the existing surveillance program, and for HVC to review the risk of spillway channel maintenance during floods less than the IDF. The recommendation for S3 Pond is to resolve uncertainty regarding potential liquefaction of foundation, during EDGM. The absence of in-situ testing prevents the potential for this risk to be ruled out.

Out of the 29 recommendations from the most recent DSR (SRK 2019), 27 have been closed. The workplan to address the remaining recommendations (2) was updated in 2021.

Table 8.1 Previous Recommendations Related to Facility Performance – Status Update

ID No.	Performance Area	Recommended Action	Priority[1]	Recommended Deadline
HD-2017-01	Flood Management	HVC should modify the spillway channel to pass the peak spillway design outflow beneath the access road or regrade the road surface so that water that flows over the road will report to the downstream spillway channel.	3	Q4 2020 (Open – HVC Revised Target Date Q2 2022)
HD-2018-02	*Flood Management*	*Update flood routing assessment for Highmont TSF and associated seepage ponds based on the most recent site wide hydrology information for consistency and to confirm compliance.*	*3*	*Q3 2019* *(CLOSED)*
S2-2019-01	Flood Management	S2 Pond spillway channel profile has been changed due to the temporary access over the channel. Original channel profile/capacity should be restored.	3	Q1 2020 (Open – HVC Revised Target Date Q4 2022)
S5-2018-02	Flood Management	To accommodate the temporary blocking of the spillway during freshet, raise the dam crest so that the IDF (100-year 72-hour duration) can be stored within the impoundment, assuming no pumping is required. (Take into consideration, HD-2018-02)	2	Q3 2021 (Open – HVC Revised Target Date Q2 2022, following results from HD-2018-02) Status Update: HVC is planning to level dam crest low point to El. 1452.2 m to increase flood attenuation capacity in the facility. Additional pumping capacity required to manage IDF has been included in OMS Manual. Although, this system still relies upon pumping, IDF requirements will be met so recommendation can be closed after crest is levelled up.

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 2021 Recommendations Related to Facility Performance

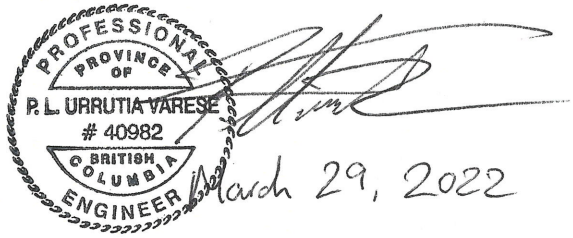
ID No.	Applicable Reg. or OMS Reference	Recommended Action	Priority[1]	Recommended Deadline
Highmont TSF				
HD-2021-01	Surveillance	KCB recommends HVC update the OMS Manual monitoring frequency to monthly for piezometers P-E, P-G and P-K, to assess recent change trend in piezometric levels.	3	Q2 2022
HD-2021-02	Surveillance	HVC should shift the Highmont TSF transducer (currently in the spillway channel) to the upstream (i.e., impoundment side) of the spillway culverts, so that the transducer measures a reliable pond level for reliable tracking of freeboard during flood events and is independent of whether there is flow out the gate or not.	4	Q4 2022
HD-2021-03	Design	During the 2022 risk assessment review, assess whether current controls are appropriate to manage localized scour/erosion damage to the spillway channel, downstream of the dam toe. Alternatively, assess if additional controls to reduce maintenance for flood events greater than ~200-year return event are required.	4	Q4 2022
Seepage Recovery Ponds				
S3-2021-01	Physical Stability	Due to uncertainty related to potential liquefaction of foundation, HVC to develop and implement risk controls to confirm adequate performance of the S3 Pond dam during the design seismic event (2,475-year return period).	3	Q4 2022

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.

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



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Engineer of Record, Designated Representative
Senior Geotechnical Engineer, Associate

Rick Friedel, P.Eng., P.E.
Senior Reviewer

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FIGURES

TO ASHCROFT

L-L DAM

HIGHLAND TSF

COLDSTREAM CREEK

JIM BLACK LAKE

PUKAIST CREEK

HOWIE FALLS

RAW WATER RESERVOIR

H-H DAM

TROJAN TSF

BETHLEHEM TSF

INKIKUH CREEK

LAURA LAKE

VALLEY PIT

7-DAY POND TSF

MILL SITE

SOUTHEAST DUMP POND

TO KAMLOOPS

CALLING LAKE

LORNEX PIT

HIGHMONT TSF

GNAWED LAKE

THOMPSON RIVER

N

5,000 10,000 15,000 20,000 25,000 30,000 35,000 40,000

40,000 35,000 30,000 25,000

Legend

- L-L DAM CLIMATE STATION
- HIGHLAND VALLEY SNOW SURVEY STATION (NO. 1C09A)
- CREEK/RIVER
- HIGHWAY
- DITCH

0 5km

NOTES:
1. PROJECTION: HVC MINE GRID.
2. TSF = TAILINGS STORAGE FACILITY.
3. BASE DATA PROVIDED BY THE GOVERNMENT.
4. IMAGERY PROVIDED BY ESRI.

CLIENT
Highland Valley Copper / Teck

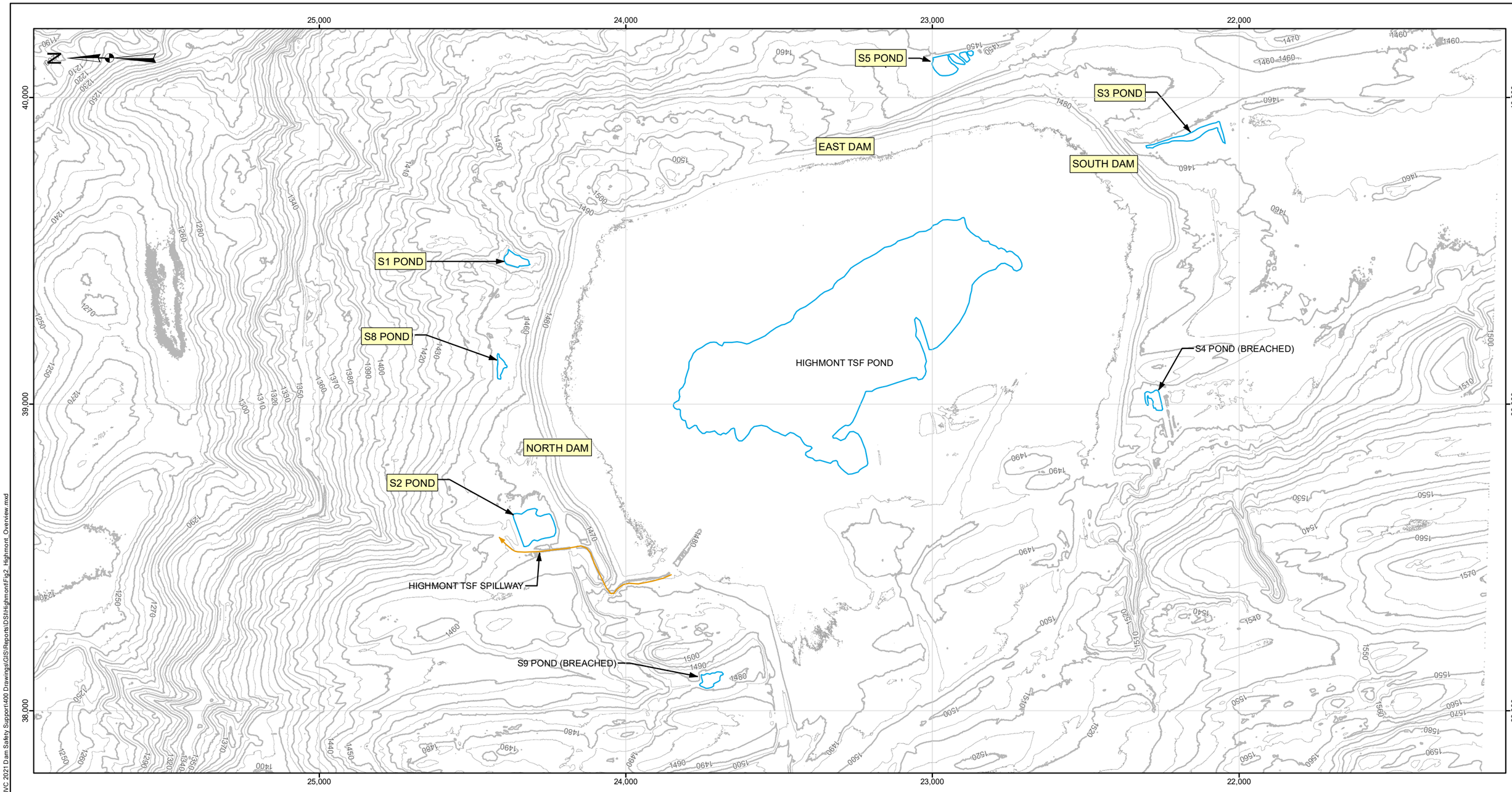
Klohn Crippen Berger

PROJECT
HIGHMONT TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE
MINE SITE PLAN

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C12	1

Date: 2021-12-22
Document Path: \\vt.klohn.com\ProjData\MVCR\M02341C12-HVC 2021 Dam Safety Support\400 Drawings\GIS\Reports\DS\Highmont\Fig1_Highmont_MineSitePlan.mxd



LEGEND

- SPILLWAY
- WATERBODY

0 500m

NOTES:
1. PROJECTION: HVC MINE GRID.
2. TOPOGRAPHY FROM HVC, LIDAR FLOWN ON AUGUST 23RD, 2014.

CLIENT
Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT
HIGHMONT TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE
HIGHMONT TAILINGS STORAGE FACILITY
OVERVIEW

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C12	2

Date: 2021-12-22
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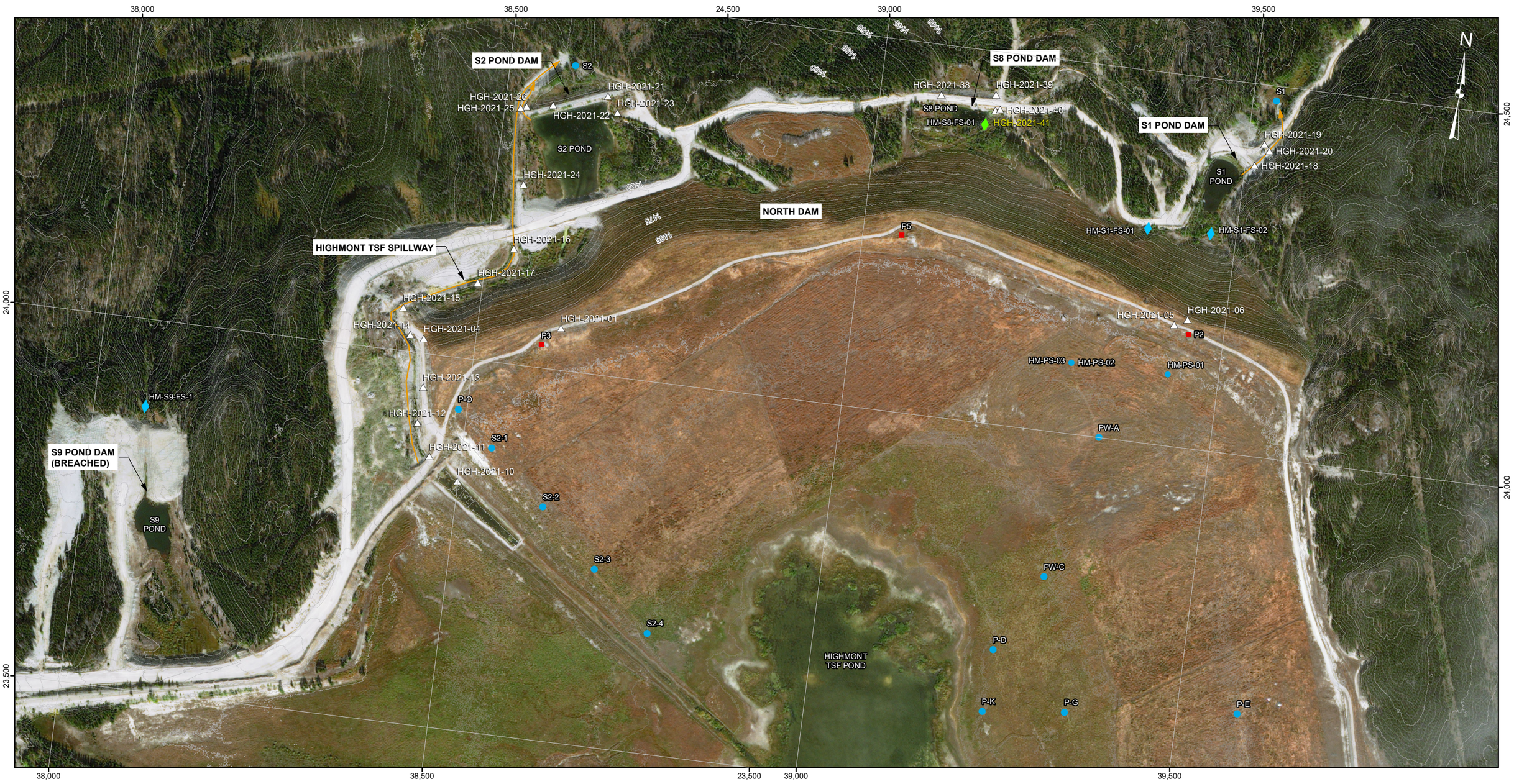


LEGEND

INSTRUMENTATION TYPE (ACTIVE)

- STANDPIPE PIEZOMETER
- SURVEY MONUMENT
- PIPE/BUCKET FLOW READING
- WEIR

△ WAYPOINT (HGH-2021-XX)

→ SPILLWAY

0 250m

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

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: NORTH DAM PLAN

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C12	3

Date: 2022-01-17
Document Path: \\mt.klohn.com\Proj\Data\MVC\RM\02341C12-HVC 2021 Dam Safety Support\400 Drawings\GIS\Reports\DS\Highmont\Fig3_Highmont_NorthDam.mxd

40,000 23,500 23,000 22,500

39,500 40,000 39,000 39,500

24,000 39,000 23,500 23,000 22,500

N

1460 1470 1480 1450 1490 1485

HGH-2021-33
HGH-2021-32
HGH-2021-31
HGH-2021-36
HGH-2021-37
HGH-2021-34
HGH-2021-33
S5 POND
HM-S5-FS-01
S5 POND DAM
EAST DAM
P6
HGH-2021-02
HGH-2021-07
HGH-2021-06
P2
HGH-2021-05
P-E
PW-H
PW-L
P-I
P-M
HM-S3-FS-01
S3 POND
P4
HGH-2021-08
SOUTH DAM
PW-C
P-G
PW-J
P-N
S3-1
S3-2
P-D
P-K
PW-P
HIGHMONT
TSF POND

0 250m

LEGEND

INSTRUMENT TYPE (ACTIVE)
- STANDPIPE PIEZOMETER
- SURVEY MONUMENT
- WAYPOINT (HGH-2021-XX)
- SPILLWAY

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

CLIENT
Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT
HIGHMONT TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE
EAST DAM
PLAN

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C12	4

Date: 2021-12-22
Document Path: \\vnt.klohn.com\Proj\Data\MVCR\M02341C12-HVC 2021 Dam Safety Support\400 Drawings\GIS\Reports\DSI\Highmont\Fig4_Highmont_EastDamPlan.mxd

LEGEND

INSTRUMENT TYPE (ACTIVE)

- STANDPIPE PIEZOMETER
- SURVEY MONUMENT
- WEIR
- WAYPOINT (HGH-2021-XX)
- SPILLWAY
- SPILLWAY (PLUGGED)

0 250m

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

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

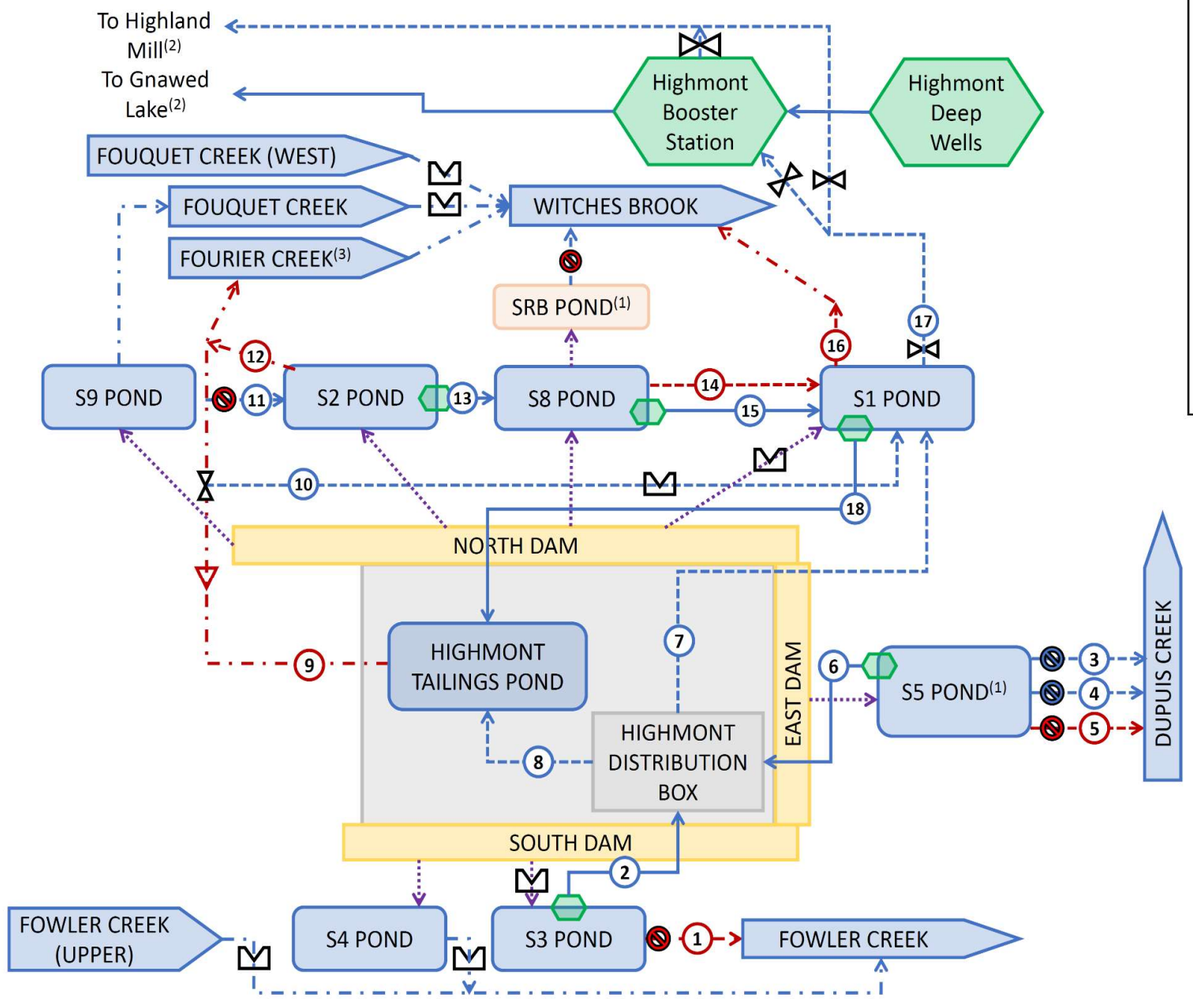
PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: SOUTH DAM PLAN

SCALE	PROJECT No.	FIG No.
AS SHOWN	M02341C12	5

Date: 2022-01-17
Document Path: \\vnt.klohn.com\Proj\Data\M\VCR\M02341C12-HVC 2021 Dam Safety Support\400 Drawings\GIS\Reports\DSI\Highmont\Fig5_Highmont_SouthDamPlan.mxd

HIGHMONT
CONCEPTUAL FLOW DIAGRAM



- Gravity pipe flow
- Pumped pipe flow
- Open channel flow
- Spillway (pipe or channel)
- Seepage flow
- Fuse Plugged
- Permanently plugged
- Valve
- Slide gate
- Weir

Notes:
1. The Sulfate Reduction Bacteria (SRB) pond at S8 is downstream of the S8 Dam. The SRB pond at S5 consists of the five ponds in series in the centre of the facility. Water quality in both ponds do not meet discharge requirements at this time.
2. See the Gnawed Lake process flow diagram for additional details from S1 to the Mill.
3. Subject to water license constraints. See Environment for details.

- Tailings dam
- Pond
- Pond (non-operational)
- Pump(s)
- Natural watercourse

No.	Name	Description	Status
1	S3 Spillway	Open channel	Non-operational, plugged prior to 2010
2	S3 Reclaim	Seepage water pumped to the Highmont TSF	Operational
3	S5 Outlet #1	2x 8”dia. HDPE pipes with control valves	Non-operational, metal plates placed at intake and pipes filled with till in 2015
4	S5 Outlet #2	1 x 8”dia. HDPE pipe with control valve	
5	S5 Overflow	2x 200 mm dia. HDPE pipes	Operational, partially blocked at intake
6	S5 Reclaim	Pond water pumped to the Highmont TSF	Operational
7	Distribution to S1	1x 18” dia. pipeline from the Highmont Distribution Box to S1	Non-Operational
8	Distribution Box to Tailings Pond	1x 18” dia. pipeline from the Highmont Distribution Box to the tailings pond	Non-Operational
9	Highmont Spillway	Open channel comprised of (U/S to D/S): i) Lock-block control sill; ii) Approach channel excavated in tailings; iii) Culvert crossings; iv) Channel excavated through rock; v) Flow control structure with 4’ high slide gate and diversion to S1; and vi) Till plug diversion to S2 (decommissioned).	Operational
10	Diversion to S1	18” dia. HDPE pipeline	Operational
11	Diversion to S2	Open channel	Non-Operational
12	S2 Spillway	Open channel	Operational
13	S2 Outlet	1x 18” dia. HDPE pipeline carrying water pumped from S2 to S8	Operational
14	S8 Spillway	1x 18” dia. HDPE pipe with trash rack and headwall	Operational
15	S8 Outlet	1x 14” dia. HDPE pipeline carrying water pumped from S8 to S1	Operational
16	S1 Spillway	1x 900 mm dia. HDPE pipe discharging onto a riprap-lined apron	Operational
17	S1 Outlet	600 mm dia. HDPE pipe with manually operated valve	Operational
18	S1 Reclaim	Seepage water pumped back to the tailings pond	Operational

NOT FOR CONSTRUCTION

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: FLOW SCHEMATIC FOR HIGHMONT TAILINGS STORAGE FACILITY

SCALE	PROJECT No.	FIG. No.
NTS	M02341C12	6

APPENDIX I

Annual Facility Performance Report

Site Visit Checklist, Observations and Photographs

APPENDIX I-A

North, East, and South Dams

Site Visit Checklist, Observations and Photographs

Appendix I-A
Annual Facility Performance Report Site Visit Checklist, Observations and Photographs – North, East, and South Dams

SITE VISIT CHECKLIST

Facility:	Highmont North, East, and South Dams	**Site Visit Date:**	July 29, 2021
Weather:	Cloudy / Smoky	**Inspector(s):**	Pablo Urrutia, P.Eng. Delton Breckenridge, EIT
Freeboard (pond level to dam crest):	7.2 m based on maximum water elevations on July 29th from remote pond level monitoring system		

Outlet Condition Survey

Description	Outlet Controls?	Was it flowing?	Flow rate
Spillway Channel	Control gate (slightly open)	☒ Yes ☐ No	Minor, S1 diversion (not measured)

Are the following components in ***SATISFACTORY CONDITION***?
(check one if applicable)

EMBANKMENT	Yes/No	SPILLWAY	Yes/No
U/S Slope	☒ Yes ☐ No	Culverts Crossing Dam	☒ Yes ☐ No
Crest	☒ Yes ☐ No	Channel Invert	☒ Yes ☐ No
D/S Slope	☒ Yes ☐ No	Channel Slopes	☒ Yes ☐ No
D/S Toe	☒ Yes ☐ No	Culverts	☐ Yes ☒ No
PIPELINE DIVERSION	**Yes/No**		
Trash Rack	☒ Yes ☐ No		

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

INDICATOR	EMBANKMENT	SPILLWAY
Piping	☐ Yes ☒ No	
Sinkholes	☐ Yes ☒ No	
Seepage	☐ 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	☐ Yes ☒ No
Excessive Growth	☐ Yes ☒ No	☐ Yes ☒ No
Excessive Debris	☐ Yes ☒ No	☐ Yes ☒ No

List and describe any deficiencies:
- No dam safety deficiencies observed.
- Regarding culverts downstream of the toe of the North Dam, see AFPR recommendation HD-2017-01.

Comments:
- Refer to Site Visit Observations section.

SITE VISIT OBSERVATIONS

Impoundment

- **Tailings Beach**: The tailings beach is well vegetated and the pond was well setback from the dam crest (>290 m) based on reservoir level, typical for this time of year (Photo I-A-1 to Photo I-A-3).
- **Pond**: At the time of the site visit the pond was centrally located in the impoundment, similar to the image on Figure 1 through Figure 3 (Photo I-A-1 to Photo I-A-3).

Dam

- **Crest**: Good physical condition. No signs of significant erosion, deterioration, displacement, or cracking (Photo I-A-4 to Photo I-A-7). Minor rutting on North Dam crest and crest access road was observed; rutting is managed by HVC as needed (Photo I-A-4 to Photo I-A-5).
- **Left and Right Abutments**: Good physical condition. No signs of erosion, deterioration, horizontal displacement, or cracking.
- **Downstream Slope and Spillway**:
  - Good physical condition. Downstream slope well vegetated throughout, providing adequate erosion protection for future service life (Photo I-A-8 to Photo I-A-17).
  - The steepened lower portion of the North Dam downstream slope near the dam spillway is noticeably less vegetated. This portion was constructed with rockfill at a steeper grade. Comparison of the recent aerial imagery (October 8, 2020) and aerial imagery from 2003, as well as contour records from 1994, indicate that in section no significant adverse changes have been observed compared to previous AFPR (Photo I-A-27 and Photo I-A-28).
  - There is vegetation growth in the Highmont spillway channel (downstream of approach channel and rock chute) which needs to be cleared as part of routine maintenance before freshet, including vegetation obstructing culverts crossing dam (Photo I-A-20 and Photo I-A-22).
- **Seepage**:
  - Seepage from North Dam western underdrains was minimal and clear. The ponded water did not reach the toe of the dam and no flow was seen through the road culverts to S2 Pond. There are no signs of recent ponding or issues related to seepage flow through the road fill (Photo I-A-28 to Photo I-A-30).
  - No seepage was observed along downstream toe of East Dam.
  - No seepage was observed along downstream toe of South Dam.

SITE VISIT PHOTOGRAPHS

LEGEND:

- HGH = Highmont Tailings Facility.
- HGH-2021-## refers to 2021 AFPR waypoints shown on Figure 3, Figure 4, and Figure 5.
- Photographs taken during the site visit on July 29, 2021.

Photo I-A-1 View of tailings impoundment and pond from North Dam. Beach is covered by vegetation. No signs of distress, settlement, or depression. Small pond is present in the centre of facility (HGH-2021-01).

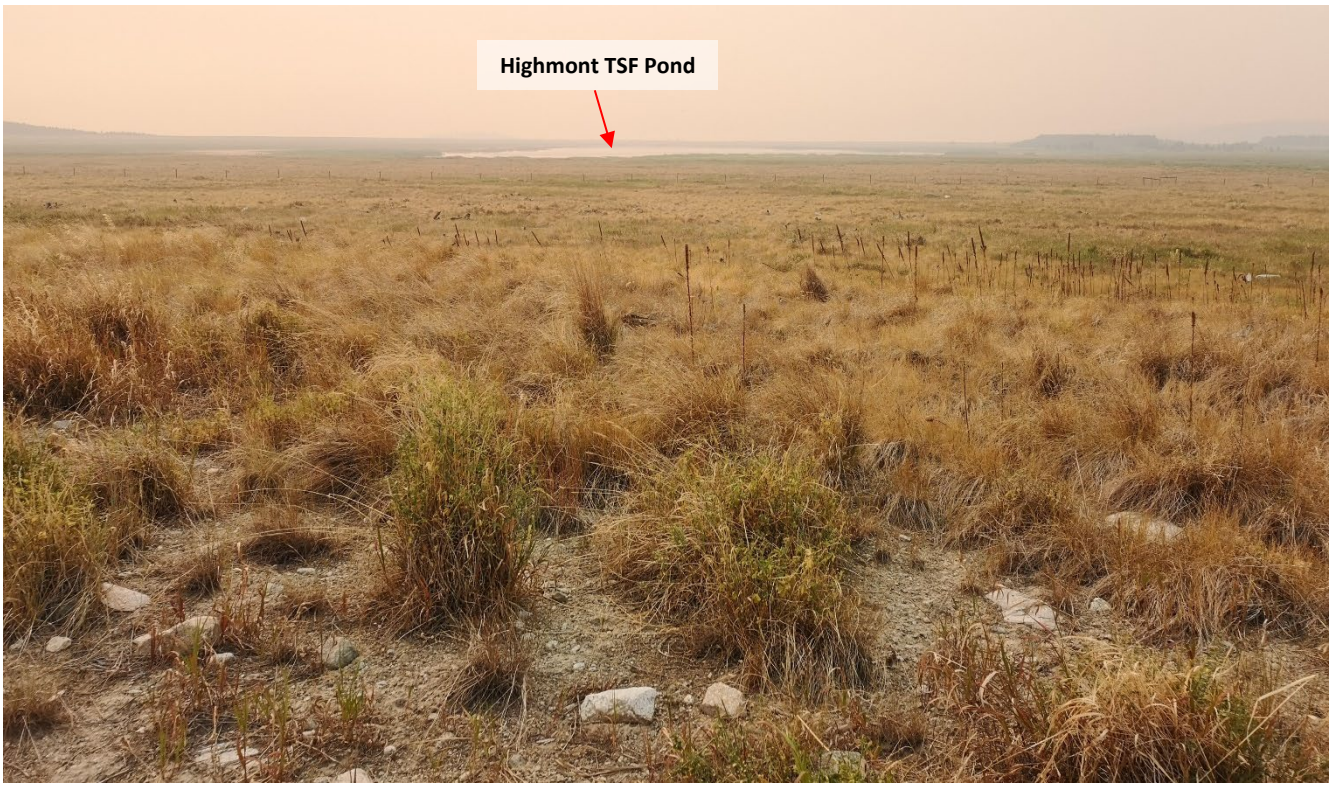


Photo I-A-2 View of tailings impoundment and beach from East Dam (HGH-2021-02)

Photo I-A-3 View of tailings impoundment and beach from South Dam (HGH-2021-03)

Photo I-A-4 North Dam crest is in good condition. No signs of distress, settlement or depression; minor rutting observed is managed by HVC, as needed (HGH-2021-01)

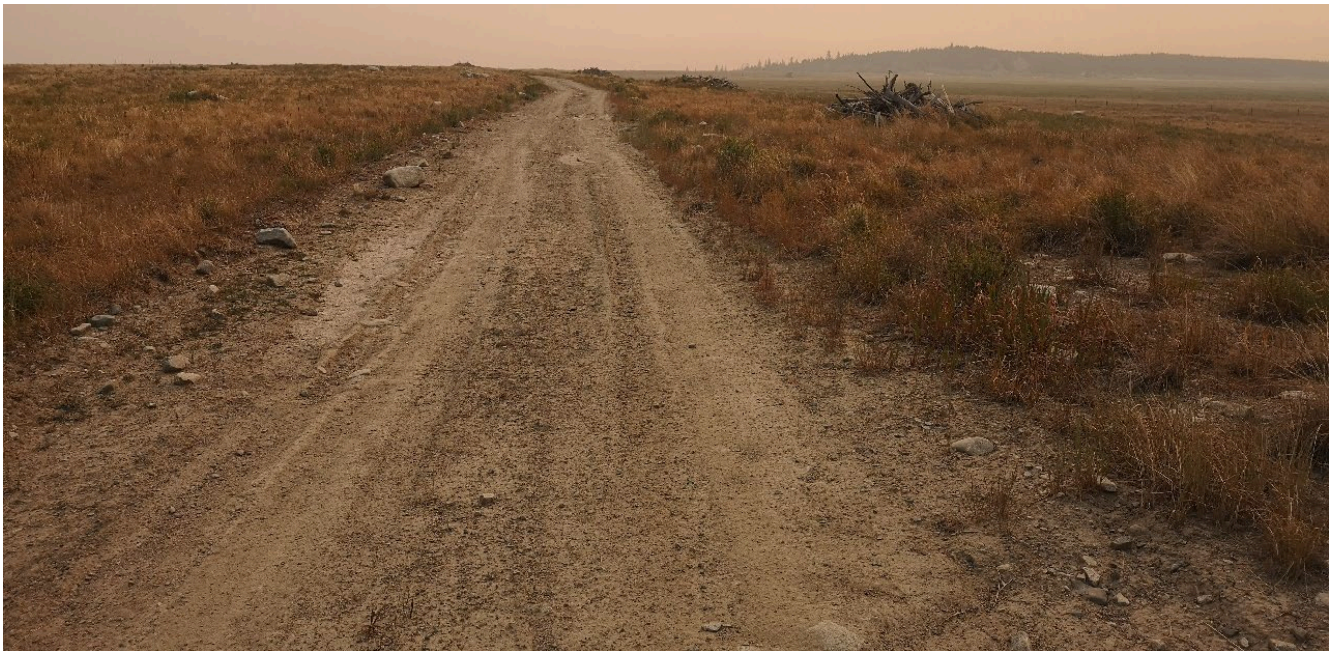


Photo I-A-5 North Dam crest access road to S1 Diversion. Minor rutting observed is managed by HVC as needed (HGH-2021-04)

Photo I-A-6 North Dam crest near right abutment. Crest is in good condition (HGH-2021-05)

Photo I-A-7 East Dam crest. Crest is in good condition. No signs of deformation or distress were observed (HGH-2021-02)

Photo I-A-8 View of North Dam downstream slope looking northwest. Vegetation was about 0.5 m tall. No signs of distress or deformation were observed (HGH-2021-06)

Photo I-A-9 View of North Dam downstream toe and S1 Pond. No signs of distress or deformation were observed (HGH-2021-06)

Photo I-A-10 View of North Dam downstream slope looking east (HGH-2021-06)

Photo I-A-11 East Dam downstream slope. Slope is vegetated and in good condition (HGH-2021-07)

Photo I-A-12 View of South Dam downstream slope looking northeast. Slope is vegetated and in good condition (HGH-2021-08)

Photo I-A-13 South Dam downstream slope and view of S3 Pond with two pools of water (pond El. ~1456.5 m). South Dam slope is vegetated and in good condition (HGH-2021-08)

Photo I-A-14 View of South Dam downstream slope looking southwest. Slope is vegetated and in good condition (HGH-2021-08)

Photo I-A-15 View of South Dam downstream slope at right abutment looking east. Slope is vegetated and in good condition (HGH-2021-09)

Photo I-A-16 South Dam downstream slope and view of S4 Pond from South Dam. S4 embankment is breached (HGH-2021-09)

Photo I-A-17 View of South Dam downstream slope at right abutment looking northwest. Slope is vegetated and in good condition (HGH-2021-09)

Photo I-A-18 Highmont Spillway approach channel, concrete lock-block control sill – Spillway was not flowing at the time of the site visit. Water ponded downstream of sill is controlled by level at spillway flow control gate (HGH-2021-10)

Photo I-A-19 Approach channel. Road culverts are partially submerged, section upstream of culverts is clear of debris and vegetation (HGH-2021-10)

Photo I-A-20 Area downstream of approach channel culverts and upstream of flow control gate – Culverts and channel were partially obstructed during the site visit, but vegetation was cleared by HVC in Q3/Q4 2021 as part of routine maintenance (HGH-2021-11)

Photo I-A-21 Spillway flow control gate. Valve is operational and could move up and down (tested for slight movement). Sliding gate is slightly open (HGH-2021-12)

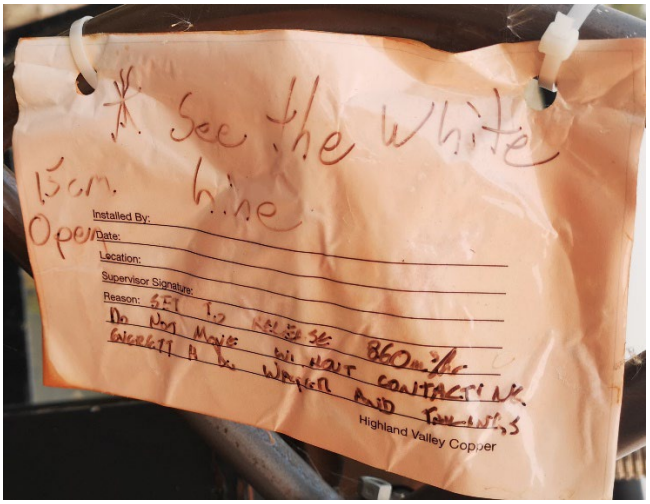


Photo I-A-22 Downstream area of spillway flow control gate (HGH-2021-13)

Photo I-A-23 Highmont Spillway channel, S1 Pond diversion trash rack. Minor flow into the diversion. Trash rack is clear of debris. No flow downstream of diversion (HGH-2021-14)

Photo I-A-24 Highmont Spillway channel, S1 Pond diversion control (HGH-2021-14)

Photo I-A-25 Highmont Spillway channel, downstream of S1 Pond diversion and control. No flow downstream of S1 diversion. Minor vegetation was observed in the channel (HGH-2021-14)

Photo I-A-26 Highmont Spillway channel upstream of spillway drop (HGH-2021-15)

Photo I-A-27 Highmont Spillway channel downstream of spillway drop. Channel is in good condition. North Dam downstream toe is visible. No signs of distress or deformation (HGH-2021-15)

Photo I-A-28 North Dam downstream slope and toe, downstream of Highmont Spillway. North dam toe is in good condition. Spillway stilling basin is heavily vegetated. (HGH-2021-16)

Photo I-A-29 Water is ponded downstream of spillway drop. Vegetation obstructing spillway channel (HGH-2021-17)

Photo I-A-30 North Dam toe access road crossing culverts. Culverts are misshapen; see AFPR recommendation HD-2017-01 (HGH-2021-16)

APPENDIX I-B

Seepage Recovery Dams

Site Visit Checklist, Observations and Photographs

Appendix I-B
Annual Facility Performance Report Site Visit Checklist, Observations and Photographs – Seepage Recovery Dams

SITE VISIT CHECKLISTS

Seepage Recovery Pond S1

Facility:	Highmont Seepage Recovery Dam S1	**Site Visit Date:**	July 29, 2021
Weather:	Cloudy / Smoky	**Inspector(s):**	Pablo Urrutia, P.Eng. Delton Breckenridge, EIT
Freeboard (pond level to dam crest):	2.4 m based on maximum water elevations on July 29th from remote pond level monitoring system		

Outlet Condition Survey

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

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

(check one if applicable)

EMBANKMENT	Yes/No	SPILLWAY	Yes/No
U/S Slope	☒ Yes ☐ No	Entrance	☒ Yes ☐ No
Crest	☒ Yes ☐ No	Walls	☒ Yes ☐ No
D/S Slope	☒ Yes ☐ No	Channel	☒ Yes ☐ No
D/S Toe	☒ Yes ☐ No	Channel Slopes	☒ Yes ☐ No

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

INDICATOR	EMBANKMENT	SPILLWAY
Piping	☐ Yes ☒ No	
Sinkholes	☐ Yes ☒ No	
Seepage	☐ 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	☐ Yes ☒ No
Excessive Growth	☐ Yes ☒ No	☐ Yes ☒ No
Excessive Debris	☐ Yes ☒ No	☐ Yes ☒ No

List and describe any deficiencies:

- No dam safety deficiencies observed.

Comments / Notes:

- Refer to Site Visit Observations section.

Seepage Recovery Pond S2

Facility:	Highmont Seepage Recovery Dam S2	**Site Visit Date:**	July 29, 2021
Weather:	Cloudy / Smoky	**Inspector(s):**	Pablo Urrutia, P.Eng. Delton Breckenridge, EIT
Freeboard (pond level to dam crest):	2.6 m based on maximum water elevations on July 29th from remote pond level monitoring system		

Outlet Condition Survey

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

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

(check one if applicable)

EMBANKMENT	Yes/No	SPILLWAY	Yes/No
U/S Slope	☒ Yes ☐ No	Entrance	☒ Yes ☐ No
Crest	☒ Yes ☐ No	Channel	☐ Yes ☒ No
D/S Slope	☒ Yes ☐ No	Channel Slopes	☒ Yes ☐ No
D/S Toe	☒ Yes ☐ No		

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

INDICATOR	EMBANKMENT	SPILLWAY
Piping	☐ Yes ☒ No	
Sinkholes	☐ Yes ☒ No	
Seepage	☐ Yes ☒ No	
Surface 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

List and describe any deficiencies:

- No dam safety deficiencies observed.

Comments / Notes:

- Refer to Site Visit Observations section.

Seepage Recovery Pond S3

Facility:	Highmont Seepage Recovery Dam S3	**Site Visit Date:**	July 29, 2021
Weather:	Cloudy / Smoky	**Inspector(s):**	Pablo Urrutia, P.Eng. Delton Breckenridge, EIT
Freeboard (pond level to dam crest):	2.5 m based on maximum water elevations on July 29th from remote pond level monitoring system		

Outlet Condition Survey

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

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

(check one if applicable)

EMBANKMENT	Yes/No	SPILLWAY	Yes/No
U/S Slope	☒ Yes ☐ No	Entrance	☐ Yes ☐ No ☒ N/A
Crest	☒ Yes ☐ No	Walls	☐ Yes ☐ No ☒ N/A
D/S Slope	☒ Yes ☐ No	Channel	☐ Yes ☐ No ☒ N/A
D/S Toe	☒ Yes ☐ No	Channel Slopes	☐ Yes ☐ No ☒ N/A

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

INDICATOR	EMBANKMENT	SPILLWAY
Piping	☐ Yes ☒ No	
Sinkholes	☐ Yes ☒ No	
Seepage	☐ 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	☐ Yes ☒ No
Excessive Growth	☐ Yes ☒ No	☐ Yes ☒ No
Excessive Debris	☐ Yes ☒ No	☐ Yes ☒ No

List and describe any deficiencies:

- No dam safety deficiencies observed.

Comments:

- Refer to Site Visit Observations section.

Seepage Recovery Pond S5

Facility:	Highmont Seepage Recovery Dam S5	**Site Visit Date:**	July 29, 2021
Weather:	Cloudy / Smoky	**Inspector(s):**	Pablo Urrutia, P.Eng. Delton Breckenridge, EIT
Freeboard (pond level to dam crest):	2.9 m based on maximum water elevations on July 29th from remote pond level monitoring system		

Outlet Condition Survey

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

Are the following components of your dam in ***SATISFACTORY CONDITION***?

(check one if applicable)

EMBANKMENT	Yes/No	OUTLET Pipe - north	Yes/No	OUTLET Pipe - south	Yes/No
U/S slope	☒ Yes ☐ No	Inlet	Closed/Plugged	Inlet	Closed/Plugged
Crest	☒ Yes ☐ No				
D/S Slope	☒ Yes ☐ No				
D/S Toe	☒ Yes ☐ No				

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

INDICATOR	EMBANKMENT	OUTLET - north	OUTLET - south
Seepage	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No
External Erosion	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No
Cracks	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No
Settlement	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No
Sloughing/Slides	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No
Animal Activity	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No
Excessive Growth	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No
Excessive Debris	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No

List and describe any deficiencies:

- No dam safety deficiencies observed.

Comments:

- Outlet pipes from pump sump sub-cell are sealed:
  - Refer to outstanding AFPR recommendation RE: flood routing.
- Refer to Site Visit Observations section.

Seepage Recovery Pond S8

Facility:	Highmont Seepage Recovery Dam S8	**Site Visit Date:**	July 29, 2021
Weather:	Cloudy / Smoky	**Inspector(s):**	Pablo Urrutia, P.Eng. Delton Breckenridge, EIT
Freeboard (pond level to dam crest):	1.1 m based on maximum water elevations on July 29th from remote pond level monitoring system		

Outlet Condition Survey

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

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

(check one if applicable)

EMBANKMENT	Yes/No	OUTLET	Yes/No
U/S Slope	☒ Yes ☐ No	Outlet Pipe	☒ Yes ☐ No
Crest	☒ Yes ☐ No	Outlet Controls	☒ Yes ☐ No
D/S Slope	☒ Yes ☐ No		
D/S Toe	☒ Yes ☐ No		

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

INDICATOR	EMBANKMENT	OUTLET
Piping	☐ Yes ☒ No	
Sinkholes	☐ 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

List and describe any deficiencies:

- No dam safety deficiencies observed.

Comments:

- Refer to Site Visit Observations section.

SITE VISIT OBSERVATIONS

Seepage Recovery Pond S1

- **Crest**: Good physical condition. No signs of significant erosion, deterioration, displacement, or cracking (Photo I-B-1).
- **Left and Right Abutment**: Good physical condition. No signs of significant erosion, deterioration, displacement, or cracking (Photo I-B-1).
- **Downstream Slope**: Good physical condition. Slope covered in gravel and moderately vegetated. This provides adequate erosion protection based on performance over the service life (Photo I-B-2).
- **Pond**: At the time of site visit was about 1.5 m below the spillway invert, which is typical for this time of the year (Photo I-B-3 and Photo I-B-4).
- **Spillway**: Good physical condition (Photo I-B-5 and Photo I-B-6).
- **Low-level Outlet**: The outlet pipe trash rack was clear of large debris (Photo I-B-4). KCB suggests algae build-up on the trash rack be cleared as part of HVC routine monitoring and maintenance.
- **Seepage**: None observed.

Seepage Recovery Pond S2

- **Crest**: Good physical condition. No signs of significant erosion, deterioration, displacement, or cracking (Photo I-B-7 and Photo I-B-8).
- **Left and Right Abutment**: Good physical condition. No signs of significant erosion, deterioration, displacement, or cracking.o
- **Downstream Slope:** Good physical condition. Well vegetated near left abutment, and sparsely vegetated throughout the rest of the downstream slope. Gravel and vegetation provide adequate erosion protection based on performance over the service life (Photo I-B-9 and Photo I-B-16).
- **Pond:** Pond level was more than 2 m below the invert of the spillway, which is typical for this time of the year (Photo I-B-12).
- **S2 Inlet Channel – Highmont TSF Spillway Diversion**: A plug was in place across the S2 inlet, so no flow was diverted from the Highmont TSF spillway into S2 Pond except under large flows. Highmont TSF Spillway Diversion channel, the S2 inlet and inlet channel are heavily vegetated. Vegetation needs to be removed by HVC as part of routine maintenance (Photo I-B-13 and Photo I-B-14).

- **Spillway**: Good physical condition. Spillway channel is partially blocked (i.e., reduced section), reducing its capacity (appears to be from a temporary access over the channel); see AFPR recommendation S2-2019-01. Bushes and small trees were present at the spillway inlet and need to be removed as part of routine maintenance by HVC (Photo I-B-15).
- **Seepage**: Seepage is not monitored downstream of the dam. However, signs of recent ponded water at the downstream toe were observed (healthy vegetation at the toe) (Photo I-B-16).

Seepage Recovery Pond S3

- **Crest**: Good physical condition. No indicators of significant concern observed (e.g. cracking, slumping, horizontal displacement) (Photo I-B-17 to Photo I-B-19).
- **Left and Right Abutment**: Good physical condition. No observations of significant scour or other indicators of potential concern (e.g. cracking, slumping, horizontal displacement) (Photo I-B-23).
- **Downstream Slope**: Good physical condition. Slope is sparsely vegetated over the layer of gravel which provides adequate erosion protection based on performance over the service life (Photo I-B-20 to Photo I-B-22).
- **Pond**: At the time of the site visit, pond level was more than 2 m below the crest of the dam, which is typical for this time of the year (Photo I-B-24).
- **Seepage**: Seepage is not monitored downstream of the dam. No ponded water was observed at the downstream toe in the low point.
- **Spillway**: Spillway intake is blocked with glacial till to prevent discharge of water that does not meet water quality regulatory requirements (Photo I-B-25).

Seepage Recovery Pond S5

- **Crest**: Good physical condition. No signs of significant erosion, deterioration, displacement, or cracking. Minor rutting should be corrected as part of routine maintenance (Photo I-B-26). The low point along the access road should be levelled (Photo I-B-26 and Photo I-B-27)
- **Left and Right Abutment**: Good physical condition. No signs of significant erosion, deterioration, displacement, or cracking.
- **Downstream Slope**: Good physical condition. Minor vegetation present throughout slope. No signs of erosion, deterioration, or animal activity (Photo I-B-28).
- **Pond**: During the site visit, the pond was observed to be more than 1.0 m below crest of dam which is typical for this time of the year. Pond was highly vegetated during the site visit (Photo I-B-29 to Photo I-B-31).

- **Low-level Outlet and Spillway**: The Low-Level Outlet valves were closed and the inlets of the spillway pipes were partially obstructed by sand bags (Photo I-B-32 to Photo I-B-36).

  Spillway pipe valve is too low, it may not be accessible during a flood event.

  Area around outlet control into the sub-cell where inflow reports to S5 Pond is heavily vegetated; needs to be cleared as part of routine maintenance by HVC.

- **Seepage**: Change of vegetation on the downstream toe of the perimeter crest suggests there has been temporary ponding at the toe, likely due to the run-off (Photo I-B-37). No seepage was observed.

Seepage Recovery Pond S8

- **Crest**: Good physical condition. No signs of significant erosion, deterioration, displacement, or cracking (Photo I-B-38).
- **Left and Right Abutment**: Good physical condition. No signs of significant erosion, deterioration, displacement, or cracking.
- **Downstream Slope**: Good physical condition. Moderate vegetation throughout slope and large wood debris present. No observed signs of erosion, deterioration, or adverse displacement. (Photo I-B-39).
- **Pond**: At the time of the site visit the pond appeared lower in elevation when compared to the 2020 site visit. Less than 2 m below the crest of the dam (Photo I-B-40 and Photo I-B-41).
- **Spillway**: The outlet pipe was clear of debris (Photo I-B-42).
- **Seepage**: None observed.

SITE VISIT PHOTOGRAPHS

LEGEND:

- HGH = Highmont Tailings Facility.
- HGH-2021-## refers to 2021 AFPR waypoints shown on Figure 3, Figure 4 and Figure 5.
- All photographs taken during the site visit on July 29th, 2021

Seepage Recovery Pond S1

Photo I-B-1 S1 Pond: Overview of crest looking west towards left abutment (HGH-2021-18).

Photo I-B-2 S1 Pond: S1 Pond dam downstream slope (HGH-2021-19).

Photo I-B-3 S1 Pond: View of S1 Pond, spillway intake, and Low-Level Outlet (LLO) (HGH-2021-18).

Photo I-B-4 S1 Pond: LLO to the left of spillway intake. Pond level was about 1.5 m below inlet. Vegetation partially obstructing intake; needs to be cleared during routine maintenance (HGH-2021-18).

Photo I-B-5 S1 Pond: Spillway channel and pipe intake looking downstream. Channel is clear of vegetation and no sign of obstruction was observed at the pipe intake (HGH-2021-18).

Photo I-B-6 S1 Pond: Spillway channel upstream of pipe intake, looking toward the pond (HGH-2021-20).

Seepage Recovery Pond S2

Photo I-B-7 S2 Pond: View of S2 Pond embankment crest, looking toward left abutment (HGH-2021-21).

Photo I-B-8 S2 Pond: View of S2 Pond embankment crest, view from mid dam towards left abutment (HGH-2021-22).

Photo I-B-9 S2 Pond: View of downstream slope. Slope is in good condition (HGH-2021-21).

Photo I-B-10 S2 Pond: Overview of upstream slope riprap. Slope is in good condition (HGH-2021-23).

Photo I-B-11 S2 Pond: S2 Pond with view of downstream slope of Highmont North Dam in the background (HGH-2021-21).

Photo I-B-12 S2 Pond: Low-Level Outlet (HGH-2021-23).

Photo I-B-13 S2 Pond: Till plug (~1.2 m high and ~ 1m wide) is placed in S2 inlet channel. Highmont TSF Spillway diversion channel is heavily vegetated; needs to be cleared as part of routine maintenance (HGH-2021-24).

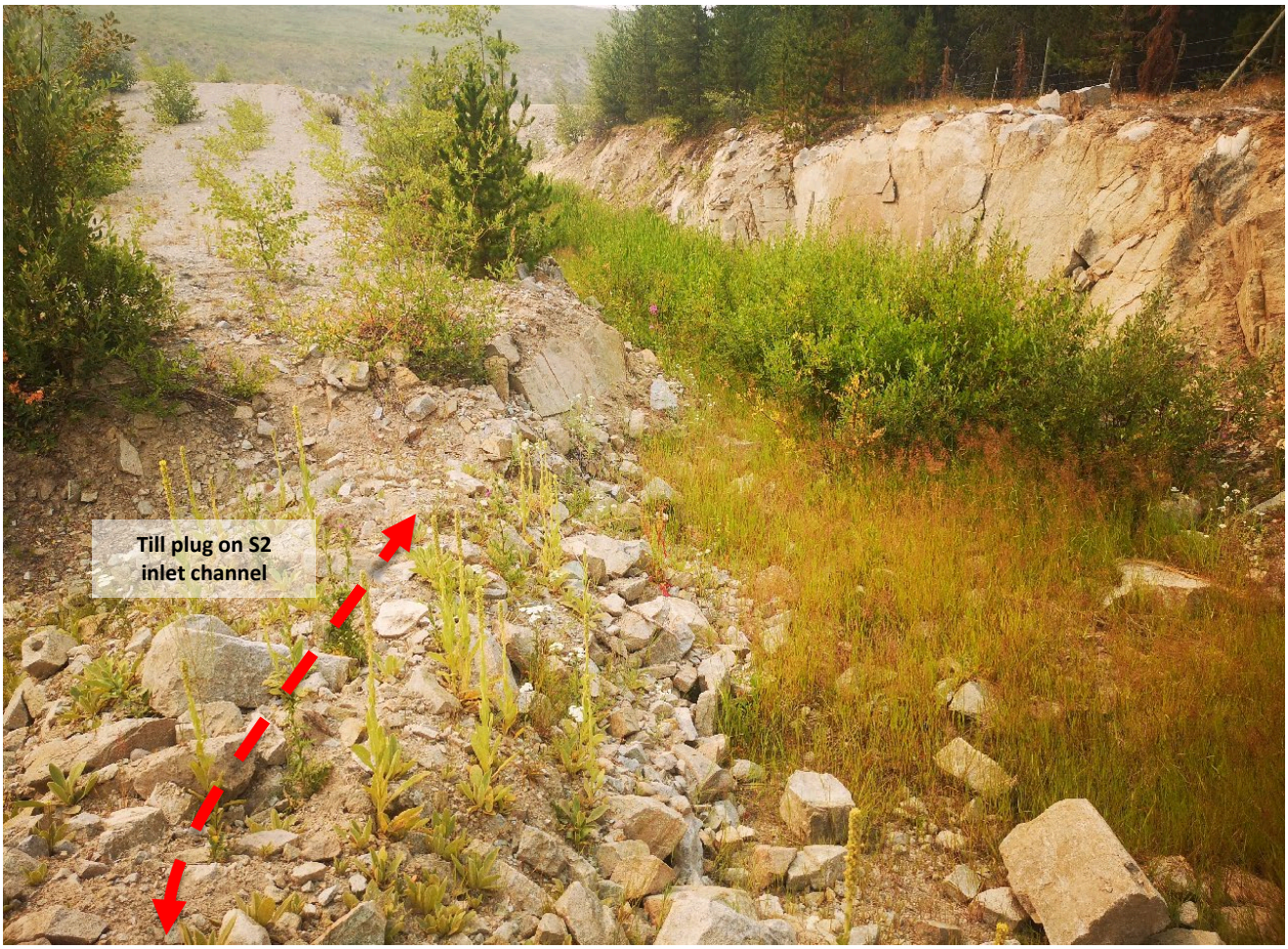


Photo I-B-14 S2 Pond: S2 Pond inlet and channel from Highmont Spillway Diversion. Channel and the inlet are vegetated; needs to be cleared as part of routine maintenance. (HGH-2021-24).

Photo I-B-15 S2 Pond: View of Highmont Spillway channel. Channel is in good condition. Excess vegetation needs to be removed by HVC as part of routine maintenance (HGH-2021-25).

Photo I-B-16 S2 Pond: Vegetation and signs of recent ponded water at downstream toe (HGH-2021-26).

Seepage Recovery Pond S3

Photo I-B-17 S3 Pond: Overview of dam crest from right abutment (HGH-2021-27).

Photo I-B-18 S3 Pond: Overview of dam crest from mid dam, looking toward left abutment (HGH-2021-28).

Photo I-B-19 S3 Pond: Overview of dam crest from left abutment (HGH-2021-29).

Photo I-B-20 S3 Pond: Overview of downstream slope from right abutment (HGH-2021-27).

Photo I-B-21 S3 Pond: Overview of downstream slope with small trees from mid dam (HGH-2021-28).

Photo I-B-22 S3 Pond: Overview of downstream slope from left abutment (HGH-2021-29).

Photo I-B-23 S3 Pond: Overview of upstream slope from right abutment (HGH-2021-27).

Photo I-B-24 S3 Pond: Impoundment and Highmont South Dam slope in the background. View from S3 Pond left abutment, looking northwest (HGH-2021-29).

Photo I-B-25 S3 Pond: View of blocked spillway inlet at right abutment (HGH-2021-30).

Seepage Recovery Pond S5

Photo I-B-26 S5 Pond: Overview of crest. Minor rutting observed on crest and access road is managed by HVC, as needed (HGH-2021-31).

Photo I-B-27 S5 Pond: View of access road on the divider dyke. Minor rutting observed on crest of divider dyke is managed under routine maintenance (HGH-2021-31).

Photo I-B-28 S5 Pond: Downstream slope of perimeter crest, looking north (HGH-2021-31).

Photo I-B-29 S5 Pond: S5 Pond north outlet pipe, permanently sealed. Metal plates placed at intake and pipes filled with till in 2015 (HGH-2021-32 and HGH-2021-33).

Photo I-B-30 S5 Pond: Overview of Pumping Sub-cell (HGH-2021-34).

Photo I-B-31 S5 Pond: Overview of S5 Pond basin (HGH-2021-32).

Photo I-B-32 S5 Pond: Pumping Sub-cell spillway channel (HGH-2021-34).

Photo I-B-33 S5 Pond: Pumping Sub-cell Outlet #2 (South). Metal plates placed at intake and pipes filled with till in 2015 (HGH-2021-35).

Photo I-B-34 S5 Pond: Overview of downstream slope and Outlet #2 pipe daylighting at toe, looking east (HGH-2021-35).

Photo I-B-35 S5 Pond: Spillway Overflow pipes partially blocked at intake by sand bags. Potential animal burrow identified. KCB suggests clearing out vegetation from spillway channel and backfilling potential animal burrow (HGH-2021-36 and HGH-2021-37).

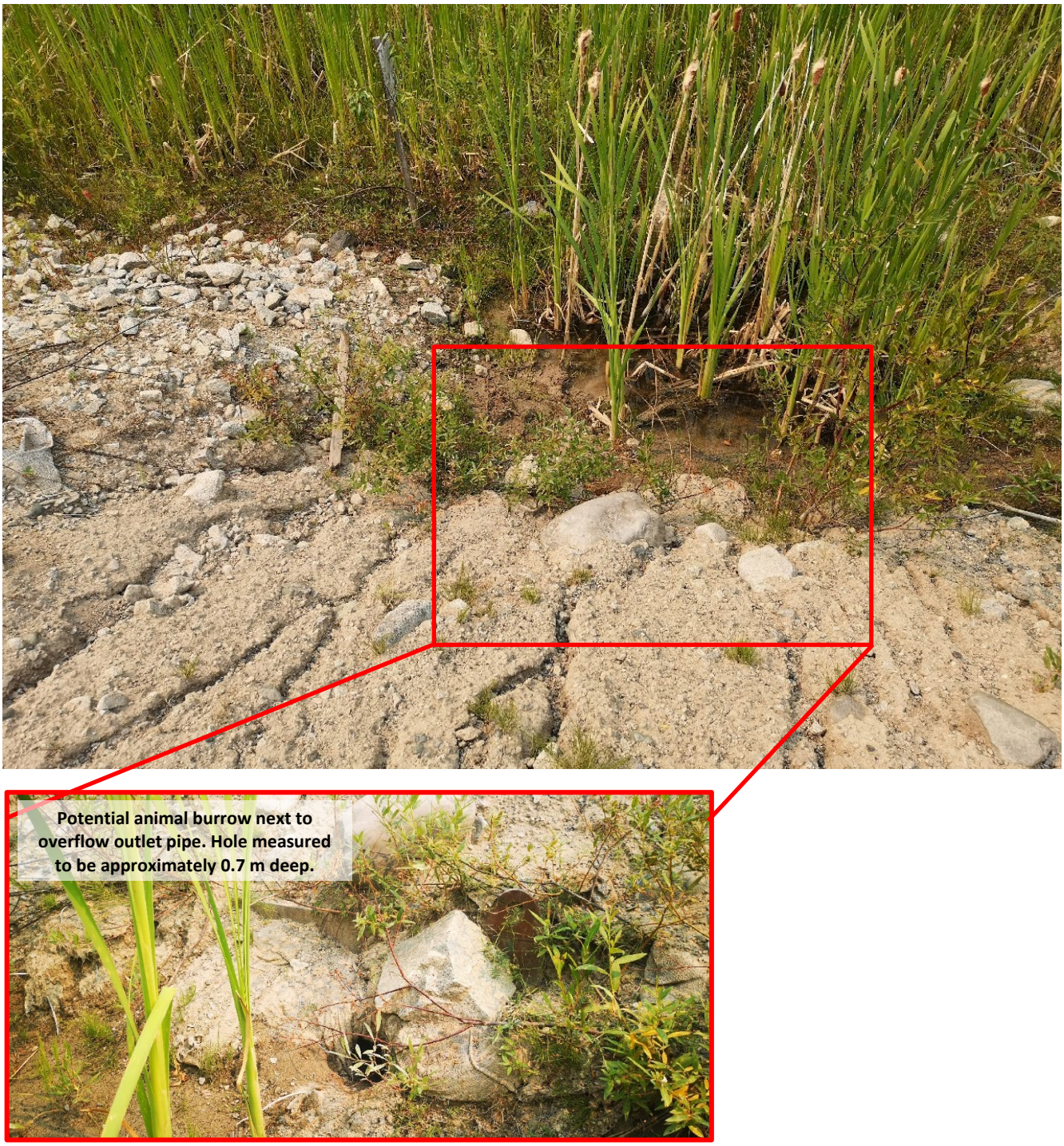


Photo I-B-36 S5 Pond: Overview of downstream slope and S5 Overflow outlet pipes daylighting at toe, looking east (HGH-2021-36).

Photo I-B-37 S5 Pond: Downstream toe of perimeter crest. Change of vegetation suggests there has been temporary ponding at the toe likely due to the run-off; no signs of seepage (HGH-2021-31).

Seepage Recovery Pond S8

Photo I-B-38 S8 Pond: Overview of crest from left abutment (HGH-2021-38).

Photo I-B-39 S8 Pond: View of downstream slope (HGH-2021-39).

Photo I-B-40 S8 Pond: View of S8 Pond impoundment. Highmont North Dam downstream slope is visible on right hand side of picture (HGH-2021-38).

Photo I-B-41 S8 Pond: View of impoundment, catwalk and outlet pump to S1 Pond (HGH-2021-40 and HGH-2021-41).

Photo I-B-42 S8 Pond: Overview of overflow pipe trash rack. Rack is clear of debris. Current water level is below the invert (HGH-2021-40).

APPENDIX II

Climate and Instrumentation

APPENDIX II-A

Climate Data

Appendix II-A
Climate Data

HVC provided weather data from the L-L Dam Weather Station (El. 1186.0 m), for the 2021 AFPR review period, for KCB to review. KCB adjusted the L-L Dam Weather Station data and Historical Average Lornex Synthetic Record data using the Highmont/Bethlehem and Trojan Area adjustment factors provided in Golder (2021). KCB selected these adjustment factors as their elevation is consistent with the Highmont TSF catchment (>El. 1487 m, i.e. dam crest). To support key precipitation trends and impacts on observed dam performance, KCB downloaded data from the Kamloops Pratt Road Weather Station (Environment Canada Station No. 116C8P0, El. 729.0 m, 73 km away), and was provided data from the Shula Weather Station (El. 1208 m, station located on HVC property) by HVC, to review and compare precipitation trends against the L-L Dam Weather Station data. The Kamloops Pratt Road Weather Station (El. 729.0 m) was used for comparison rather than the Kamloops Airport Station (El. 345.3 m), as the elevation at the Pratt Road Station is closer to L-L Dam Weather Station (El. 1186.0 m).

The precipitation normals (adjusted Highland Valley Lornex Synthetic Record) and precipitation records between October 2020 and September 2021 (adjusted L-L Dam, unadjusted Kamloops Pratt Road and unadjusted Shula Flats data), are tabulated and plotted in Table II-A-1 and Figure II-A-1, respectively. The following observations are noted for the L-L Dam adjusted precipitation in the reporting period:

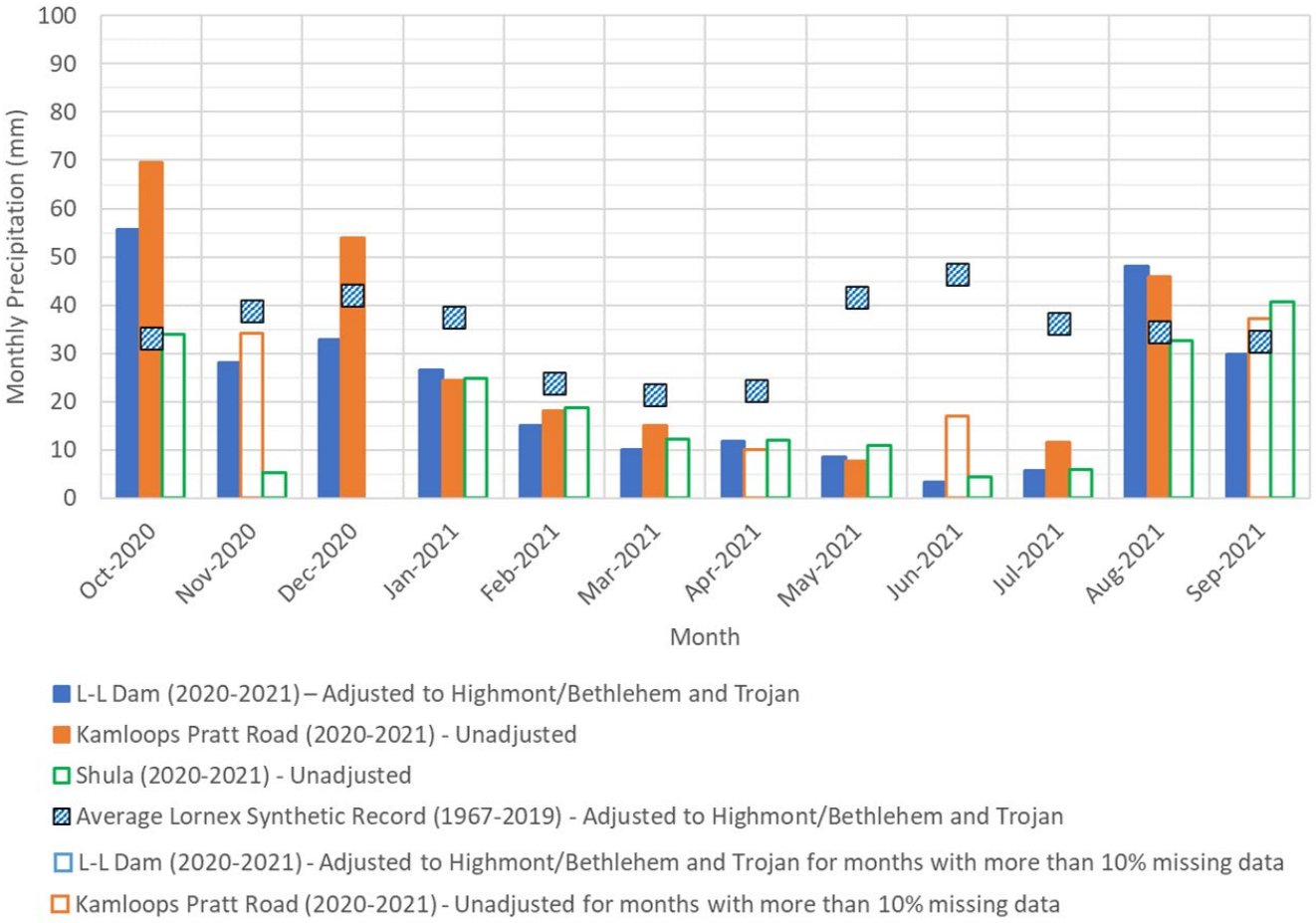
- All storm events during the review period were less than the 10-year return period rainfall event (40 mm in 24 hours). The largest 24-hour rainfall events measured at the L-L Dam Weather Station during the review period were: 23.7 mm on October 23, 2020; 16.2 mm on December 21, 2020; and 18.5 mm on August 16, 2021.
- In Figure II-A-1, all months, except for October 2020 and August 2021 reported 9% to 93% decreases relative to average precipitation. October 2020 precipitation increased 67% relative to the historic normals; August 2021 precipitation increased 40%.
- The L-L Dam Weather Station database included some gaps in 2020 measurements. HVC managed to improve the monitoring program and, as Figure II-A-1 indicates, there were no data gaps in the 2021 measurements. In addition, consistency in trends between the Kamloops Pratt Road Station, the Shula Weather Station data for 2021, and the L-L Weather Station provides confidence in the L-L Weather Station data.
- In Table II-A-2, snowpack depth measurements from the Highland Valley Station (El. 1268 m) indicate the snow had melted during April 2021, and was gone by May 1st. In comparison, the water balance assumes 30% of snowmelt occurs in March and 70% in April (Golder 2020a).
- Seasonal rise and fall of pond levels is associated with freshet. In 2021, pond levels dropped in May, coincident with completion of snowmelt, which is consistent with historic trends. Rainfall measured from March through May, when reservoir level was rising, was approximately 35% of the historical average during that same period, which suggests the majority of the 2021 freshet was related to snowmelt.

Table II-A-1 Monthly Precipitation

Month	Availability of Data (%)	Precipitation (mm)			
	L-L Dam Weather Station	L-L Dam Weather Station Data Adjusted to Highmont/Bethlehem and Trojan Area [1] (2020 to 2021)	Average Lornex Synthetic Record Adjusted to Highmont/Bethlehem and Trojan Area [2] (1967 to 2019)	Unadjusted Kamloops Pratt Road Weather Station (2020 to 2021)	Unadjusted Shula Weather Station [5] (2020-2021)
Oct 2020	99	55.6	33.3	69.6	33.9
Nov 2020	100	28.1	38.9	34.2 [4]	5.2 [4]
Dec 2020	100	32.9	42.1	54.0	N/A [6]
Jan 2021	100	26.5	37.5	24.4	24.9
Feb 2021	100	15.0	23.7	18.0	18.7
Mar 2021	100	10.1	21.5	15.0	12.3
Apr 2021	100	11.7	22.4	10.0 [4]	11.9
May 2021	100	8.4	41.7	7.6	10.9
Jun 2021	100	3.4	46.5	17.0 [4]	4.4
Jul 2021	100	5.8	36.3	11.6	5.9
Aug 2021	100	48.1	34.4	45.8	32.6
Sep 2021	100	29.7	32.6	37.2 [4]	40.7
Annual Total	-	275.4	410.8	344.4	201.4

Notes:
1. Available data from L-L Dam climate station was adjusted by a L-L Dam-to-Highmont/Bethlehem and Trojan Area adjustment factor of 1.02 (Golder 2021).
2. Estimated by Golder (2021) using appropriate adjustment factors and average precipitation measured at Highland Valley Lornex climate station (Environment Canada ID No. 1123469 at El. 1268 m from 1967 to 2011). Golder (2021) infilled the data gaps prior to November 2011 and created a long-term synthetic precipitation record to the end of 2019. Monthly average of the synthetic record adjusted to Highmont/Bethlehem and Trojan Area by a Lornex-to-Highmont/Bethlehem and Trojan Area adjustment factor of 1.12 are shown herein, refer to Golder (2021) for detailed information.
3. Review period for the Highmont TSF Annual Facility Performance Reports is from October 2020 through September 2021.
4. Monthly precipitation with more than 10% missing data.
5. 2021 monthly precipitation data provided to KCB as summarized data for the given month; therefore, the completeness of the data was not independently verified.
6. HVC noted that the data set was not complete enough to report, and as a result it was not counted.

Figure II-A-1 Monthly Precipitation



Note:
1. The Shula weather station data used for this comparison only included monthly values (i.e., no daily data) and thus, KCB was not able to assess the completeness of the dataset.

Seasonal snowpack depth is not measured at the L-L Dam weather station. Instead, HVC to monitors snowpack with monthly measurements at the Highland Valley snow survey station (Station No. 1C09A) near the Trojan TSF. The measurements are sorted by survey period (the first of January through May) to compare snowpack depths, in snow-water equivalent (SWE), for the same period each year. Historical average and 2021 snowpack depths, based on available records, are summarized in Table II-A-2.

Figure II-A-2 compares SWE data and temperature data from January to June 2021. The following observations are inferred from these data:

- The daily temperature recorded between January and June 2021 is within the historical monthly average records (between 2000 and 2019).

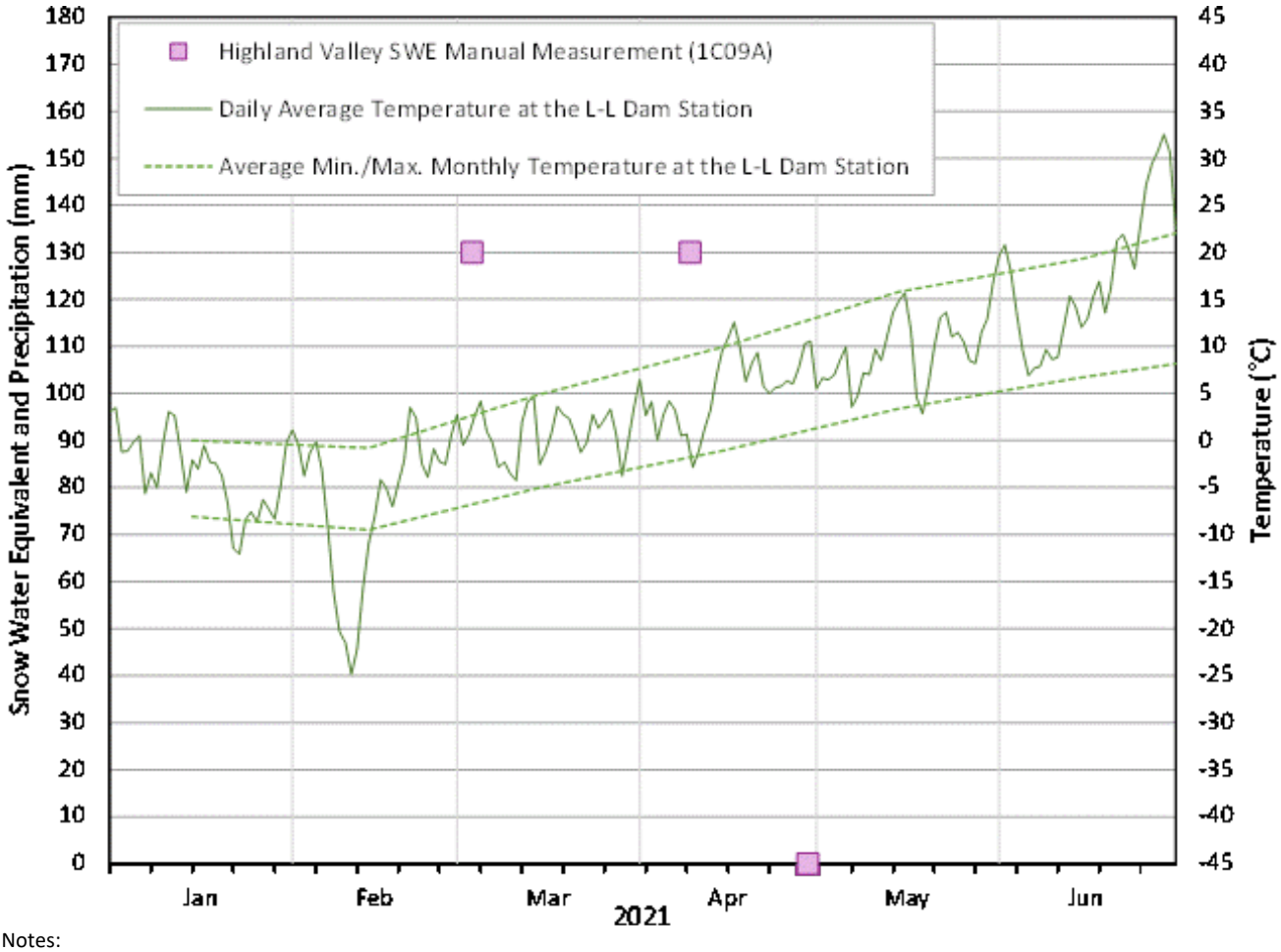
- The snowpack was depleted over a period of three weeks (between April 9 to 29), which is a quicker rate than the forecast snowmelt pattern from the HVC site wide water balance based on Golder (2020a).
- The rise in temperature above 0°C in April coincides with the snowmelt period manually recorded at the Highland Valley station.
- Rain was not a major factor in 2021 snowmelt, as the maximum daily precipitation recorded close to the snowpack depletion period is less than 6 mm/day.

Table II-A-2 Historical Average and 2021 Snowpack Depths

Survey Period	Years of Record[1]	Historic Average Snowpack Depth[2] (mm SWE[3])	2021 Snowpack Depth (mm SWE[3])	Percent Change Relative to Historic Average
January 1st	11	50.2	Not surveyed	N/A
February 1st	25	83.5	Not surveyed	N/A
March 1st	55	91.9	130	42%
April 1st	53	101.3	130	28%
May 1st	54	27.6	0	-100%
May 15th	25	2.4	Not surveyed	N/A
June 1st	8	0	Not surveyed	N/A

Notes:
1. At the Highland Valley snow survey station (Station No. 1C09A) near the Bethlehem TSF. Data prior to 1966 were not included as the station was moved to its current location in 1965.
2. Calculated based on available period on record.
3. SWE = snow water equivalent.

Figure II-A-2 Temperature Records and Measured Snowpack between January and June 2021



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

APPENDIX II-B

Instrumentation Summary and Plots

Appendix II-B
Instrumentation Summary and Plots

II-B-1 PIEZOMETERS

Piezometric readings from 2011 to 2021 are shown on Figure II-B-1 to Figure II-B-5.

Thresholds for piezometers were updated and reported in the 2016 AFPR (KCB 2017). The thresholds were set at 0.5 m above the maximum elevation head to identify any deviations from established trends. Questionable readings (e.g., where there was a spike that has not been repeated) were not used when defining thresholds. Maximum and minimum water levels during this review period and instrument thresholds were reviewed as part of 2021 Annual Facility Performance Report (AFPR), refer to Table II-B-1.

Table II-B-1 Piezometric Levels during the review period and 2022 thresholds

Instrument ID	Piezometric Levels during the review period [1] (m)		Proposed 2022 Threshold Value (m)[2]
	Maximum	Minimum	
S1	1431.5	1431.3	1432.4
S2	1451.3	1450.8	1452.5
S2-1	1479.9	1479.8	1481.4
S2-2	1480.3	1480.3	1482.0
S2-3	1481.8	1481.6	1483.4
S2-4	1482.3	1480.8	1482.9
S3-1	1481.3	1481.3	1482.0
S3-2	1482.0	1481.5	1483.0
PW-A	1479.1	1479.1	1480.5
PW-C (TALL)	1480.8	1480.4	1482.7
P-D	1480.4	1479.6	1482.2
P-E	1482.9	1481.3	***1483.4***
P-G	1481.7	1480.7	1482.5
PW-H	1480.6	1480.4	1481.3
P-I	1481.1	1481.0	1482.7
PW-J	1480.4	1479.4	1482.1
P-K	1480.3	1480.1	1482.2
PW-L	1481.0	1480.7	1481.8
P-M	1481.4	1481.3	1483.5
P-N	1480.3	1479.9	1481.9
P-O	1479.4	1479.4	1482.4
PW-P	1480.0	1480.0	1481.6
HM-PS-01 (13-SRK-14)	1478.2	1478.2	1480.5
HM-PS-02 (13-SRK-14)	1477.5	1477.5	1480.5
HM-PS-03 (13-SRK-13)	1477.9	1477.8	1480.5

Notes:
1. Oct 2020 through Sep 2021.
2. ***Bold Italics*** indicate revised threshold for 2022.

II-B-2 SURVEY MONUMENTS

Survey monuments at the Highmont North, East, and South Dams are shown on Figures 3, 4, and 5, respectively. Starting in November 2019, HVC changed the method used to survey the displacement monuments on the TSF. Previously, monuments were surveyed using a ground based total station with digital level. This has changed to a GPS Real Time Kinematic (RTK) survey. Based on the survey data collected to date, the RTK method is suitable to monitor horizontal displacement. In comparison to the total station method, the RTK surveys are showing less variance (i.e., error) in the horizontal plane but increased variance in elevation.

Survey results are shown on Figure II-B-6. The baseline location for each monument using the RTK method is offset from the total station surveys. However, subsequent readings show this is related to the change in survey method and not a movement trend.

Survey results using the RTK method are shown on Figure II-B-6. The horizontal surveys are plotted for the RTK method only, based on the new baseline location. However, KCB maintained a continuous record of settlement based on incremental change between RTK surveys.

Table II-B-2 summarizes incremental and cumulative displacement during the 2021 AFPR review period. Incremental displacements are relative to the November 2019 RTK baseline. Change from initial survey for horizontal displacement is also reported relative to the November 2019 RTK baseline.

Table II-B-2 2021 Survey Monument Incremental Displacement Summary

Monument	Incremental[1]		Change from Initial Survey	
	Vector Horizontal Displacement (mm)	Vertical Displacement (mm)	Vector Horizontal Displacement[2] (mm)	Vertical Displacement[3] (mm)
P2	20, parallel to dam crest (toward east)	+2	13, parallel to dam crest (toward northeast)	-15
P3	38, upstream (toward southeast)	+11	31, upstream (toward southeast)	+22
P4	38, downstream (toward southeast)	-9	21, downstream (toward southeast)	-49
P5	21, upstream (toward southeast)	+19	23, upstream (toward southeast)	+13
P6	24, downstream (toward east)	-18	16, downstream (toward east)	-36
P7	45, downstream (toward southeast)	+11	37, downstream (toward southeast)	-30

Notes:
1. Incremental displacements are calculated between the September 2020 and August 2021 surveys.
2. Cumulative horizontal displacements calculated relative to the RTK November 2019 baseline.
3. All monuments earliest historic readings are in 2007. Cumulative vertical displacements calculated by adding the incremental displacement from the surveys over the review period and the displacement from the 2019 survey (revised baseline) up until the review period (while assuming no vertical displacement occurred between the last total station survey with elevation data (October 2019) and the date of the GPS RTK baseline survey (November 2019), as this is believed to be error that is not representative of movement).

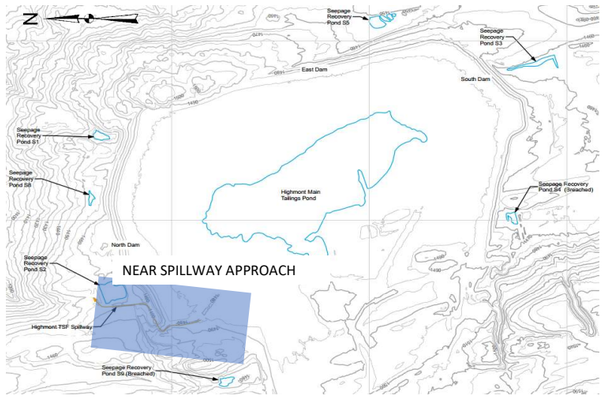
The current survey movement thresholds were set based on typical variance and error using the total station method; refer to Table II-B-3. These thresholds will be revised by KCB and HVC in 2022, based on the RTK survey method data. The survey readings for this review period do not indicate any increased displacement, and horizontal movement trends and settlement rates were consistent with recent behaviour.

Table II-B-3 Total Station Survey Monument Displacement Thresholds

Instrument ID	Horizontal Vector Displacement from Original Position (mm)	Incremental Settlement Between Readings (mm)	Total Settlement (mm)
P2	80	20	50
P3			50
P4			75
P5			150
P6			75
P7			75

Notes:
1. Thresholds will be revised in 2022 by KCB and HVC based on the GPS Real Time Kinematics (RTK) method.

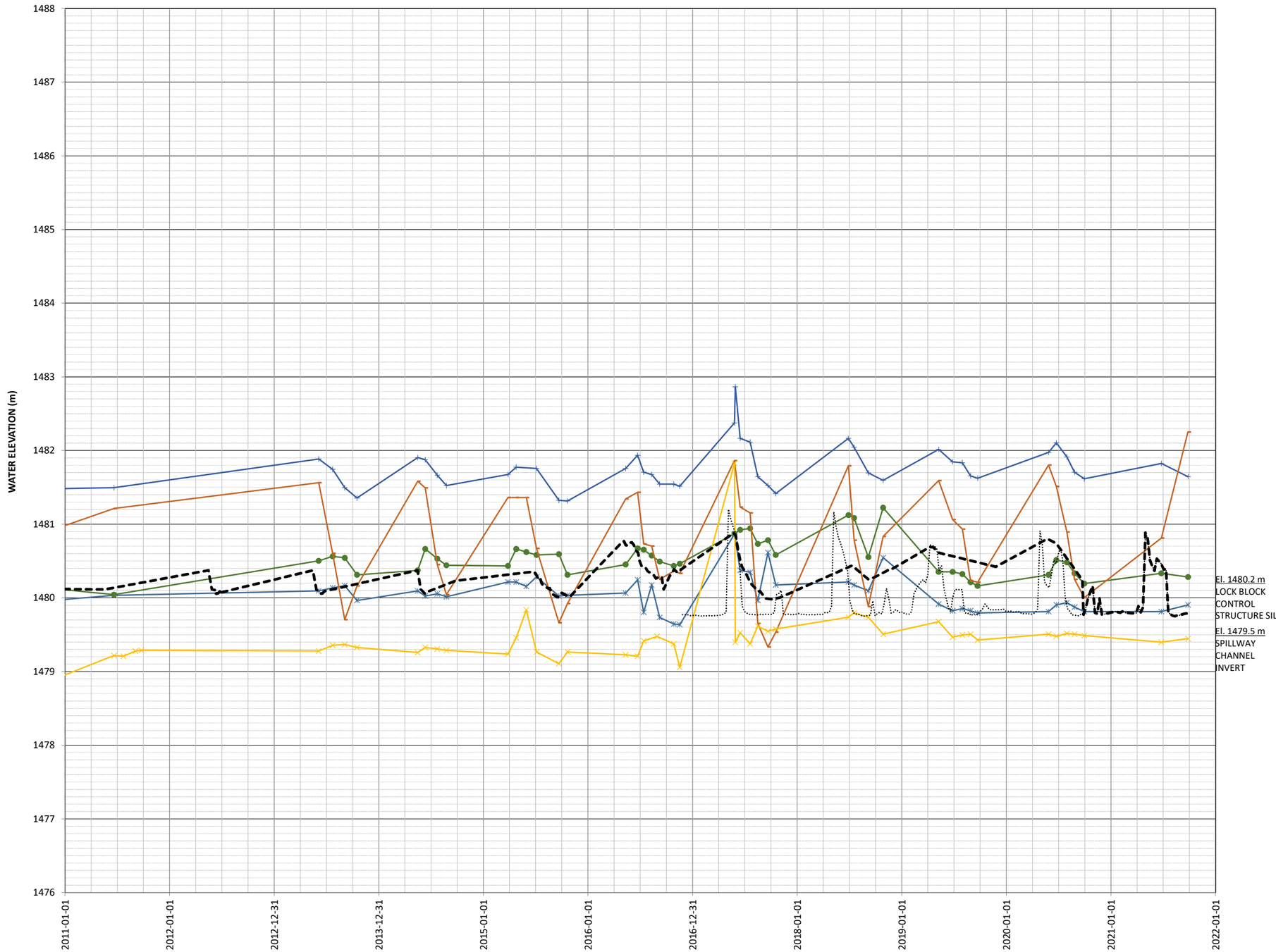
INSTRUMENTATION PLOTS



LEGEND:

- S2-1 (TIP EL. 1477.5 m,)
- S2-2 (TIP EL. 1479.2 m,)
- S2-3 (TIP EL. 1476.7 m,)
- S2-4 (TIP EL. 1477.8 m,)
- P-O (TIP EL. 1478.8 m,)
- HIGHMONT TSF POND LEVEL
- HIGHMONT SPILLWAY (TRANSDUCER DATA)

PIEZOMETER ID	2021 THRESHOLD EL. (m)
P-O	1482.4
S2-1	1481.4
S2-2	1482.0
S2-3	1483.4
S2-4	1482.9



NOTES:
1. HIGHMONT POND LEVEL PLOTS TRANSDUCER DATA FROM SEPTEMBER 27, 2020 TO END OF 2021 AFPR REPORTING PERIOD.

CLIENT: Highland Valley Copper / Teck
Klohn Crippen Berger

PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: HIGHMONT TSF PIEZOMETRIC DATA
2011-2021

NEAR SPILLWAY APPROACH

PROJECT No. M02341C12

FIG No. II-B-1

January 5, 2022
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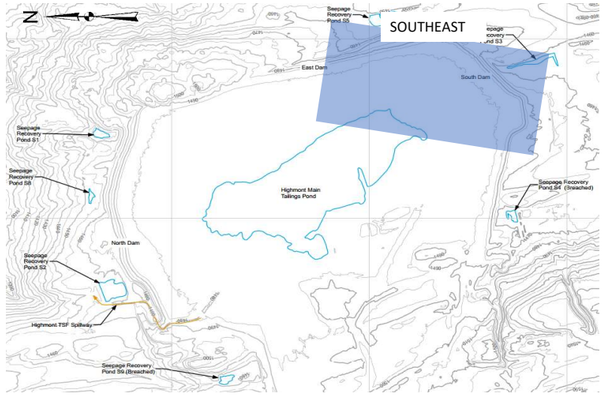
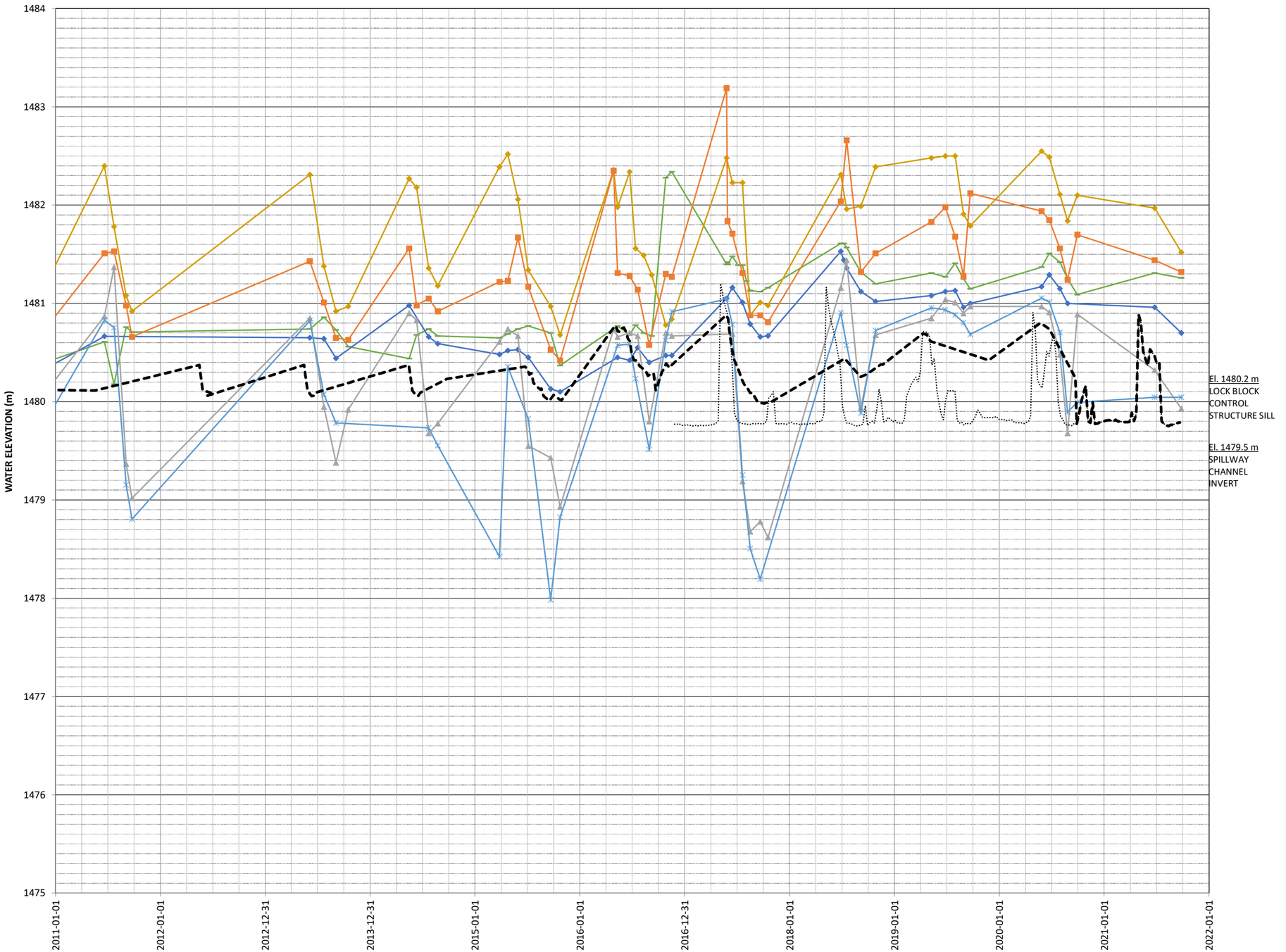


LEGEND:

- S3-1 (TIP EL. 1476.3 m,)
- S3-2 (TIP EL. 1477.4 m,)
- PW-L (TIP EL. 1473.5 m,)
- P-M (TIP EL. 1474.3 m,)
- P-N (TIP EL. 1473.6 m,)
- PW-P (TIP EL. 1473.5 m,)
- HIGHMONT TSF POND LEVEL
- ····· HIGHMONT SPILLWAY (TRANSDUCER DATA)

PIEZOMETER ID	2021 THRESHOLD EL. (m)
PW-L	1481.8
P-M	1483.5
P-N	1481.9
S3-1	1482.0
S3-2	1483.0
PW-P	1481.6



NOTES:
1- PW-L WAS REPORTED DRY ON SEP 30, 2020.
2. HIGHMONT POND LEVEL PLOTS TRANSDUCER DATA FROM SEPTEMBER 27, 2020 TO END OF 2021 AFPR REPORTING PERIOD.

CLIENT: Highland Valley Copper / Teck
Klohn Crippen Berger
PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT
TITLE: HIGHMONT TSF PIEZOMETRIC DATA
2011-2021
SOUTH EAST
PROJECT No. M02341C12
FIG No. II-B-2

January 5, 2022
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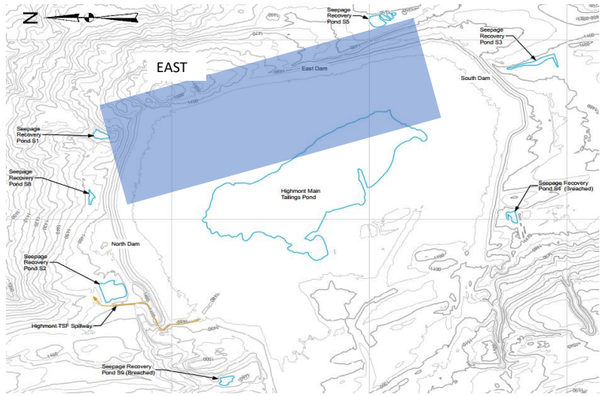

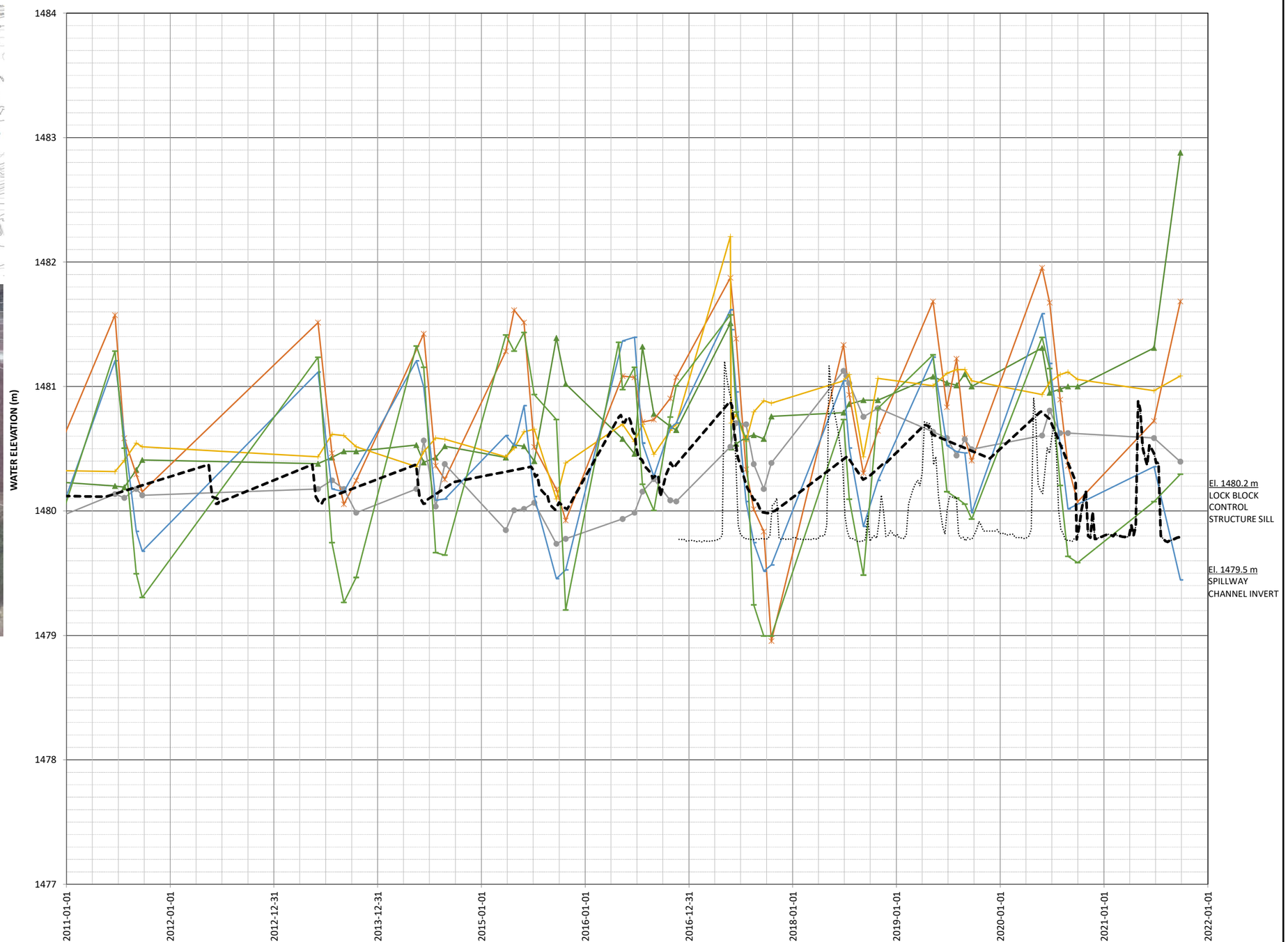

LEGEND:

- P-E (TIP EL. 1473.4 m,)
- P-G (TIP EL. 1475 m,)
- PW-H (TIP EL. 1473.4 m,)
- P-I (TIP EL. 1474.6 m,)
- PW-J (TIP EL. 1475.4 m,)
- P-K (TIP EL. 1474.9 m,)
- HIGHMONT TSF POND LEVEL
- HIGHMONT SPILLWAY (TRANSDUCER DATA)

PIEZOMETER ID	2021 THRESHOLD EL. (m)
P-E	1482.6
P-G	1482.5
P-K	1482.2
PW-H	1481.3
P-I	1482.7
PW-J	1482.1

NOTES:
1. PW-H AND PW-J WERE REPORTED DRY ON SEP 30, 2020.
2. HIGHMONT POND LEVEL PLOTS TRANSDUCER DATA FROM SEPTEMBER 27, 2020 TO END OF 2021 AFPR REPORTING PERIOD.

CLIENT: Highland Valley Copper / Teck
Klohn Crippen Berger
PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT
TITLE: HIGHMONT TSF PIEZOMETRIC DATA 2011-2021
EAST
PROJECT No. M02341C12
FIG No. II-B-3

January 5, 2022
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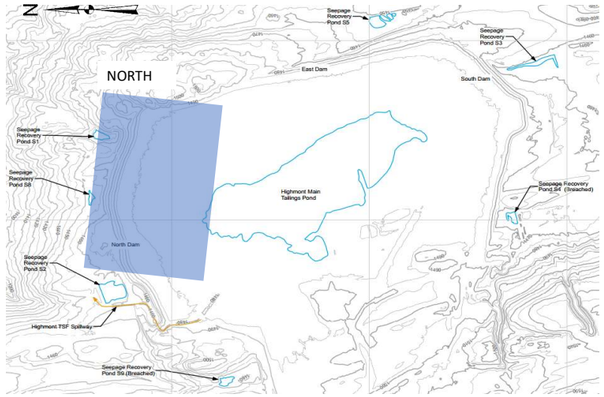
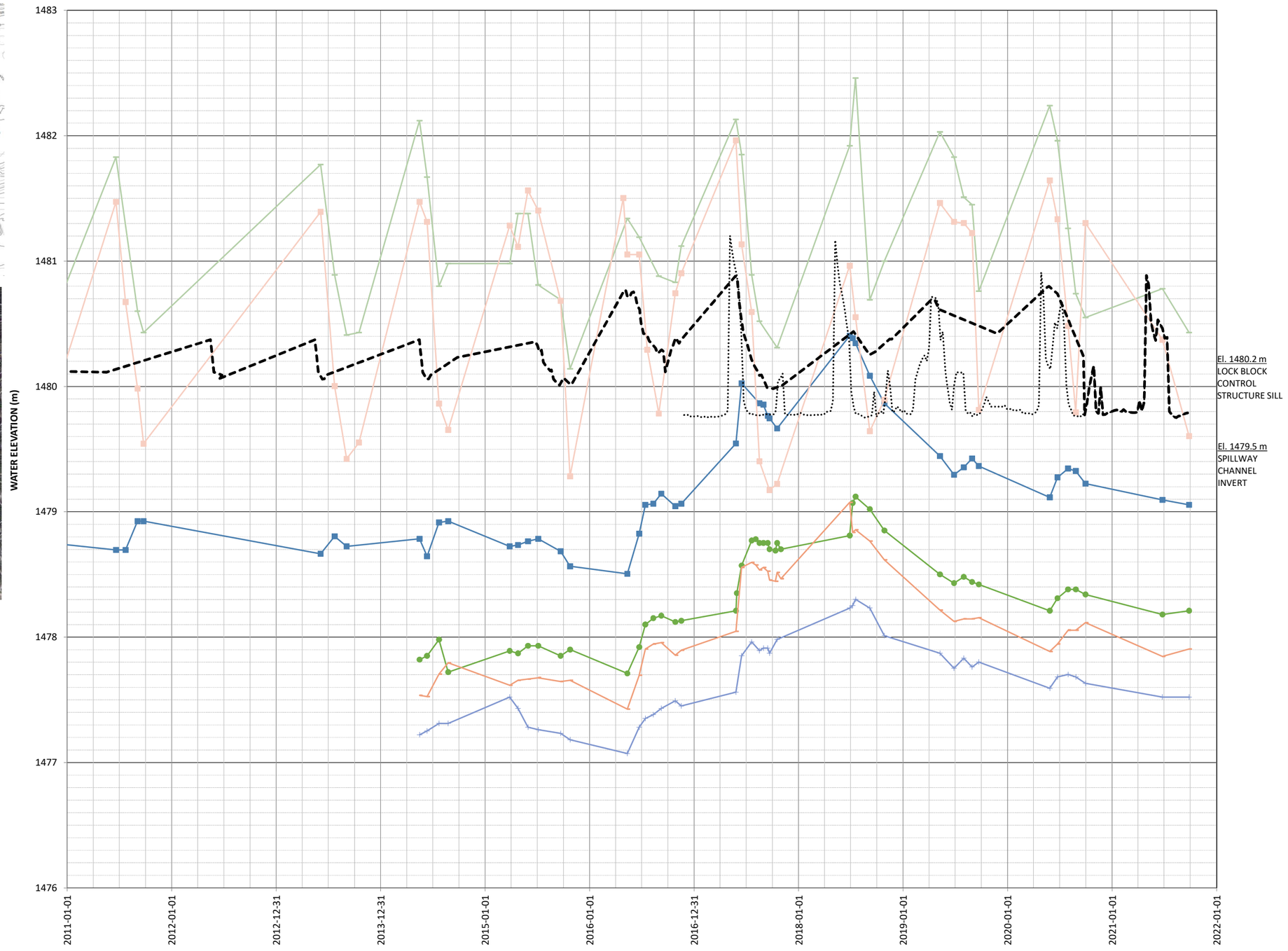


LEGEND:

- PW-A (TIP EL. 1473.3 m,)
- PW-C (TALL) (TIP EL. 1475.8 m,)
- P-D (TIP EL. 1476.6 m,)
- HM-PS-01 (13-SRK-14) (TIP EL. 1466.8 m,)
- HM-PS-02 (13-SRK-14) (TIP EL. 1456.55 m,)
- HM-PS-03 (13-SRK-13) (TIP EL. 1456.9 m,)
- HIGHMONT TSF POND LEVEL
- HIGHMONT SPILLWAY (TRANSDUCER DATA)

PIEZOMETER ID	2021 THRESHOLD EL. (m)
PW-A	1480.5
PW-C (TALL)	1482.7
P-D	1482.2
HM-PS-01 (13-SRK-14)	1480.5
HM-PS-02 (13-SRK-14)	1480.5
HM-PS-03 (13-SRK-13)	1480.5



Notes:
1. HIGHMONT POND LEVEL PLOTS TRANSDUCER DATA FROM SEPTEMBER 27, 2020 TO THE END OF THE 2021 AFPR REPORTING PERIOD.

CLIENT: Highland Valley Copper / Teck
Klohn Crippen Berger
PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT
TITLE: HIGHMONT TSF PIEZOMETRIC DATA
2011-2021
NORTH
PROJECT No. M02341C12
FIG No. II-B-4

January 5, 2022
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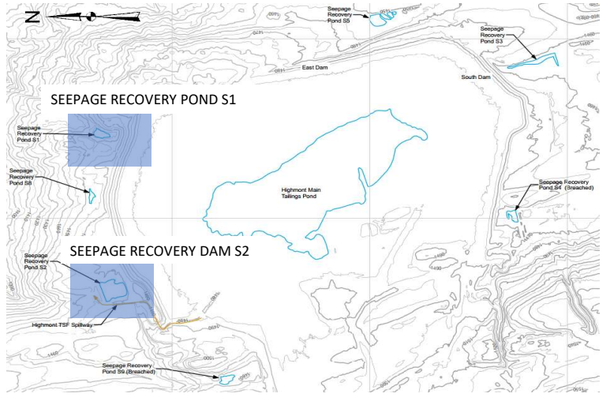
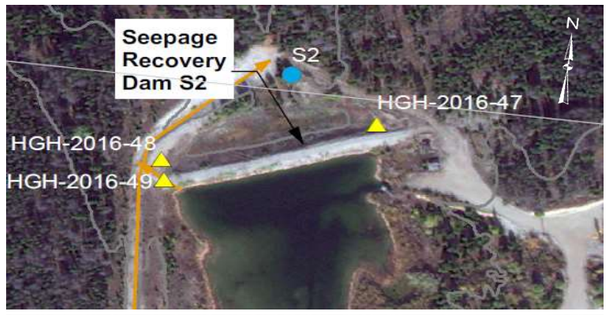
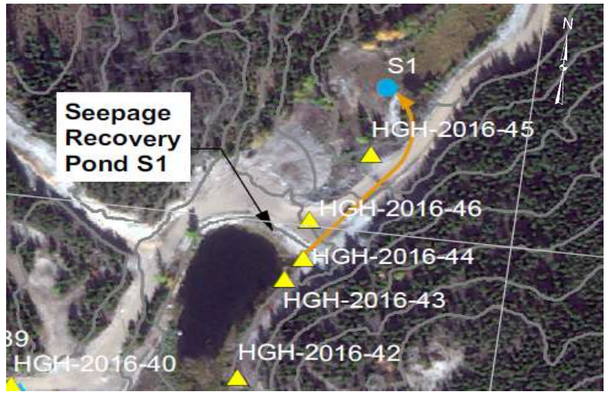
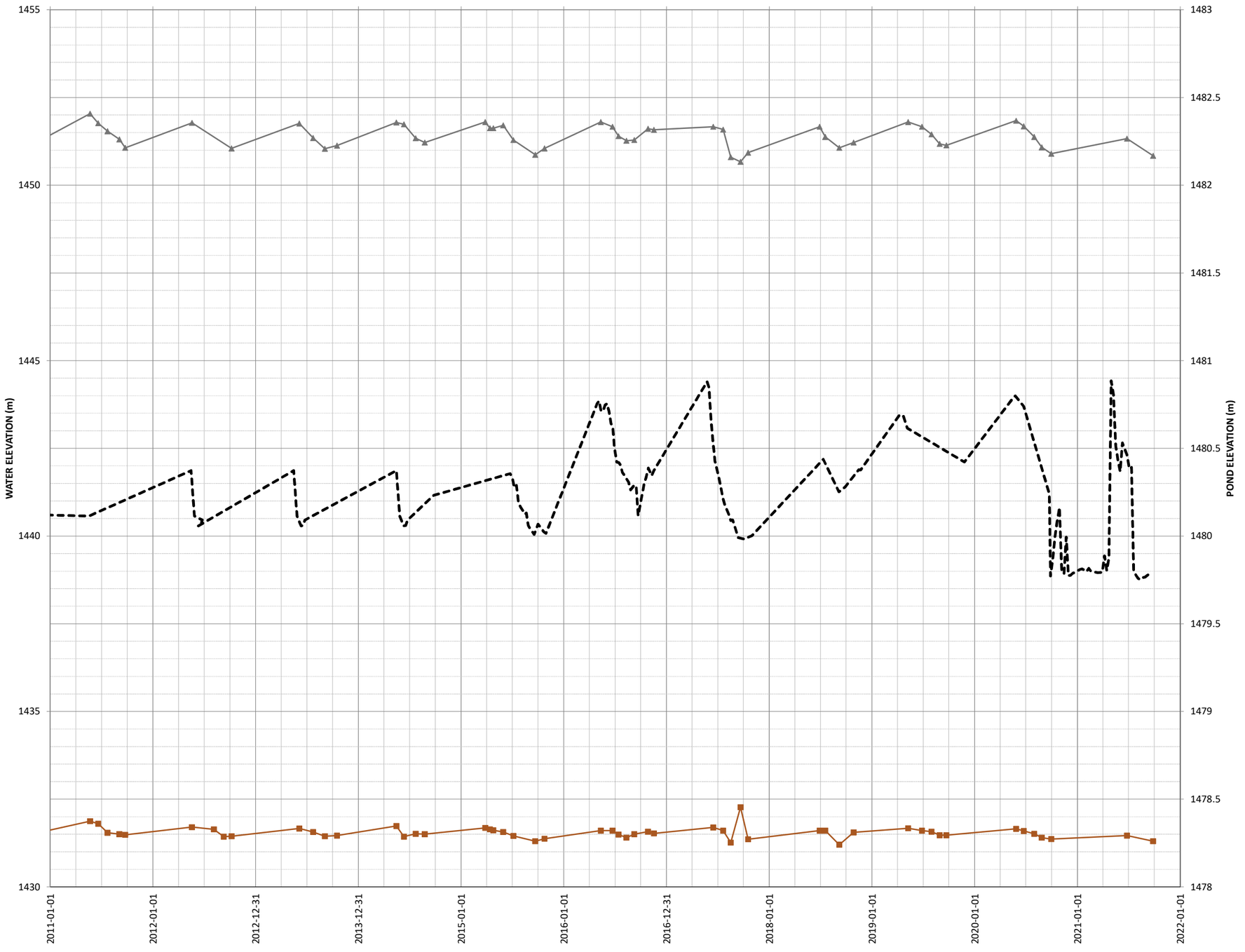








LEGEND:

- HIGHMONT TSF POND LEVEL
- S1 (TIP EL. UNKNOWN m,)
- S2 (TIP EL. UNKNOWN m,)

PIEZOMETER ID	2021 THRESHOLD EL. (m)
S1	1432.4
S2	1452.5

NOTES:

1. PIEZOMETER WATER ELEVATIONS PLOTTED ON PRIMARY (LEFT) AXIS, POND ELEVATION PLOTTED ON SECONDARY (RIGHT) AXIS.
2. TIP ELEVATIONS FOR S-1 AND S-2 ARE UNAVAILABLE.
3. HIGHMONT POND LEVEL PLOTS TRANSDUCER DATA FROM SEPTEMBER 27, 2020 TO THE END OF THE 2021 AFPR REPORTING PERIOD.

CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

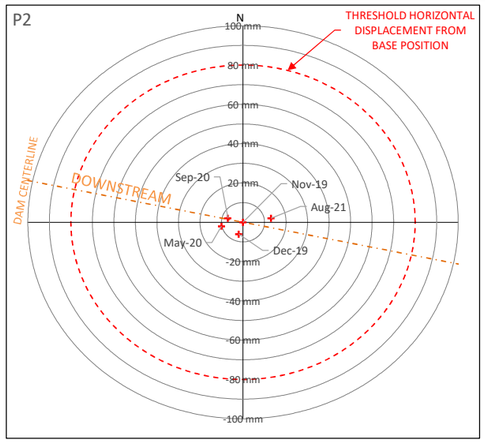
TITLE: HIGHMONT TSF PIEZOMETRIC DATA
2011-2021

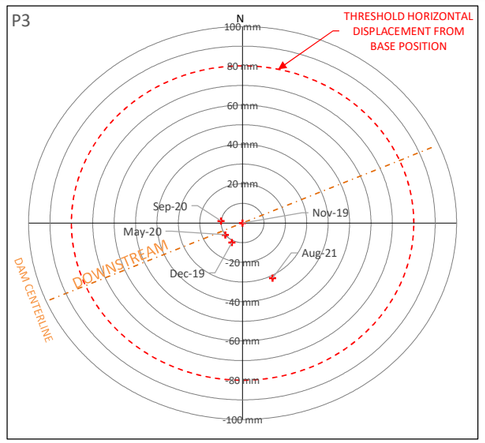
SEEPAGE PONDS

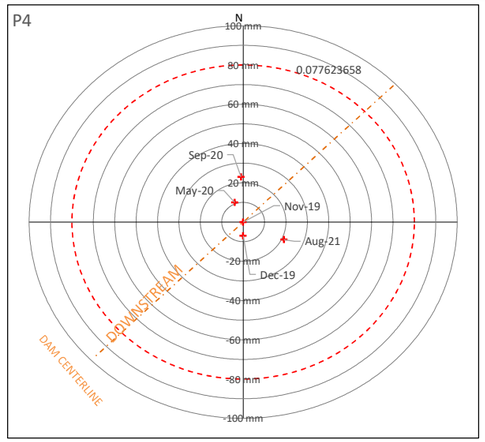
PROJECT No. M02341C12

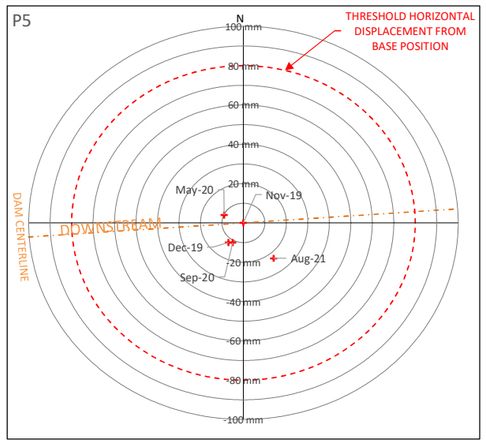
FIG No. II-B-5

January 5, 2022
Z:\MV\CRM\02341C12-HVC 2021 Dam Safety Support\300 Design\320 Piezometer Data\Highmont\[211129 Highmont Piezo.xlsx]Pond El

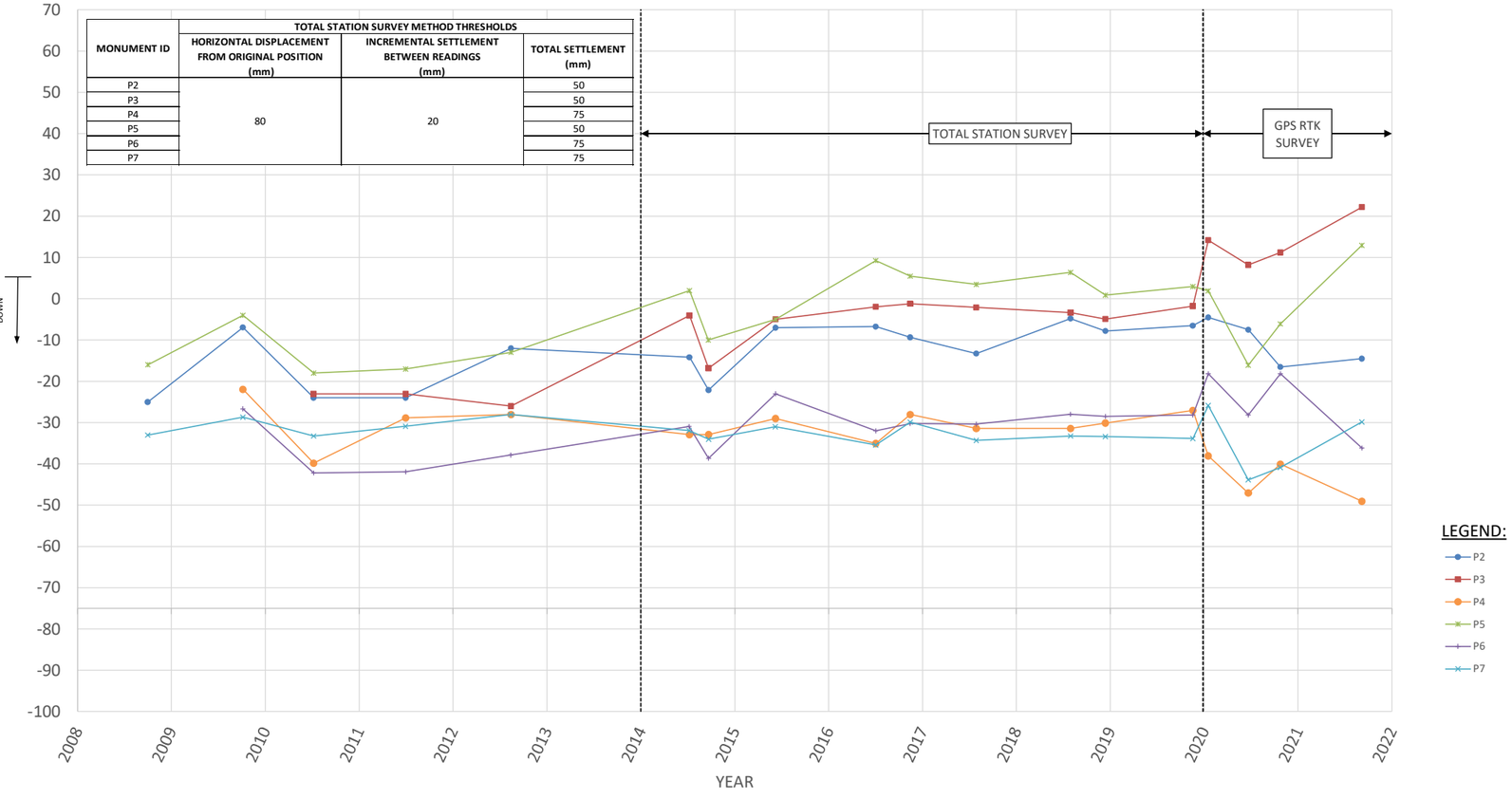


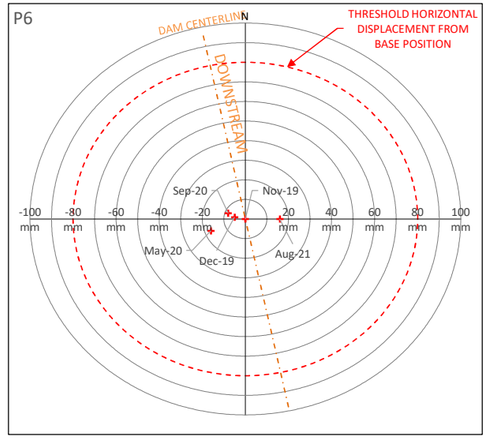


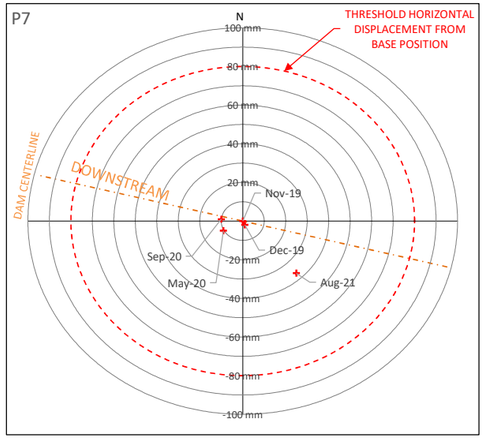




MONUMENT ID	TOTAL STATION SURVEY METHOD THRESHOLDS		
	HORIZONTAL DISPLACEMENT FROM ORIGINAL POSITION (mm)	INCREMENTAL SETTLEMENT BETWEEN READINGS (mm)	TOTAL SETTLEMENT (mm)
P2	80	20	50
P3			50
P4			75
P5			50
P6			75
P7			75







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. HIGHMONT DAM CREST MOVEMENT MONITORING DATA PRIOR TO 2007 NOT SHOWN.
4. P2 JUNE 2016 READING (NOT SHOWN IN PLAN PLOT) LOCATED 139 MM FROM INITIAL 2007 READING. READING WAS REVIEWED AND FOUND MORE LIKELY RELATED TO SURVEY ERROR THAN DISPLACEMENT. DISPLACEMENT WAS MOSTLY IN A NORTHWEST DIRECTION PERPENDICULAR TO THE DAM ORIENTATION, BUT SLIGHTLY IN THE DOWNSTREAM DIRECTION.
5. P4 2008, AND 2009 READINGS (NOT SHOWN IN PLAN PLOT) LOCATED 240 mm and 167 mm FROM INITIAL 2007 READING, RESPECTIVELY. READING WAS REVIEWED AND FOUND MORE LIKELY RELATED TO SURVEY ERROR THAN DISPLACEMENT.
6. 2021 SETTLEMENT PLOTTED BY ADDING INCREMENTAL DISPLACEMENT BETWEEN GPS RTK SURVEY READINGS TO CUMULATIVE TOTAL DISPLACEMENT ON OCT. 17, 2019. THIS ASSUMES NO SETTLEMENT OCCURED BETWEEN OCT. 17 AND NOVEMBER 12, 2019.

CLIENT: Highland Valley Copper / Teck
Klohn Crippen Berger
PROJECT: HIGHMONT TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT
TITLE: HIGHMONT DAM SURVEY MONUMENT READINGS
PROJECT No. M02341C12
FIG No. II-B-6

December 22, 2021
Z:\MVCR\M02341C12-HVC 2021 I Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monument\Bethlehem\[211203 BoseLakeDamMonitoring.xlsm]Fig V-B-10

HM-S1-FS-02 (WEIR UPSTREAM OF S1)
HM-S3-FS-01 (WEIR)
HM-S5-FS-01 (PIPE AND BUCKET)
HM-S8-FS-01 (PIPE AND BUCKET)
HIGHMONT TSF POND LEVEL
HIGHMONT SPILLWAY (TRANSDUCER DATA)

HIGHER WEIR FLOWS DUE TO 2017
HIGHER THAN AVERAGE FRESHET

WEIR FLOW (l/min)

HIGHMONT POND ELEVATION (m)

0
50
100
150
200
250
300
350

1477.5
1478
1478.5
1479
1479.5
1480
1480.5
1481

2016-01-01
2016-01-31
2016-03-01
2016-04-01
2016-05-01
2016-06-01
2016-07-01
2016-08-01
2016-08-31
2016-10-01
2016-10-31
2016-11-30
2016-12-31
2017-01-30
2017-03-02
2017-04-01
2017-05-02
2017-06-01
2017-07-02
2017-08-01
2017-09-01
2017-10-01
2017-10-31
2017-12-01
2017-12-31
2018-01-31
2018-03-02
2018-04-02
2018-05-02
2018-06-02
2018-07-02
2018-08-01
2018-09-01
2018-10-01
2018-11-01
2018-12-01
2019-01-01
2019-01-31
2019-03-03
2019-04-02
2019-05-03
2019-06-02
2019-07-02
2019-08-02
2019-09-01
2019-10-02
2019-11-01
2019-12-02
2020-01-01
2020-02-01
2020-03-02
2020-04-01
2020-05-02
2020-06-01
2020-07-02
2020-08-01
2020-09-01
2020-10-01
2020-11-01
2020-12-01
2021-01-01
2021-01-31
2021-03-02
2021-04-02
2021-05-02
2021-06-02
2021-07-02
2021-08-02
2021-09-01
2021-10-02
2021-11-01
2021-12-01
2022-01-01

Notes:
1. HIGHMONT POND LEVEL PLOTS TRANSDUCER DATA FROM SEPTEMBER 27, 2020 TO THE END OF THE 2021 AFPR REPORTING PERIOD.

CLIENT
Highland Valley Copper / Teck
Klohn Crippen Berger

PROJECT
HIGHMONT TAILINGS STORAGE FACILITY
2021 ANNUAL FACILITY PERFORMANCE REPORT

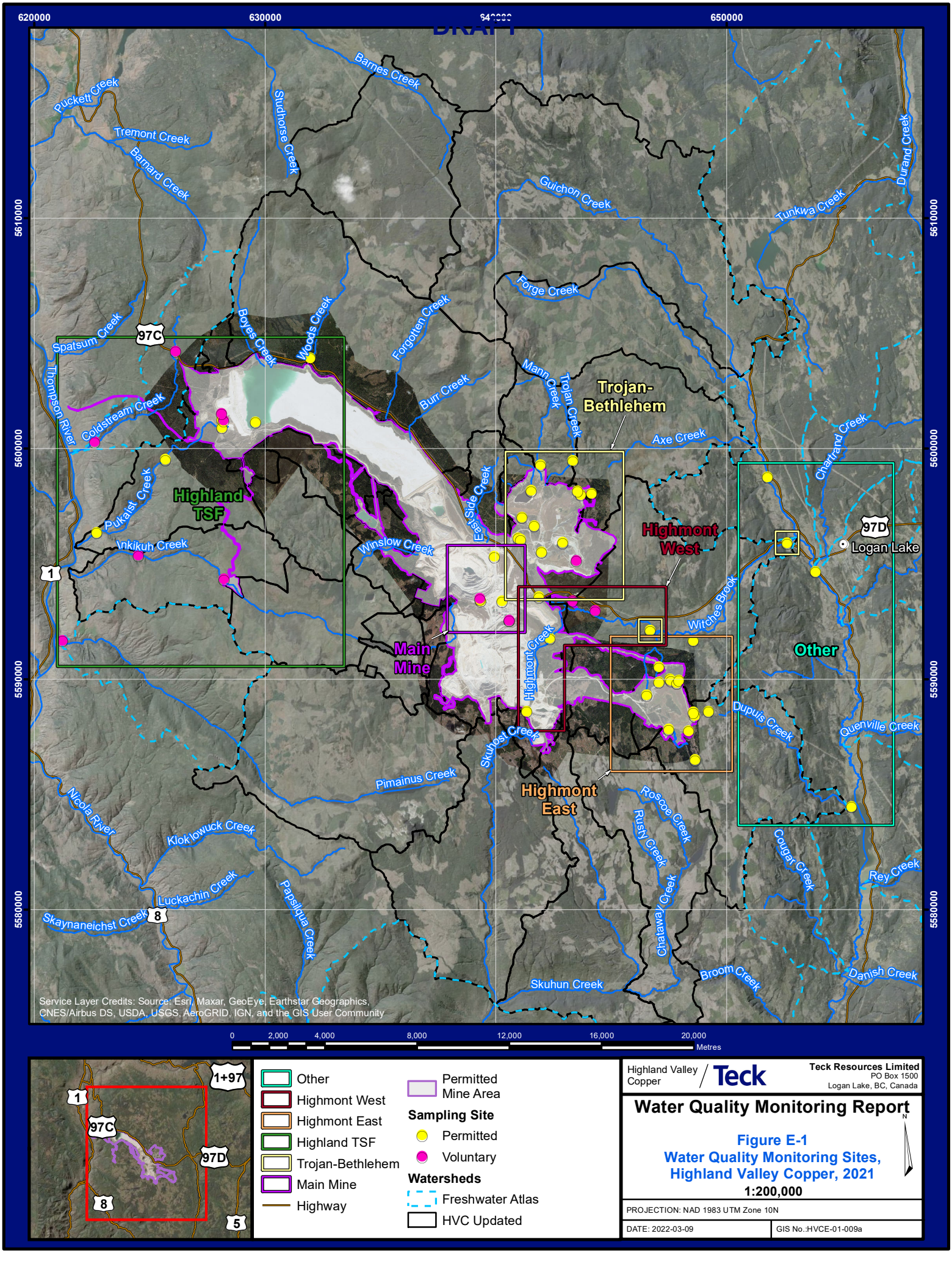
TITLE
SEEPAGE PONDS
WEIR FLOWS

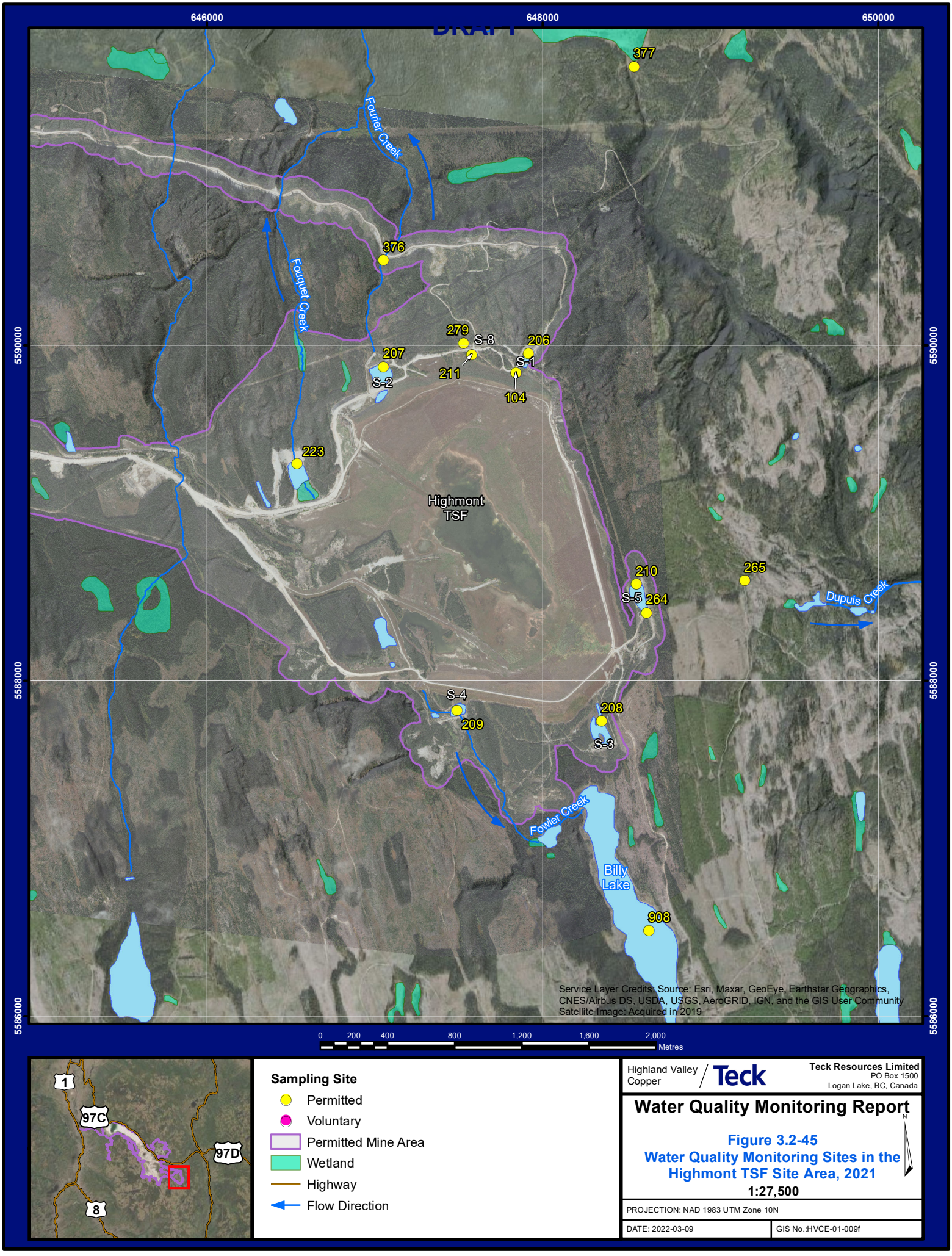
PROJECT No. M02341C12
FIG No. II-B-7

January 5, 2022
Z:\M\VCR\M02341C12-HVC 2021 Dam Safety Support\300 Design\350 Seepage Data\Highmont\[211129 Highmont Weir.xlsx]Fig. II-7 Seepage Pond Weir

APPENDIX III

Map of Water Quality Monitoring Points


DRAFT
620000
630000
640000
650000
5610000
5600000
5590000
5580000
Puckett Creek
Tremont Creek
Barnard Creek
Barnes Creek
Studhorse Creek
Guichon Creek
Tunkwa Creek
Durand Creek
Forge Creek
Spatsum Creek
97C
Boyes Creek
Woods Creek
Forgotten Creek
Thompson River
Coldstream Creek
Burr Creek
Mann Creek
Trojan Creek
Trojan-Bethlehem
Axe Creek
Chartrand Creek
Pukaist Creek
Highland TSF
East Side Creek
Highmont West
97D
Logan Lake
Inkikuh Creek
1
Winslow Creek
Witches Brook
Main Mine
Highmont Creek
Other
Dupuis Creek
Quenville Creek
Skuhost Creek
Pimainus Creek
Highmont East
Roscoe Creek
Rusty Creek
Nicola River
Klokiowuck Creek
Cougar Creek
Rey Creek
Luckachin Creek
Papsilqua Creek
Skaynaneichst Creek
8
Chatawai Creek
Broom Creek
Danish Creek
Skuhun Creek
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
0
2,000
4,000
8,000
12,000
16,000
20,000
Metres
1+97
1
97C
97D
8
5
Other
Highmont West
Highmont East
Highland TSF
Trojan-Bethlehem
Main Mine
Highway
Permitted Mine Area
Sampling Site
Permitted
Voluntary
Watersheds
Freshwater Atlas
HVC Updated
Highland Valley Copper
Teck
Teck Resources Limited
PO Box 1500
Logan Lake, BC, Canada
Water Quality Monitoring Report
N
Figure E-1
Water Quality Monitoring Sites, Highland Valley Copper, 2021
1:200,000
PROJECTION: NAD 1983 UTM Zone 10N
DATE: 2022-03-09
GIS No.:HVCE-01-009a


DRAFT
646000
648000
650000
5590000
5588000
5586000
377
Fourler Creek
376
Fouquet Creek
279
S-8
206
207
S-1
S-2
211
104
223
Highmont
TSF
210
265
S-5
264
Dupuis Creek
S-4
208
209
S-3
Fowler Creek
Billy
Lake
908
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Satellite Image: Acquired in 2019
0
200
400
800
1,200
1,600
2,000
Metres
1
97C
97D
8
Sampling Site
Permitted
Voluntary
Permitted Mine Area
Wetland
Highway
Flow Direction
Highland Valley Copper
Teck
Teck Resources Limited
PO Box 1500
Logan Lake, BC, Canada
Water Quality Monitoring Report
N
Figure 3.2-45
Water Quality Monitoring Sites in the Highmont TSF Site Area, 2021
1:27,500
PROJECTION: NAD 1983 UTM Zone 10N
DATE: 2022-03-09
GIS No.:HVCE-01-009f

APPENDIX IV

DSR Recommendations – HVC Workplan

Appendix IV
DSR Recommendations – HVC Workplan

Table IV-1 Highmont TSF: 2018 SRK DSR Recommendations for Deficiencies and Non-Conformances

ID No.	Recommended Action	DSR Assigned Priority[1]	Status (Scheduled completion)	Workplan To Complete
Highmont Tailings Storage Facility				
HD-001	*Current displacement and piezometer thresholds have been set to highlight deviations from trends and are not linked to stability assessments. No sensitivities were included in the stability assessments to verify how sensitive dam stability is to phreatic levels. Update stability analyses to include sensitivities to the phreatic surface. If phreatic levels are shown to be critical to stability, re-define thresholds based on the results of stability and/or other appropriate engineering analyses.*	*3*	*CLOSED (Q3, 2021)*	*Completed as part of 2021 stability review, which included piezometric sensitivity analyses.*
HD-002	*Most piezometers are in the upstream tailings beach, and there are none through the dams. SRK has not been provided with details on the latest stability assessments to verify how sensitive dam stability is to phreatic levels through the dam fill materials. Update stability analyses to include sensitivities to the phreatic surface. If phreatic levels in this area are shown to be critical to stability, evaluate the need to install additional piezometers through the dam that intersect the filter zones.*	*3*	*CLOSED (Q3, 2021)*	*Completed as part of 2021 stability review, which included piezometric sensitivity analyses.*
HD-003	*The PMF is not in accordance with CDA (2013) requirements. Update the PMF for the Highmont TSF and determine which PMF event (summer/autumn PMF or spring PMF) is most critical.*	*3*	*CLOSED (Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
HD-004	*Normal freeboard requirements were not evaluated. Establish a maximum normal operating water level and evaluate the required and available normal freeboard.*	*3*	*CLOSED (Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
HD-005	*Highmont TSF erosion protection in the spillway channel is sized for the 200-year peak flow and not IDF. Provide details on the justification for sizing the erosion protection for the 200-year event and the associated risk and consequence of undersized riprap should be evaluated.*	*4*	*CLOSED (Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
HD-008	The culvert crossing in the Highmont TSF spillway channel poses a risk of overtopping into seepage pond S2. Evaluate options to modify the Highmont spillway channel to ensure flows do not overtop into S2.	3	OPEN (2021, Revised 2022)	Scheduled after Flood Routing Update, HVC currently working to open a project for this scope.
S1 Pond				
S1-002	*Inflow design flood is not based on most recent hydrology analysis Update the inflow design flood and flood routing analysis using the latest hydrology.*	*4*	*CLOSED (Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
S1-003	*Normal freeboard requirements were not evaluated. Evaluate the required and available normal freeboard.*	*4*	*CLOSED (Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
S2 Pond				
S2-002	*Inflow design flood is not based on most recent hydrology analysis. Update the inflow design flood and flood routing analysis using the latest hydrology.*	*4*	*CLOSED (Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
S2-003	*Normal freeboard requirements were not evaluated. Evaluate the required and available normal freeboard.*	*4*	*CLOSED (Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
S3 Pond				
S3-001	*No in-situ data is available to estimate material properties, potential for liquefaction, and post-seismic strengths for the foundation materials found at S3. Undertake site investigations and test work to characterize the S3 foundation materials. Re-run stability analyses using revised material properties. Based on the results of the stability analysis, evaluate whether any foundation improvement is needed.*	*2*	*CLOSED (2021)*	*Completed as part of 2021 S3 Dam stability review.*
S3-002	Inflow design flood is not based on most recent hydrology analysis. Update the inflow design flood and flood routing analysis using the latest hydrology.	4	*CLOSED (Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
S3-003	Normal freeboard requirements were not evaluated. Evaluate the required and available normal freeboard.	4	*CLOSED (Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
S3-004	*Significant vegetation (including trees) observed on crest and downstream slope. Continue to remove trees, however grassy vegetation on slopes can be left in place, provided steady-state conditions continue.*	*3*	*CLOSED (2021)*	*Closed after crest maintenance. Given the dam geometry (minimum crest width of 4 m and maximum dam height of 3.4 m), small trees on downstream slope are not considered a stability or seepage concern.*

ID No.	Recommended Action	DSR Assigned Priority[1]	Status (Scheduled completion)	Workplan To Complete
S5 Pond				
S5-001	Under current operation, seepage pond S5 is not able to contain the EDF. Identify pond upgrades necessary to meet EDF compliance.	4	OPEN (Q3/Q4, 2021)	*Completed as part of 2022 Highmont TSF Flood Routing Update. EDF was not calculated as IDF is routed through pumping to Highmont TSF.*
S5-002	*Inflow design flood is not based on most recent hydrology analysis* *Update the inflow design flood and flood routing analysis using the latest hydrology.*	*4*	*CLOSED* *(Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
S5-003	*Under current operations, the minimum freeboard requirement is not being met.* *Identify pond upgrades necessary for freeboard compliance.*	*4*	*CLOSED* *(Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
S5-004	*Normal freeboard requirements were not evaluated.* *Evaluate the required and available normal freeboard.*	*4*	*CLOSED* *(Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
S8 Pond				
S8-002	*Inflow design flood is not based on most recent hydrology analysis.* *Update the inflow design flood and flood routing analysis using the latest hydrology.*	*4*	*CLOSED* *(Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
S8-003	*Available minimum freeboard does not meet the minimum freeboard requirement adopted by THVCP.* *Provide details of the IDF flood routing analysis and minimum freeboard requirement calculation based on wind setup and wave run-up as required by CDA (2013).*	*4*	*CLOSED* *(Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*
S8-004	*Normal freeboard requirements were not evaluated.* *Evaluate the required and available normal freeboard.*	*4*	*CLOSED* *(Q3/Q4, 2021)*	*Completed as part of 2022 Highmont TSF Flood Routing Update.*

Notes:
1. Recommendation priority guidelines, specified by Teck and assigned by DSR author:
   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.