Klohn Crippen Berger

# Teck Highland Valley Copper Partnership

## 2020 Annual Facility Performance Report

## *Highmont Tailings Storage Facility*



M02341B83.730

March 2021

March 19, 2021

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:

**2020 Annual Facility Performance Report**
**Highmont Tailings Storage Facility**

We are pleased to submit the 2020 Annual Facility Performance Report for the Highmont Tailings Storage Facility. The inspection and this report were prepared to comply with Section 10.5.3 of the Health, Safety and Reclamation Code for Mines in British Columbia (the Code) (MEM 2017), and Section 4.2 of the Code Guidance Document (MEM 2016).

Yours truly,

**KLOHN CRIPPEN BERGER LTD.**

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

PU/PU/NS:cd

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# Teck Highland Valley Copper Partnership

## 2020 Annual Facility Performance Report

## *Highmont Tailings Storage Facility*

# EXECUTIVE SUMMARY

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (THVCP) to complete the 2020 Annual Facility Performance Report[1] (AFPR) of the Highmont Tailings Storage Facility (TSF) for the period of October 2019 to September 2020. The Highmont TSF, located 8 km southeast of the operating mill, is a reclaimed, inactive facility constructed in 1980 and operated until 1984. The Highmont TSF is maintained by THVCP and considered to be in the active care closure phase as defined by the Canadian Dam Association (CDA 2019).

The review covers the Highmont TSF structures summarized in Table 1. There were no significant changes to the key geotechnical or hydrotechnical hazards during the review period.

**Table 1 Dam Consequence Categories**

| Dam | Description | Consequence Category(1) |
|---|---|---|
| Highmont Dams (North, East and South) | Retaining dams which comprise glacial till starter dams which were raised with rockfill by the centerline method. Filter zones separate retained tailings and rockfill. | High |
| S3 Pond | Ponds retained by dams constructed of compacted glacial till with a drainage blanket downstream of a seepage cut-off. | High |
| S1, S2 and S5 Pond | | Significant |
| S8 Pond | | Low |

Notes:
1. Based on CDA (2013)

The facility has been inactive for more than 35 years, the surface of the dam has been reclaimed and pond level lowered. During operations there were no significant dam safety incidents. Under the current configuration, the piezometric levels and gradients through the tailings and dam are lower than during operations and the downstream slope has been regraded to a shallower angle which increase the factor of safety against slope failure and internal erosion.

The performance of the Highmont Dams is assessed based on the following:

- compliance with design criteria;
- comparison of actual conditions to design assumptions;
- consistency between measured response[2] and expected behaviour[3]; and
- presence or absence of potential dam safety concern indicators.

On this basis, the performance of the dams during the review period was acceptable.

Other than routine maintenance activities, as defined in the OMS Manual (e.g., clearing weirs of vegetation), there were no major repairs or construction activities completed during the review period.

[1] Past Annual Facility Performance Reports were referred to as Dam Safety Inspections (DSI).
[2] "Measured response" refers to instrumentation readings and visual observations during inspections.
[3] "Expected behaviour" for an inactive facility is based on interpretation of the historic measured response.

During 2020, key tailings management roles for the Highmont TSF transitioned as planned:

- Mr. Pablo Urrutia, P.Eng. (representative of KCB), transitioned into the Engineer or Record (EoR) role, replacing Mr. Rick Friedel, P.Eng. Mr. Friedel remains involved to support the transition.
- Mr. Bryan Bale, P.Eng. (THVCP Chief Engineer - Tailings), transitioned into the TSF Qualified Person (QP), replacing Mr. Chris Anderson, P.Eng.

The current Operation, Maintenance and Surveillance (OMS) Manual and the Emergency Preparedness and Response Plan (EPRP) (THVCP 2018) are suitable for the facility. As part of the routine update cycle both documents are being revised to align with the most recent industry guidance documents. A trial exercise of the EPRP was completed on December 9, 2020 in which THVCP and KCB representatives participated.

Due to the COVID 19 pandemic and to meet provincial health regulations THVCP implemented protocols limiting site resources. To support this change, the EoR and THVCP agreed to modify the frequency of some routine surveillance activities which did not compromise the overall surveillance and management controls at the Highmont TSF but helped ensure priority activities were maintained.

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. The adequacy of the instrumentation was reviewed as part of this AFPR and remains sufficient for the existing condition of the structure.

Information from routine surveillance activities was reported and reviewed once completed by THVCP during weekly dam safety meetings. This information is also shared with and reviewed by the EoR. An overall performance assessment is completed by the EoR as part of the AFPR. In addition, a routine engineering review can be triggered by the first level of the TARP in response to a localized deviation from historic behaviour.

The behaviour of the facility is expected to remain consistent with historic patterns. Variation in performance from year to year is primarily related to climate (i.e., freshet flows, water balance) or extreme events (e.g., seismic or flood), none of which occurred during the review period. Key observations from the performance review completed as part of the AFPR are:

- None of the reviews identified an issue of dam safety concern or unacceptable performance.
- A new method to survey monuments at the Highmont Dams was implemented to monitor for potential movement trends. Horizontal movement trends measured during the review period were consistent with historic behaviour. Increased variance observed in elevation data coincide with the use of the new survey method; additional readings are required to better define the accuracy limitations of this method for settlement monitoring.

- Visual inspections by the dam inspector, the EoR or others working in the area did not identify any indications of unacceptable behaviour at the dams.
- The Highmont TSF reservoir levels and patterns were similar to historic trends. The seasonal fluctuation during 2020 was within the typical range and less than the larger freshet events from 2017 and 2018.
- Minimum freeboard measured at the Highmont Dams during the review period was 6.2 m, which greatly exceeds the minimum freeboard required during the Inflow Design Flood to accommodate wave run-up and wind (0.4 m).

As required by permit (PE-376), water quality downstream of the Highmont TSF is monitored by THVCP. Water quality monitoring data for the area is summarized and reported in 2020 Annual Water Quality Monitoring Report. A copy of the report was provided to KCB as part of the AFPR and no significant non-compliances were noted.

Refer to Table 2 for status of outstanding recommendations from previous AFPRs, as of the issue date of this report. Recommendations that have been closed are shown in italics. No recommendations, related to facility performance, were identified during the 2020 AFPR. The deadline to complete the flood routing assessment and upgrade works were deferred to prioritize other flood routing activities at site which have a greater impact on risk reduction. Eight of the recommendations from the most recent DSR (SRK 2019) have been closed. A workplan to address the remaining recommendations (21) was prepared in 2020.

**Table 2 Recommendations Related to Facility Performance – Status Update**

| ID No. | Applicable Reg. or OMS Reference | Recommended Action | Priority[1] | Recommended Deadline |
|---|---|---|---|---|
| *HD-2016-05* | - | *Signage should be added to the spillway gate controls indicating which turn direction opens and closes the gate and identifying which seepage pond water is being diverted to in each position.* | *4* | *Q1 2018 (CLOSED)* |
| HD-2017-01 | Spillway | THVCP 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 – Revised Q4 2021) |
| HD-2018-02 | 10.1.8 | 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 (Open – Revised Q2 2021) |
| *HD-2019-02* | *DSR* | *KCB and THVCP to develop a work plan to address 2018 DSR recommendations.* | *3* | *April 2020 (CLOSED)* |
| *S2-2018-01* | *OMS* | *Include monitoring of the inlet plug during high flow events in the 2021 OMS manual. Define the minimum till plug elevation necessary to prevent Highmont TSF Spillway flow from entering S2 Pond, during the Inflow Design Flood (IDF).* | *3* | *Q1 2021 (CLOSED - Included in the OMS Manual update started in 2020)* |
| *S2-2018-02* | *10.1.8* | *To improve dam safety of S2 Pond, by allowing safe routing of IDF, KCB recommends the Highmont TSF spillway till plug be permanently relocated to the S2 Pond inlet channel and built to sufficient height such that the plug would not be overtopped during the Highmont TSF IDF.* | *2* | *Q1 2021 (CLOSED, plug required to flush S2 Pond which is a permit requirement)* |
| S2-2019-01 | 10.1.8 | 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, THVCP to schedule for 2021) |
| S5-2018-01 | 10.1.8 | Confirm the pumping capacity of the system at S5 Pond so that the ability to route the IDF (100-year return period, 24-hour duration), assuming the pumps are functioning as intended, can be confirmed. | 2 | Q4 2019 (*CLOSED – KCB estimated pumping capacity required to meet flood routing requirements)* |
| S5-2018-02 | 10.1.8 | 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-2019-02) | 2 | Q3 2021 (Open) |
| *S8-2018-01* | *OMS* | *A pipe was observed on the slope of the S8 Pond dam that did not appear to be connected to anything. This pipe should be removed.* | *4* | *Q4 2019 (CLOSED - THVCP confirmed there is no potential hookups for the pipe)* |

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 OF CONTENTS

EXECUTIVE SUMMARY ..... I
1 INTRODUCTION ..... 1
2 FACILITY DESCRIPTION ..... 3
2.1 Overview ..... 3
3 2020 ACTIVITIES ..... 7
3.1 2020 Construction Activities ..... 7
4 WATER MANAGEMENT ..... 8
4.1 Overview ..... 8
4.2 Climate ..... 8
4.3 Water Balance ..... 9
4.4 Flood Management ..... 10
4.5 Freeboard ..... 12
5 REVIEW OF MONITORING RECORDS AND DOCUMENTS ..... 13
5.1 Monitoring Plan ..... 13
5.2 Pond Level ..... 15
5.3 Piezometers ..... 15
5.4 Survey Monuments ..... 16
5.5 Seepage ..... 16
5.6 Water Quality ..... 17
6 INSPECTION OBSERVATIONS AND PHOTOGRAPHS ..... 18
7 ASSESSMENT OF DAM SAFETY ..... 19
7.1 Dam Classification Review ..... 19
7.2 Status of 2018 Dam Safety Review Recommendations ..... 19
7.3 Failure Mode Review ..... 20
7.3.1 Highmont TSF Dams ..... 20
7.3.2 Seepage Recovery Pond Dams ..... 20
7.4 Emergency Preparedness and Response ..... 21
8 SUMMARY ..... 22
9 CLOSING ..... 24
REFERENCES ..... 25

# TABLE OF CONTENTS
(continued)

## List of Tables

Table 1.1 Highmont TSF Structures ..... 1
Table 2.1 Summary of Approximate Dam Geometry ..... 4
Table 4.1 Annual Water Balance for Highmont TSF ..... 9
Table 4.2 Inflow Design Flood Requirements for Highmont TSF and Seepage Recovery Ponds ..... 11
Table 4.3 Freeboard for Highmont TSF and Seepage Recovery Ponds ..... 12
Table 5.1 Monitoring Activities ..... 14
Table 5.2 Highmont TSF Change in Pond Elevation ..... 15
Table 7.1 Summary of Highmont Dam Consequence Classifications ..... 19
Table 8.1 Previous Recommendations Related to Facility Performance – Status Update ..... 23

## List of Figures (In text)

Figure 2.1 Typical Cross Section of Highmont TSF North Dam (KC 1996) ..... 5
Figure 2.2 Typical Cross Section of S1 Seepage Recovery Pond Dam (KL 1980b) ..... 5
Figure 2.3 Typical Cross Section of S2, S3, and S5 Seepage Recovery Pond Dams (KL 1980b) ..... 6
Figure 4.1 Monthly Precipitation ..... 9
Figure 5.1 Highmont TSF Pond Water Elevations – 2015 to 2020 ..... 15

## List of Figures

Figure 1 Mine Site Plan
Figure 2 Highmont Tailings Storage Facility Overview
Figure 3 North Dam Plan
Figure 4 East Dam Plan
Figure 5 South Dam Plan
Figure 6 Flow Schematic for Highmont Tailings Storage Facility

## List of Appendices

Appendix I Annual Facility Performance Report Inspection Checklist, Observations and Photographs
Appendix II-A Climate Data
Appendix II-B Instrumentation Summary and Plots
Appendix III Map of Water Quality Monitoring Points
Appendix IV DSR Recommendations – THVCP Workplan

# 1 INTRODUCTION

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (THVCP) to complete the 2020 Annual Facility Performance Report[4] (AFPR) of the Highmont Tailings Storage Facility (TSF) on the Highland Valley Copper (HVC) mine site. The Highmont TSF is an inactive facility constructed in 1980 and operated from 1980 to 1984. The AFPR includes the review of North Dam, East Dam, and South Dam, which form the tailings impoundment, as well as five seepage recovery pond dams (S1, S2, S3, S5 and S8) for the period from October 2019 through September 2020. Table 1.1 summarizes the dams' functions and consequence classifications (CDA 2013). Refer to Figure 1 and Figure 2 for a layout of the facility.

**Table 1.1 Highmont TSF Structures**

| Facility | Structure | Function | Consequence Classification[1] |
|---|---|---|---|
| Highmont TSF | North Dam | Retain tailings around perimeter of the impoundment | High |
| | East Dam | | |
| | South Dam | | |
| Highmont Seepage Recovery Ponds | S1 Pond Dam | Stores seepage from Highmont TSF downstream of the North Dam | Significant |
| | S2 Pond Dam | Stores seepage from Highmont TSF downstream of the North Dam | Significant |
| | S3 Pond Dam | Stores seepage from Highmont TSF downstream of the South Dam | High |
| | S5 Pond Dam | Stores seepage from Highmont TSF downstream of the East Dam | Significant |
| | S8 Pond Dam | Stores seepage from Highmont TSF downstream of the North Dam | Low |

Notes:
1. Consequence classifications are based on Canadian Dam Association guidelines (CDA 2013).

The Highmont TSF has been reclaimed and the current condition of the facility was established in 2003 with the construction of the spillway. THVCP 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) Application of Dam Safety Guidelines to Mining Dams Technical Bulletin (CDA 2019).

The AFPR scope of work consisted of:

- visual inspection of the physical conditions of the various containment facilities;
- review of surveillance data for the review period provided by THVCP;
- review of climate and water balance data for the site;

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

- review of the Operations, Maintenance & Surveillance (OMS) Manual (THVCP 2018) to confirm it is appropriate for the existing facility; and
- review of additional activities completed at the site during the review period, if any.

The inspection and this report were prepared to comply with Section 10.5.3 of the Health, Safety and Reclamation Code for Mines in British Columbia (MEM 2017), herein referred to as the Code, and Section 4.2 of the Code Guidance Document (MEM 2016).

The inspection was completed by KCB representatives Mr. Pablo Urrutia, P.Eng. and Ms. Narges Solgi, EIT on August 5, 2020. During the inspection, the weather was sunny and did not impede the inspection. Designated roles related to tailings management, required under Part 10 of the Code, for the Highmont TSF at the end of the review period were filled by:

- Engineer or Record (EoR) – Mr. Urrutia, P.Eng. (representative of KCB):
  - Mr. Urrutia, P.Eng. transitioned into the EoR role in December 2020, replacing Mr. Rick Friedel, P.Eng. of KCB.
- TSF Qualified Person – Mr. Bryan Bale, P.Eng. (THVCP Chief Engineer, Tailings):
  - Mr. Bale, P.Eng. transitioned into the TSF Qualified Person role in September 2020, replacing Mr. Chris Anderson, P.Eng.

THVCP 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 interior of British Columbia. 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 a 1.5H:1V downstream rockfill slope which was 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

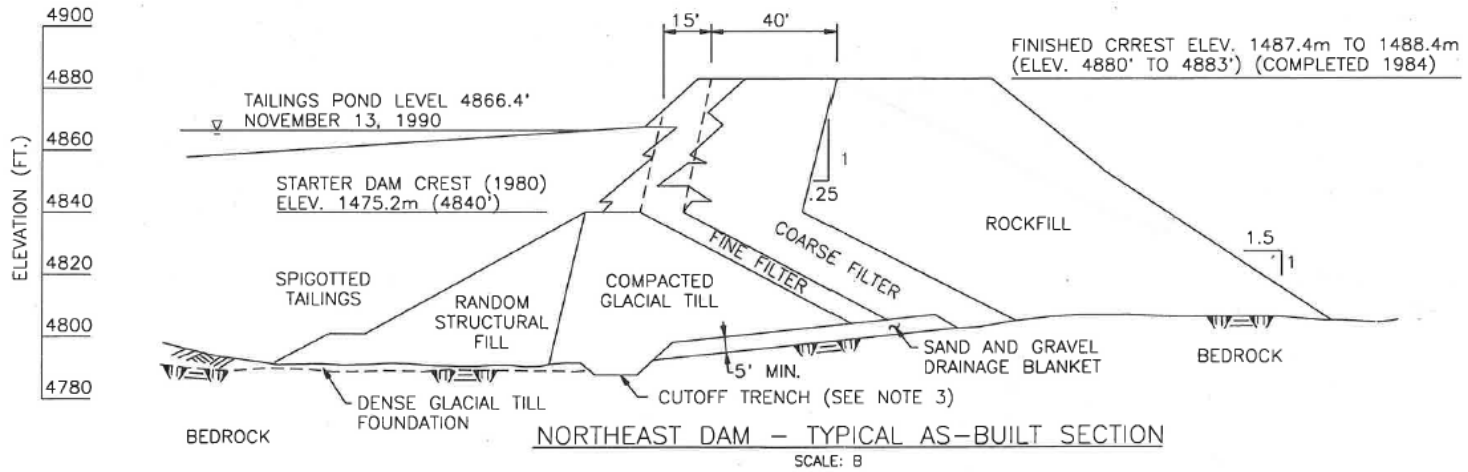
- Historically there were seven seepage recovery ponds located around the perimeter of the Highmont TSF (S1, S2, S3, S4, S5, S8 and S9) to collect seepage from the TSF and runoff from the local area. The dams at S4 and S9 have been decommissioned by breaching, leaving five active seepage recovery pond dams (S1, S2, S3, S5 and S8).
- 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 2.2, and Figure 2.3).
- In general, water from the seepage recovery ponds is diverted to the Highland Mill for reclaim via S1 Pond (refer to Figure 2.2). 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 | 47 | 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 [3] | 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).

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

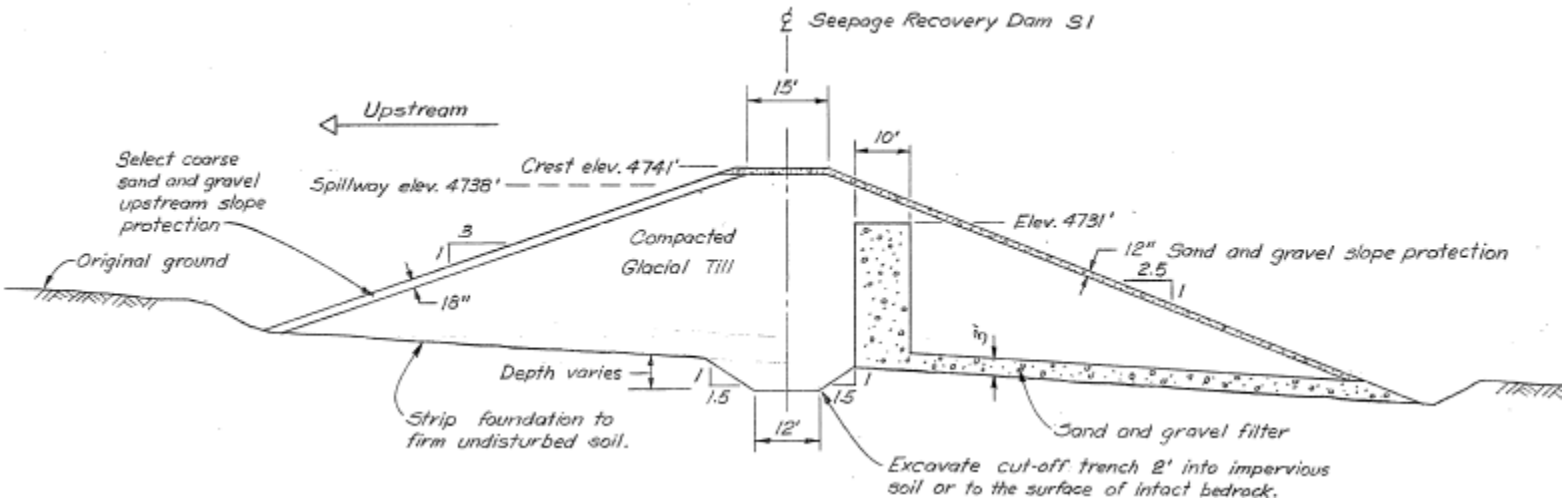
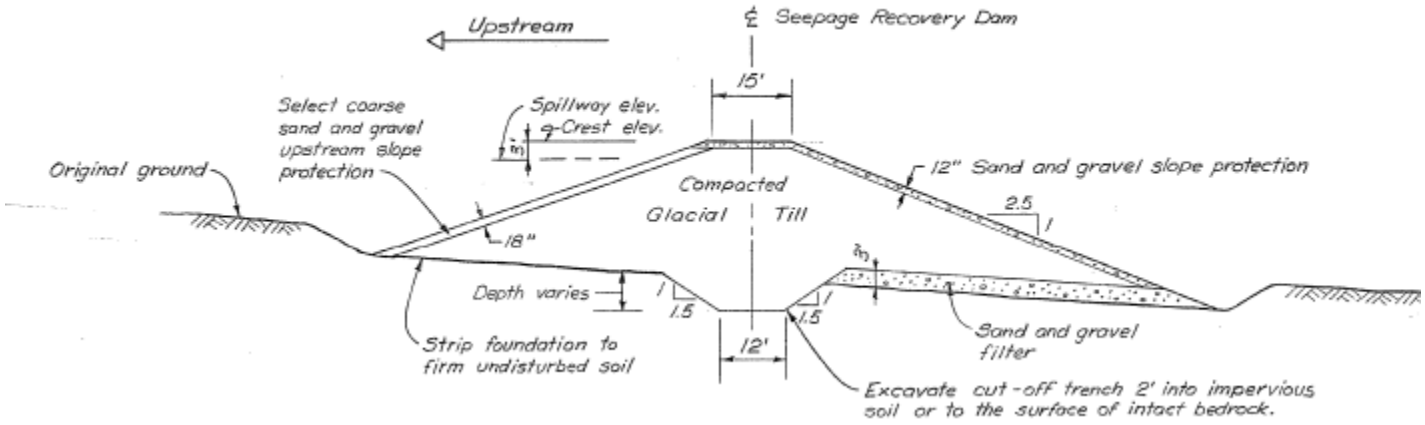


**Figure 2.3 Typical Cross Section of S2, S3, and S5 Seepage Recovery Pond Dams (KL 1980b)**



# 3 2020 ACTIVITIES

## 3.1 2020 Construction Activities

Other than routine maintenance activities, as defined in the OMS manual, (e.g., clearing weirs of vegetation), 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.

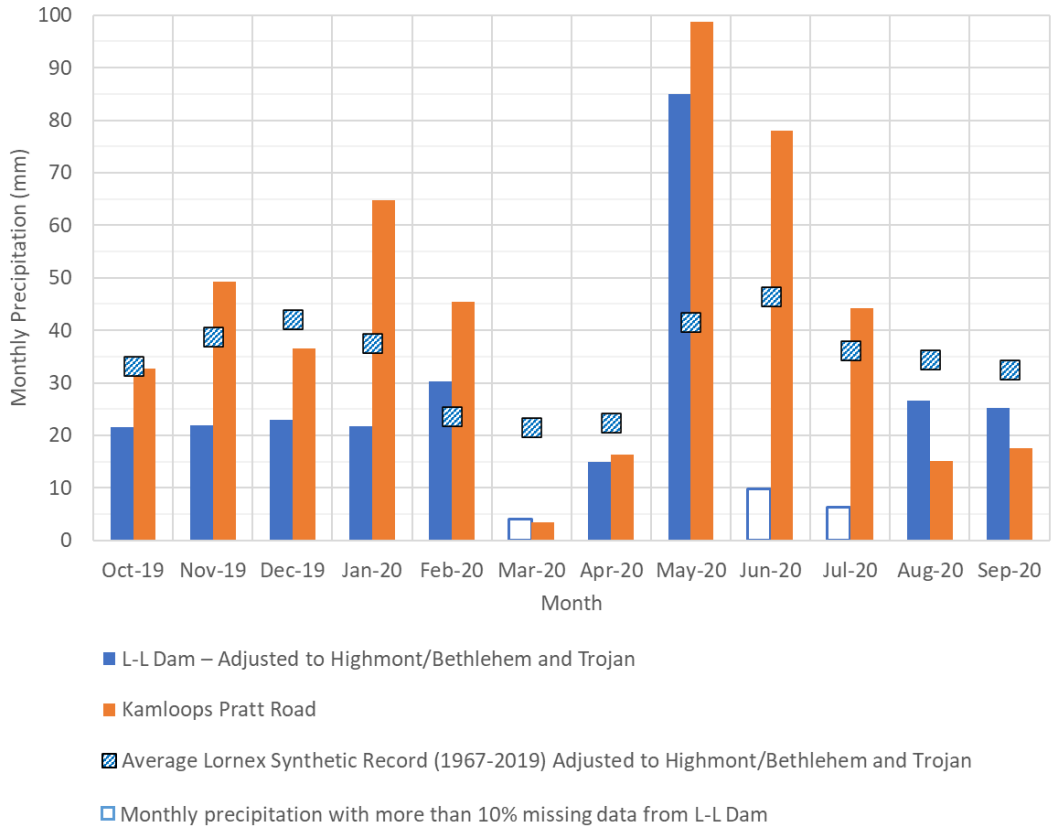
## 4.2 Climate

THVCP provided climate data from L-L Dam and Kamloops Pratt Road stations for the 2020 AFPR reporting period to KCB for review. KCB applied the appropriate corrections to L-L Dam Weather Station data and Historical Average Lornex Synthetic Record, based on HVC site wide hydrology document (Golder 2019), and compared the climate data to typical values, refer to Appendix II-A.

The following observations were noted for the reporting period (refer to Figure 4.2):

- More than 10% of the L-L Dam weather station precipitation data were missing in March, June, and July. Due to these data gaps, the review of 2020 climate to historic normals was augmented with a regional weather station.
- All storm events during 2020 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: 23.1 mm on May 30; 18.2 mm on May 17; and 12.9 mm on September 19.
- January through April precipitation was significantly less than historic normals except the precipitation in February which was higher than average.
- May precipitation was almost twice as much as the historic normals.
- Figure 4.1 indicates low precipitation at site during June and July; however, this is due to L-L Dam Weather Station data gaps during this period. THVCP inspection reports and regional climate station data indicate precipitation during this period was above historic normals.
- Snowpack depth measurements, from the Highland Valley station, indicate the snow had been melted by May 1, 2020.
- Seasonal rise and fall of pond levels are associated with freshet. The time of year when pond levels start to fall is associated with the end of freshet, in recent years this has started in April or May (Figure 5.1). In 2020, pond levels did not start to fall until mid to late June. This timing indicates that the 2020 response was driven primarily by precipitation, rather than snowmelt.

**Figure 4.1 Monthly Precipitation**




## 4.3 Water Balance

THVCP manages and tracks the annual water balance for the Highmont TSF. Table 4.1 is a summary of annual inflows and outflows, provided by THVCP. The water balance is based on simplified modelling results and therefore, the values should be treated as indicative only.

**Table 4.1 Annual Water Balance for Highmont TSF**

| Item | Volume in 2020[1] ($m^3$) |
|---|---|
| **Inflows** | |
| Direct precipitation and Runoff | 378,600 |
| Groundwater | 300 |
| *Total inflow:* | *378,900* |
| **Outflows** | |
| Seepage | 30,700 |
| Evaporation | 250,700 |
| *Total outflow:* | *281,400* |
| **Balance** | |
| Balance (inflow minus outflow) | +97,500 |

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

## 4.4 Flood Management

The flood management structures at the Highmont TSF, applicable design criteria and flood details are summarized in Table 4.2 with additional discussion regarding each structure below.

Highmont TSF and seepage recovery pond flood routing updates are scheduled for 2021. These were recommended by KCB (2019a) and SRK (2019) so that all facilities were based on the most recent hydrology. In 2020, THVCP reviewed the outstanding activities required for the tailings and water storage facilities at the site and prioritized them to suit available resources and expected timelines. Based on this review the flood routing work at Highmont TSF was deferred from 2020 to 2021. KCB agreed the deferral is the preferred approach in terms of prioritizing available resources because the Highmont TSF facilities have spillways or adequate capacity to meet flood criteria, including S5 Pond, as discussed below.

### Highmont TSF:

- Spillway is designed for the Probable Maximum Flood (PMF) which is greater than the minimum Inflow Design Flood (IDF) required by the Code.
- KCB recommended THVCP modify the area where the toe access road crosses the Highmont TSF Spillway channel, to allow the peak spillway flow to pass beneath the access road (e.g., bridge or arch culvert) or regrade the road surface (Recommendation HD-2017-01). THVCP has committed to completing this in 2021, following the update to flood routing. KCB agrees that waiting for flood routing to be completed is appropriate.

### S2 Pond:

- Flow from the Highmont TSF spillway is diverted into S2 Pond for temporary periods each year. This is done by placing a glacial till plug in the Highmont TSF Spillway channel, downstream of the dam toe (i.e., where it poses no risk to Highmont TSF).
- S2 Pond has been designed to manage the IDF assuming local catchment only (i.e., does not include flow diverted from Highmont TSF Spillway). Therefore, there is an elevated flood risk while the plug is in place. KCB had recommended no flow be diverted into S2 Pond but THVCP has confirmed this is necessary to flush the S2 Pond reservoir annually to meet a permit requirement.
- The updated OMS Manual describes the operational controls to manage the S2 inlet plug to limit the potential for excess flows to report to S2 Pond during high flow periods.

### S3 Pond:

- Spillway channel is blocked and therefore the IDF is stored, rather than routed. KCB (2019a) demonstrated that the required 72-hour IDF could be stored with adequate freeboard.

### S5 Pond:

- Based on a flood routing update conducted in 2020, using the most recent hydrology (Golder 2019), an impractical pumping rate would be required to manage the IDF, assuming no modifications are made to the facility to increase flood attenuation in the pond. The preferred option to upgrade the facility to safely manage the IDF involves raising the low point of the crest to El. 1452.2 m. Other alternatives were considered but they were not practical or impacted normal operating conditions at S5 Pond. THVCP will further evaluate potential upgrades to S5 Pond and implement the preferred alternative within the deadline of Q3 2021. THVCP plan to implement interim controls to increase flood routing capacity for 2021 freshet: increase the current pump capacity to 190 m3/hr; and event driven inspections tied to remote pond level monitoring.

### S8 Pond:

- IDF can be routed through the overflow spillway pipe (24-hour duration) or stored (72-hour duration) if the pipe became plugged and there were no other outflows (KCB 2018a).

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

| Dam | Routed or Stored (Outflow) | Spillway Type | Consequence Classification | Inflow Design Flood | | Peak Design Flood Level | IDF Depth and/or Peak Design Outflow | Spillway Design Reference |
|---|---|---|---|---|---|---|---|---|
| | | | | Required[1] | Design Event | | | |
| Highmont TSF | Routed | Open channel | High | 1/3 between 1000-yr and PMF | PMF 24-hour | 1482.4 m (Note 2) | 9.8 $m^3/s$ | (KC 2005) |
| S1 Pond | Routed | Open channel to pipe | Significant | Between 100-yr and 1000-yr | 100-yr 24-hour | 1444.1 m | 59 mm; 0.6 $m^3/s$ | (KCB 2015b) |
| S2 Pond | Routed | Open channel | Significant | Between 100-yr and 1000-yr | 100-yr 24-hour | 1458.3 m | 59 mm; 0.1 $m^3/s$ (Note 3) | |
| S3 Pond | Stored | None (plugged) | High | 1/3 between 1000-yr and PMF | 1/3 between 1000-yr and PMF, 72-hour | 1458.3 m | 174 mm (Note 4) | (KCB 2015b) (KCB 2019a) |
| S5 Pond | Routed | Pipes (removable plug) | Significant | Between 100-yr and 1000-yr | 100-yr 24-hour | 1450.8 m | Note 5 | (KCB 2019a) |
| S8 Pond | Routed | Pipes | Low | 100-yr | 100-yr 72-hour | 1451.7 m | 86 mm (Note 6) | (KCB 2018a) |

Notes:
1. Per the Code (MEM 2017) for tailings and water retaining facilities.
2. Assumes gate is in open position.
3. Does not include any additional flow from the Highmont TSF Spillway channel which may flow into S2 Pond via deflection berm.
4. As IDF is stored (i.e., no discharge), 72-hour minimum duration required for design flood as required under the Code (KCB 2019a).
5. Refer to flood management discussion in Section 4.4.
6. The S8 Pond overflow spillway pipe is operable, but routing was checked for both to store (i.e., spillway blocked) or to route (i.e., spillway open) the IDF and both conditions were satisfied.

## 4.5 Freeboard

Highmont TSF and seepage recovery ponds design and operating conditions met freeboard requirements during the review period as shown in Table 4.3 which summarizes the minimum flood freeboard required, as per the Code, and the predicted minimum freeboard based on flood routing. Other observations regarding freeboard:

- In the case of S5 Pond, upgrades are required for the facility to manage the IDF with adequate freeboard, as discussed in Section 4.4. In the meantime, THVCP plan to implement interim controls to increase flood routing capacity for 2021 freshet.
- The minimum required freeboard under normal (i.e., non-flood) conditions will be defined as part of the flood routing works scheduled for 2021 which was recommended by SRK (2019). Documenting normal freeboard requirements is considered a due diligence activity for the Highmont TSF because the large freeboard available under the existing condition (>6 m) will be greater than the expected requirement.

**Table 4.3 Freeboard for Highmont TSF and Seepage Recovery Ponds**

| Dam | Freeboard (m) | | |
|---|---|---|---|
| | Required during IDF[1] | Predicted During Peak Design Flood Level | Minimum Observed During the Review Period[9] |
| Highmont TSF | 0.4 m[2,3] | 4.6 m[5] | 6.2 m |
| S1 Pond | 0.5 m[4] | 1.0 m[4] | 2.2 m |
| S2 Pond | 0.5 m[4] | 0.7 m[4] | 1.0 m |
| S3 Pond | 0.3 m[2] | 1.1 m[2, 6] | 2.1 m |
| S5 Pond | 0.4 m | See Note 7 | 2.7 m |
| S8 Pond | 0.5 m[4] | 0.5 m[8] | 0.9 m |

Notes:
1. As per the Code, refers to minimum vertical distance between dam crest and peak IDF level.
2. Based on KCB (2018b).
3. Freeboard target of 0.5 m has been adopted by THVCP which is greater than the minimum required freeboard to accommodate wave run-up (0.4 m) as per the method proposed by CDA (2013).
4. Based on KCB (2015b).
5. Freeboard during PMF 24-hour duration spillway design flood, which is larger than IDF required under the Code. Assumes spillway gate is open.
6. Freeboard reported for 72-hour peak level IDF assuming normal operating level prior to storm.
7. Upgrades are required to manage the IDF with adequate freeboard. Refer to flood management discussion in Section 4.4.
8. Per KCB 2018a, freeboard reported for the scenario where the IDF is stored in the pond.
9. Based on maximum recorded pond elevation during the review period.

# 5 REVIEW OF MONITORING RECORDS AND DOCUMENTS

## 5.1 Monitoring Plan

The Operation, Maintenance and Surveillance (OMS) Manual, was reviewed and issued by THVCP in December 2018 (THVCP 2018). As part of the routine update cycle the OMS Manual is being revised to align with the most recent industry guidance documents. The update to the OMS Manual will include the recommended items from the DSR (SRK 2019).

Surveillance activities were completed as prescribed in the OMS Manual or as agreed with the EoR (Table 5.1). Starting in March 2020, THVCP was required to implement protocols to meet provincial health regulations related to reducing the spread of the COVID 19 pandemic. This included reducing the number of people on site to essential personnel only. Prior to reducing site personnel at the dams, THVCP requested KCB to review the Highmont TSF surveillance program to identify site activities which could be completed at a reduced frequency, that would allow THVCP to reduce site personnel, but not compromise the overall surveillance controls at the facility. The modified frequency recommended by KCB is summarized in Table 5.1 and remain appropriate during 2021 while site personnel restrictions remain in place.

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 levels during the review period. Instrumentation triggers, which notify THVCP if a TARP level has been exceeded, were reviewed and updated by the EoR, where appropriate, as part of this AFPR.

Information from routine surveillance activities was reported and reviewed once completed by the THVCP Tailings Group, including the QP, during the weekly intra-departmental meeting. This information is also shared with and reviewed by the EoR. An assessment of performance is completed by the EoR as part of the AFPR based on the following:

- compliance with design criteria;
- comparison of actual conditions to design assumptions;
- consistency between measured response[5] and expected behaviour[6]; and
- presence or absence of potential dam safety concern indicators.

On this basis, the performance of the dams during the review period was acceptable.

The site visit for the most recent dam safety review (DSR) (SRK 2019) was completed in 2018. The Code requires a DSR be undertaken every five years for tailings dams; therefore, the next DSR is scheduled for 2023. The status of recommendations from the most recent DSR (SRK 2019) are discussed further in Section 7.2.

[5] "Measured response" refers to instrumentation readings and visual observations during inspections.
[6] "Expected behaviour" for an inactive facility is based on interpretation of the historic measured response.

## Table 5.1 Monitoring Activities

| TSF Monitoring | Facility | Minimum Frequency[1] | Responsible Party | Documentation | 2020 Frequency Compliance[1] | Notes for the Review Period |
|---|---|---|---|---|---|---|
| **Inspections** | | | | | | |
| Routine Visual Inspection[2] | Highmont Dams | Every 2 Months | THVCP | THVCP Inspection Reports | Yes | - |
| | S1, S2, S3,and S5 Seepage Recovery Ponds | Monthly | THVCP | THVCP Inspection Reports | Yes | - |
| | S8 Seepage Recovery Pond | Quarterly | THVCP | THVCP Inspection Reports | Yes | - |
| Event-Driven Inspection | All | Event-Driven[3] | THVCP | THVCP Inspection Reports | N/A | No event-driven inspections were triggered during 2020. |
| Annual Facility Performance Report | All | Annually | KCB | Inspection Report by KCB | Yes | This report. |
| Dam Safety Review | All | Every 5 years | THVCP | Report | N/A | Next DSR is due in 2023. |
| **Instrumentation Monitoring** | | | | | | |
| Piezometers | Highmont Dams Spillway, S1, and S2 Seepage Recovery Ponds | Quarterly[2] | THVCP | Annual Facility Performance Report | Yes | - |
| Seepage flow instruments | S1, S3, S5,and S8 Seepage Recovery Ponds | Quarterly[2] | THVCP | Annual Facility Performance Report | Yes | - |
| Pond level | All | Monthly[2] | THVCP | | Yes | |
| **Surveys** | | | | | | |
| Dam Crest | Highmont Dams | Annually | THVCP | Annual Facility Performance Report | Yes | |
| Survey monuments | Highmont Dams | Annually | THVCP | | 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 pond level measurements and observations of unusual condition and/or dam safety concerns (e.g., settlement, sinkholes, slope sloughing, erosion, seepage, piping, etc.)
3. THVCP 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 2020).

## 5.2 Pond Level

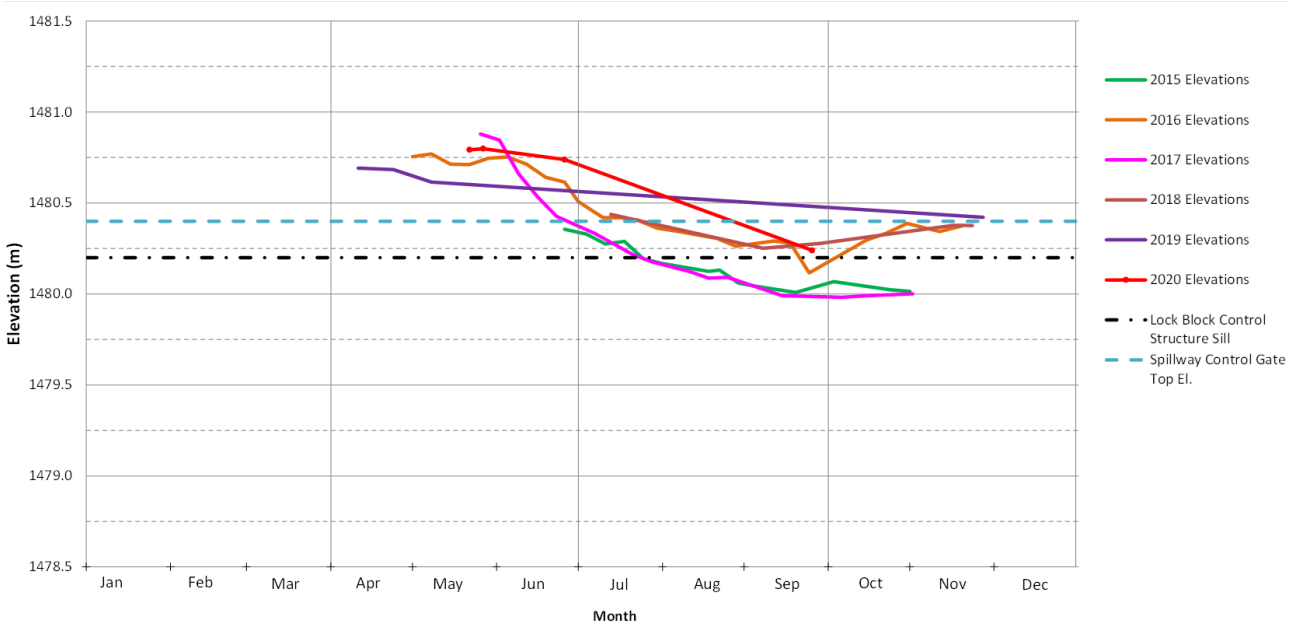
THVCP has a transducer installed at the Highmont TSF spillway channel, near the inlet, to monitor pond levels. In addition, the Highmont TSF pond level was surveyed five times during 2020 freshet and visually checked during routine inspections. In general, 2020 levels were higher during freshet compared to 2019 levels but the seasonal pond level variations were consistent with historic observations, which shows no long-term trend of increasing pond volume, refer to Figure 5.1. The historical annual fluctuation in pond level is less than 1 m, as shown in Table 5.2.

**Table 5.2 Highmont TSF Change in Pond Elevation**

| Annual Change | Change in Pond Level 2019 to 2020 | Range of Annual Pond Level Change 2015 to 2019 |
|---|---|---|
| Peak Pond | 0.1 m | -0.4 m to 0.4 m (avg. 0.1 m) |
| Pond at End of Review Period* | 0.1 m | -0.4 m to 0.5 m (avg. 0.2 m) |

*End of review periods, between 2015 and 2020, varied between September and November.

**Figure 5.1 Highmont TSF Pond Water Elevations – 2015 to 2020**




## 5.3 Piezometers

The current suite of instruments is considered sufficient for the Highmont TSF. Piezometric levels since 2011, instrument Notification Level[7] thresholds, as well maximum and minimum piezometric levels during the review period are reported in Appendix II-B.

[7] 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.

Piezometer measurements during the review period show similar seasonal patterns as previous years, which reflects fluctuation in the Highmont TSF pond level. A summary of key observations for this reporting period are as follows:

- There were no piezometric threshold exceedances during the review period.
- 2020 piezometric levels show that groundwater levels in the impoundment are highest in the beach and fall towards the Highmont TSF perimeter dams and the pond. This pattern has been persistent for the instrumentation record for the existing condition.
- 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 2019 to 2020 was less than that observed from 2018 to 2019.

## 5.4 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. Starting in November 2019, THVCP 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 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 movement 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 2020, there were no threshold value exceedances and the surveys indicate dams are performing as expected and consistent with recent behaviour:

- Horizontal movement: The survey readings for this review period do not indicate any increased displacement and horizontal movement trends. The observed horizontal movements are showing variability around basepoint typical of survey accuracy limitations.
- Vertical movement: The increased variance in elevations, both in the up (P3 and P6) and down (P2, P4, P5, P7) direction, coincide with the use of the new method. Additional readings will better define the accuracy limitations with this method.

## 5.5 Seepage

Seepage flows are monitored upstream of four seepage recovery ponds (S1, S3, S5, and S8 Ponds) at instruments (weirs). 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.

Monitoring frequencies for all ponds are set primarily for environmental and water balance factors, not dam safety. Monthly data were reviewed by KCB as part of this AFPR and magnitude of flow and patterns were considered adequate from a dam safety perspective. Flows were consistent with recent trends and Highmont pond levels, and no observations of turbid flow, related to potential piping were noted in the inspection reports.

## 5.6 Water Quality

As required by permit (PE-376), water quality downstream of the Highmont TSF is monitored by THVCP. A summary of data to be included in the 2020 Annual Water Quality Monitoring Report was provided to KCB by THVCP for review as part of the AFPR. Select observations and findings from the monitoring data are summarized as follows:

- There are fourteen permitted surface water quality monitoring sites in the Highmont area, as shown on the site monitoring plan in Appendix III.
- There are two authorized discharges with permitted performance targets in PE-376 for this site: Sample Site #264 (S5 SRB Pond Outlet) and Sample Site #279 (S8 SRB Pond Outlet). There was no discharge to the environment from these two sites during 2020. Water was reclaimed back to the Highmont system as shown in Figure 6.
- All sampling sites were in compliance with the required sampling frequencies and parameters except for:
  - Sample Site #104 (Highmont Tailings Pond) which missed one sampling event in October.
  - Sample Site #210 (SRB S5 Pond inlet) and Sample Site #211 (SRB S8 Pond inlet) which missed measurements of total dissolved solids (TDS) data in July.
  - Sample Site #376 (creek below S2/S8 Pond) and Sample Site #377 (creek below S1 Pond) were sampled 3 times out of 4 required times between March and October.
  - Sample Site #908 (Billy Lake) which missed measurements of in situ pH in August and September.

The 2020 monitoring results were screened against applicable BC Water Quality Guidelines (WQG). Further discussion on specific WQG exceedances and water quality trends observed during 2020 are separately reported in the 2020 Annual Water Quality Monitoring Report which is submitted by THVCP to Ministry of Environment and EMPR.

# 6 INSPECTION OBSERVATIONS AND PHOTOGRAPHS

Copies of the field inspection forms, 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 2020 AFPR site visit is as follows:

- Highmont TSF: Impoundment, dam crest and downstream slopes appear similar to conditions observed during 2019 site inspections. Closure covers continue to perform well on downstream slopes.
- 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. THVCP partially cleared the channel prior to 2020 freshet. HVC completed clearing works after the site visit.

# 7 ASSESSMENT OF DAM SAFETY

## 7.1 Dam Classification Review

The dam consequence classifications are summarized in Table 7.1. The dam consequence classifications were last reviewed by KCB and THVCP representatives during a workshop held on February 12, 2020, which concluded that all consequence classifications remain unchanged.

The 2018 DSR recommended upgrading the S8 Pond dam consequence from “Low” to “Significant” to be consistent with the classification of S1 Pond and S2 Pond, which the DSR considered to have a similar potential environmental consequences (SRK 2019). This recommendation was reviewed by THVCP and KCB during the 2020 workshop. The review concluded the current consequence class is appropriate given the lower potential release volume from a breach of S8 Pond, relative to both S1 and S2.

**Table 7.1 Summary of Highmont Dam Consequence Classifications**

| Name of Dam | Consequence Classification (CDA 2013) |
|---|---|
| Highmont TSF Dams | High(1) |
| S1 Pond dam | Significant |
| S2 Pond dam | Significant |
| S3 Pond dam | High |
| S4 Pond dam | N/A (Breached; no longer a dam structure) |
| S5 Pond dam | Significant |
| S8 Pond dam | Low |
| S9 Pond dam | N/A (Breached; no longer a dam structure) |

Note:
1. The East Dam was assigned a "Significant" consequence classification in AMEC (2014). However, THVCP has adopted an increased standard and is managing all Highmont dams as "High" consequence.

## 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[8] of 2; S5-005 has been closed whereas efforts to address S3-001 were advanced in 2020 and 2021 (see discussion in Section 7.3.2). 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.

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

In 2020, THVCP and KCB developed a workplan to address the DSR recommendations (Appendix IV). In total, eight have been closed-out with the remaining 21 scheduled for completion in 2021.

## 7.3 Failure Mode Review

KCB understands that Teck's long-term goal for all tailings facilities is to reach landform status with all potential failure modes, that could result in catastrophic release of tailings and/or water, being reduced to non-credible. The long-term goal for the Highmont TSF is for all potential failure modes to be non-credible based on Extreme consequence loading conditions. Evaluation of failure modes with respect to this goal is ongoing.

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 remains appropriate for the current structure.

### 7.3.1 Highmont TSF Dams

- Slope Stability: existing condition of the dams meet design FOS criteria, required by the Code, for global slip surfaces which would result in an uncontrolled release of tailings under static ($\geq$ 1.5), pseudo-static (>1.0) and post-earthquake ($\geq$ 1.2) loading. The key design controls related to dam stability are the compacted rockfill which comprise the majority of the dam shell and relatively low piezometric levels in the impoundment and dam (KCB 2015d). Under the current configuration, the piezometric levels and gradients through the tailings and dam are lower than during operations and the downstream slopes have been regraded to a shallower angles (from 1.5:1V to between ~2.3H:1V and 2.5H:1V) which increase the factor of safety against slope failure.
- Overtopping: the open channel spillway is designed to safely pass a flood (PMF, 24-hour duration) which is significantly greater than the minimum IDF recommended under the Code (1/3 between 1000-year and PMF). Under existing conditions, the following additional controls and factors 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.
  - 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).

### 7.3.2 Seepage Recovery Pond Dams

- Slope Stability (all ponds except S3 Pond): Stability analyses under static and pseudo-static loadings, indicate the FOS for slip surfaces through dam fill and foundation are greater than the minimum FOS required by the Code (KCB 2015c).

- Slope Stability (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. 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 design seismic event. Screening stability analysis concluded that if this unit does liquefy the dam may become unstable:
  - The DSR (SRK 2019) recommended that further assessment should be conducted related to this uncertainty (DSR Recommendation ID: S3-001). THVCP is reviewing the related risk and, in 2021, will define the path forward to address which may include site investigations to resolve the uncertainty.
  - In early 2021, KCB completed a review of the potential for pond release under the worst case where the sand and gravel material is susceptible to liquefaction and an earthquake large enough to trigger liquefaction were to occur. KCB found that the large freeboard (relative to the downstream slope height) and the compacted glacial till seepage cut-off beneath the dam reduce the potential for pond release under such scenario.
- Overtopping:
  - All seepage recovery ponds manage overtopping by safely routing the IDF, required under the Code, through a spillway, pumping or storing as described in Section 4.4.

## 7.4 Emergency Preparedness and Response

The emergency preparedness and response plan (EPRP) for the Highmont TSF forms a part of the 2018 OMS Manual and is appropriate for the current structure. The EPRP is being reviewed as part of the ongoing OMS manual updates to ensure it remains consistent with changes made to the OMS manual and site emergency response procedures.

Training and testing of the EPRP was completed on December 9, 2020. The training consisted of a trial of the EPRP using hypothetical scenario at the L-L Dam. Participants included members of THVCP's operation team (including site management), THVCP QP and EoR. Along with testing of the system, THVCP contacts offsite emergency response resources to ensure that contact information is current.

# 8 SUMMARY

The observed performance of the Highmont TSF is consistent with expected performance and within design requirements. There have been no significant changes to the condition of the structure during 2020.

The status of recommendations related to facility performance identified during past AFPRs, as of the issue date of this report, are summarized in Table 8.1. Closed recommendations are shown in *italics*. The deadline to complete the flood routing assessment and upgrade works were deferred to prioritize other flood routing activities at site which have a greater impact on risk reduction, as noted in Table 8.1. No new recommendations, related to facility performance, were identified during this review.

**Table 8.1 Previous Recommendations Related to Facility Performance – Status Update**

| ID No. | Applicable Reg. or OMS Reference | Recommended Action | Priority[(1)] | Recommended Deadline |
|---|---|---|---|---|
| *HD-2016-05* | - | *Signage should be added to the spillway gate controls indicating which turn direction opens and closes the gate and identifying which seepage pond water is being diverted to in each position.* | *4* | *Q1 2018 (CLOSED)* |
| HD-2017-01 | Spillway | THVCP 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 – Revised Q4 2021) |
| HD-2018-02 | 10.1.8 | 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 (Open – Revised Q2 2021) |
| *HD-2019-02* | *DSR* | *KCB and THVCP to develop a work plan to address 2018 DSR recommendations.* | *3* | *April 2020 (CLOSED)* |
| *S2-2018-01* | *OMS* | *Include monitoring of the inlet plug during high flow events in the 2021 OMS manual. Define the minimum till plug elevation necessary to prevent Highmont TSF Spillway flow from entering S2 Pond, during the Inflow Design Flood (IDF).* | *3* | *Q1 2021 (CLOSED - Included in the OMS Manual update started in 2020)* |
| *S2-2018-02* | *10.1.8* | *To improve dam safety of S2 Pond, by allowing safe routing of IDF, KCB recommends the Highmont TSF spillway till plug be permanently relocated to the S2 Pond inlet channel and built to sufficient height such that the plug would not be overtopped during the Highmont TSF IDF.* | *2* | *Q1 2021 (CLOSED, plug required to flush S2 Pond which is a permit requirement)* |
| S2-2019-01 | 10.1.8 | 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, THVCP to schedule for 2021) |
| S5-2018-01 | 10.1.8 | Confirm the pumping capacity of the system at S5 Pond so that the ability to route the IDF (100-year return period, 24-hour duration), assuming the pumps are functioning as intended, can be confirmed. | 2 | Q4 2019 (*CLOSED – KCB estimated pumping capacity required to meet flood routing requirements)* |
| S5-2018-02 | 10.1.8 | 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-2019-02) | 2 | Q3 2021 (Open) |
| *S8-2018-01* | *OMS* | *A pipe was observed on the slope of the S8 Pond dam that did not appear to be connected to anything. This pipe should be removed.* | *4* | *Q4 2019 (CLOSED - THVCP confirmed no potential hookups for the pipe)* |

Notes:
1. Recommendation ID numbers from 2017 Annual Facility Performance Report have been revised as shown.
2. Recommendation priority guidelines, specified by Teck and assigned by KCB:
   *Priority 1*: A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant risk of regulatory enforcement.
   *Priority 2*: If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory enforcement; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
   *Priority 3*: Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
   *Priority 4*: Best Management Practice – Further improvements are necessary to meet industry best practices or reduce potential risks.

# 9 CLOSING

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 2019 Annual Facility Performance Report 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.

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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.
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# FIGURES

Figure 1 Mine Site Plan
Figure 2 Highmont Tailings Storage Facility Overview
Figure 3 North Dam Plan
Figure 4 East Dam Plan
Figure 5 South Dam Plan
Figure 6 Flow Schematic for Highmont Tailings Storage Facility


Legend

- L-L Dam Climate Station
- 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

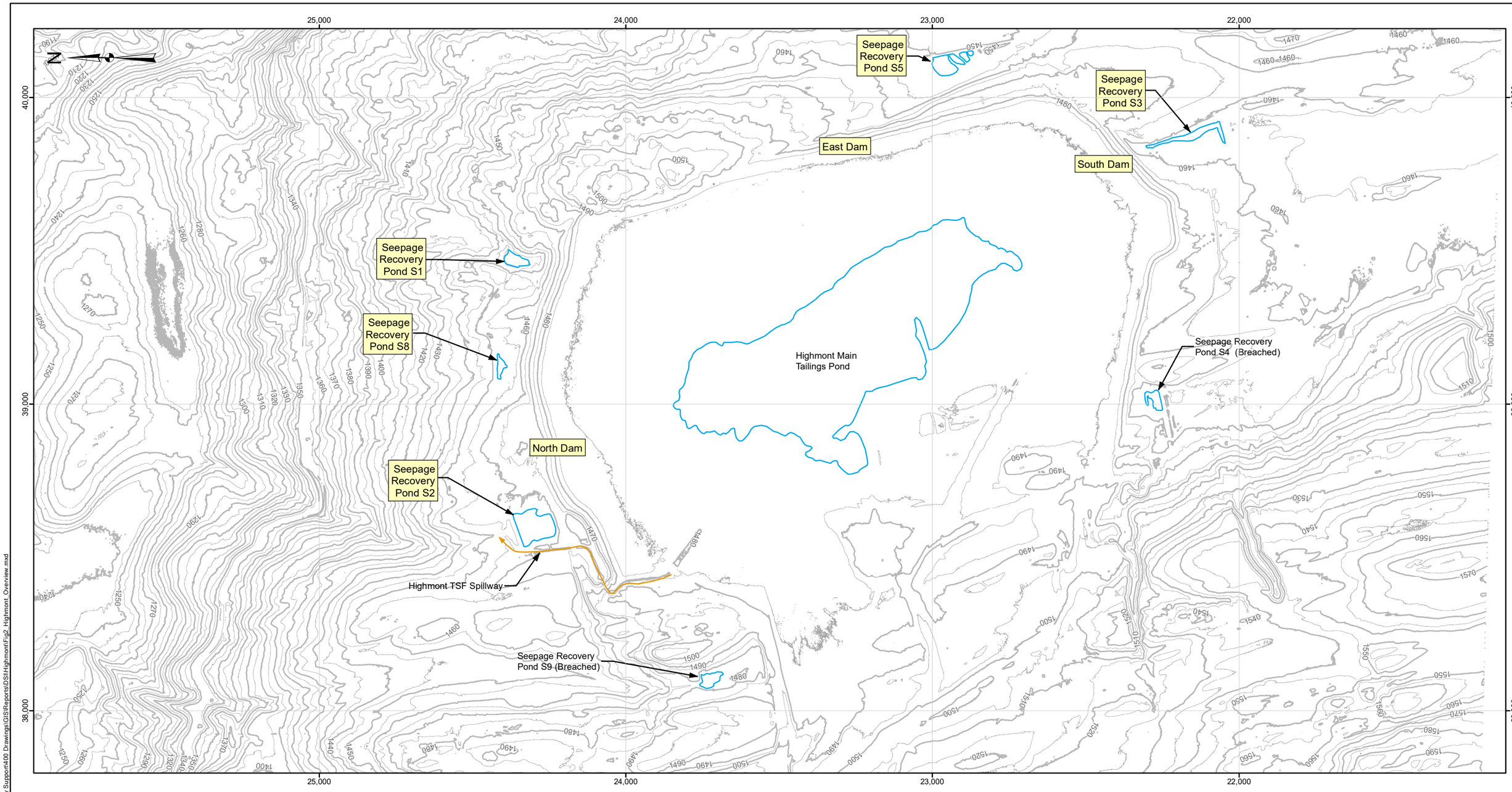
Klohn Crippen Berger

PROJECT: HIGHLAND TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: MINE SITE PLAN

| SCALE | PROJECT No. | FIG No. |
|---|---|---|
| 1:100,000 | M02341B83 | 1 |

Date: 2021-01-07
Document Path: Z:\MVCR\M02341B83 - HVC 2020 Dam Safety Support\400 Drawings\GIS\Reports\DSI\Highland\Fig1_Highland_MineSitePlan.mxd




Legend

- Spillway
- Waterbody
- Index Contour (10 m)
- Intermediate Contour (5 m)

0 500m

Notes:
1. Projection: HVC Mine Grid.
2. Topography from HVC, LiDAR flown on August 23rd, 2014.

Date: 2021-01-18
Document Path: Z:\MV\CRM\M02341B83 - HVC 2020 Dam Safety Support\400 Drawings\GIS\Reports\DS\Highmont\Fig2_Highmont_Overview.mxd

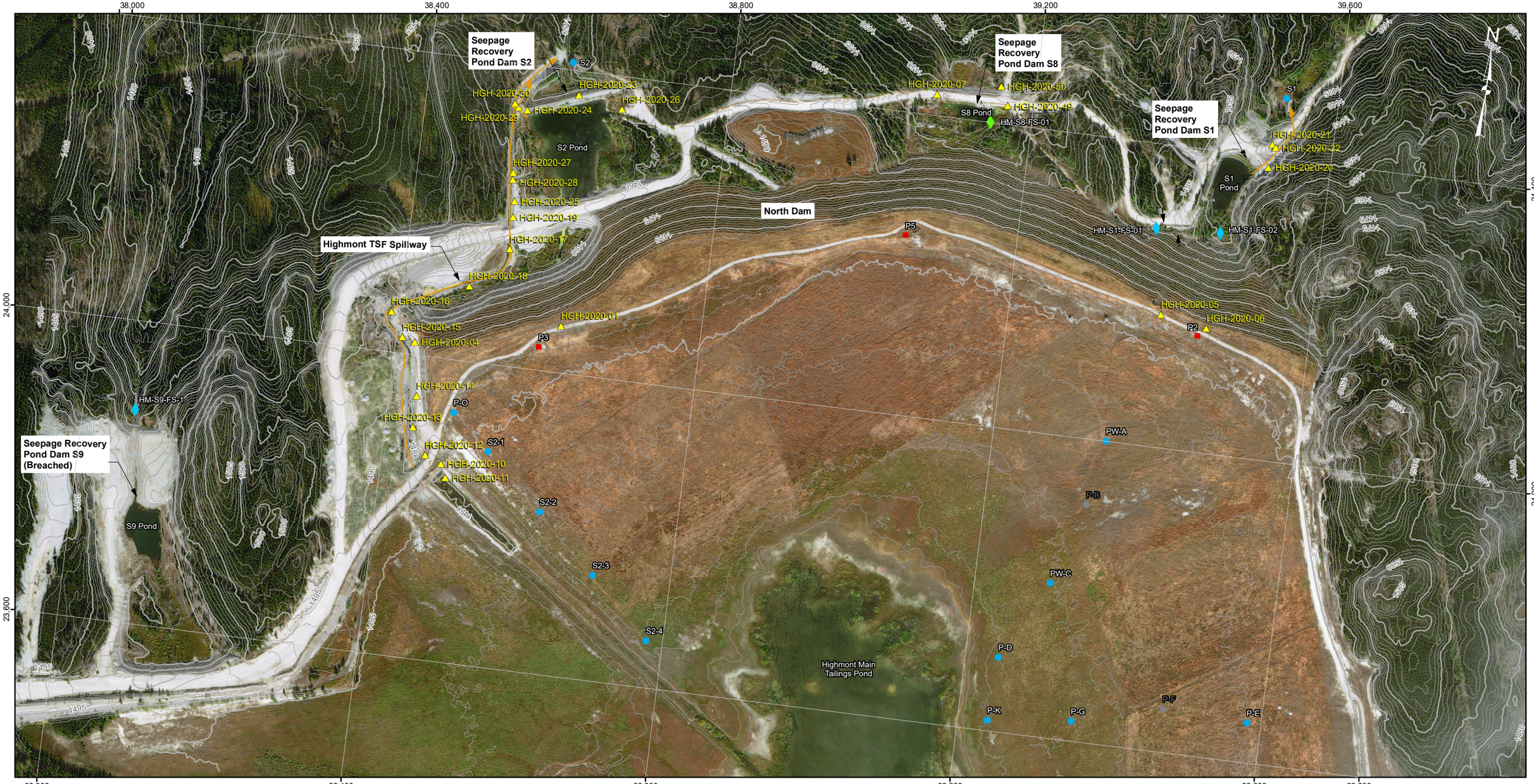
CLIENT: Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: HIGHMONT TAILINGS STORAGE FACILITY OVERVIEW

| SCALE | PROJECT No. | FIG No. |
|---|---|---|
| 1:12,000 | M02341B83 | 2 |




Legend

Instrument Type (Active)
- Standpipe Piezometer
- Survey Monument
- Pipe/Bucket Flow Reading
- Weir

Instrument Type (Defunct)
- Standpipe Piezometer

- Waypoint (HGH-2020-xx)
- Spillway
- Index Contour (5 m)
- Intermediate Contour (1 m)

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

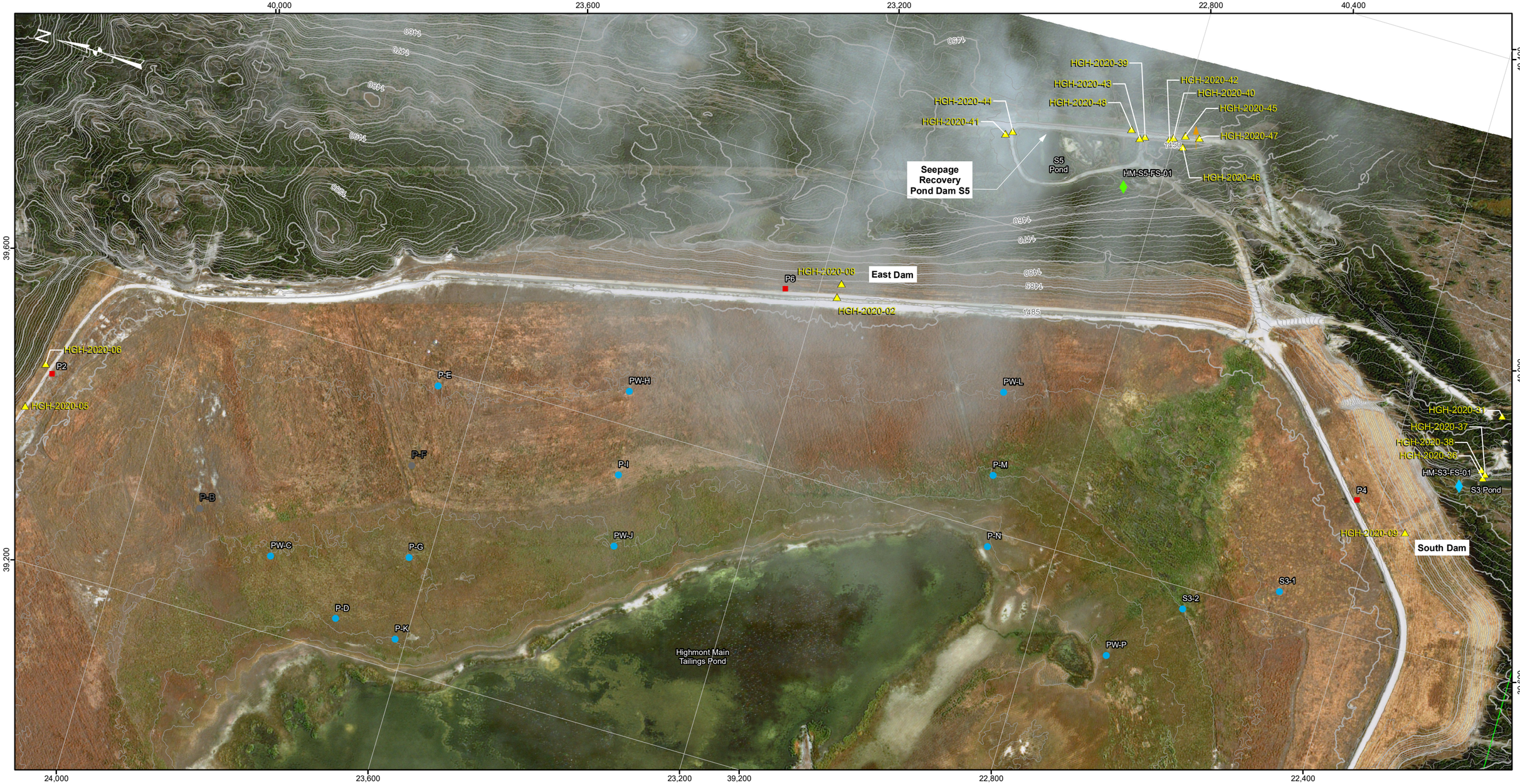
Klohn Crippen Berger

PROJECT
HIGHMONT TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE
NORTH DAM PLAN

| SCALE | PROJECT No. | FIG No. |
|---|---|---|
| 1:5,000 | M02341B83 | 3 |

Date: 2020-12-01
Document Path: Z:\MV\CRM\02341B83 - HVC 2020 Dam Safety Support\400 Drawings\GIS\Reports\DS\Highmont\Fig3_Highmont_NorthDamPlan.mxd




Legend

Instrument Type (Active)
- Standpipe Piezometer
- Survey Monument

Instrument Type (Defunct)
- Standpipe Piezometer

- Waypoint (HGH-2020-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.

Date: 2020-12-01
Document Path: Z:\MV\CRM\02341B83 - HVC 2020 Dam Safety Support\400 Drawings\GIS\Reports\DSI\Highmont\Fig4_Highmont_EastDamPlan.mxd

CLIENT
Highland Valley Copper / Teck

Klohn Crippen Berger

PROJECT
HIGHMONT TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE
EAST DAM
PLAN

| SCALE | PROJECT No. | FIG No. |
|---|---|---|
| 1:5,000 | M02341B83 | 4 |


Legend

Instrument Type (Active)
- Standpipe Piezometer
- Survey Monument
- Weir

Waypoint (HGH-2020-xx)
Spillway
Spillway (Plugged)

Index Contour (5 m)
Intermediate Contour (1 m)

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

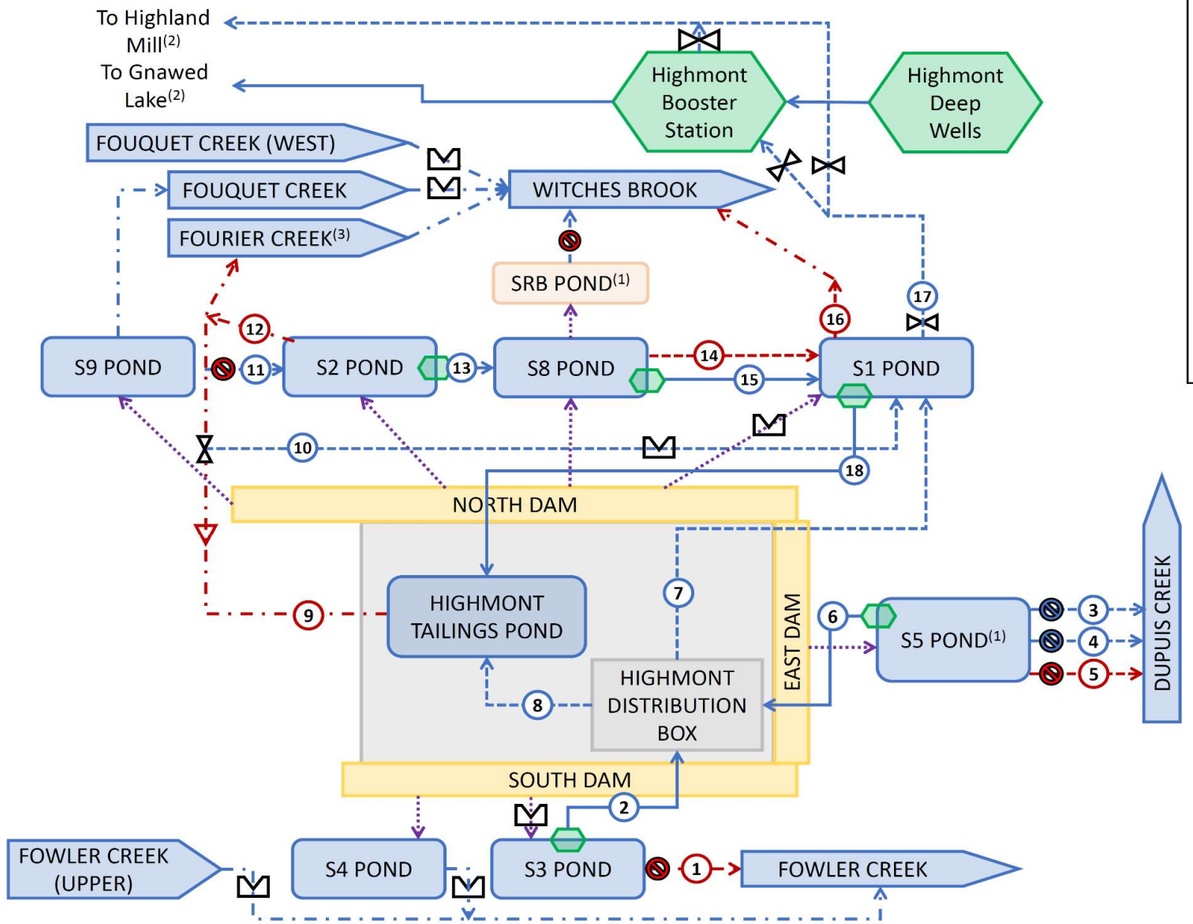
PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: SOUTH DAM PLAN

| SCALE | PROJECT No. | FIG No. |
|---|---|---|
| 1:5,000 | M02341B83 | 5 |

Date: 2020-12-01
Document Path: Z:\MV\CRM\M02341B83 - HVC 2020 Dam Safety Support\400 Drawings\GIS\Reports\DS\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):<br>i) Lock-block control sill;<br>ii) Approach channel excavated in tailings;<br>iii) Culvert crossings;<br>iv) Channel excavated through rock;<br>v) Flow control structure with 4’ high slide gate and diversion to S1; and<br>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
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: FLOW SCHEMATIC FOR HIGHMONT TAILINGS STORAGE FACILITY

| SCALE | PROJECT No. | FIG. No. |
|---|---|---|
| NTS | M02341B83 | 6 |

# APPENDIX I

## Annual Facility Performance Report Inspection Checklist, Observations and Photographs

# APPENDIX I-A

## Annual Facility Performance Report Inspection Checklist, Observations and Photographs North, East, and South Dams

# Appendix I-A
# Annual Facility Performance Report
# Inspection Checklist, Observations and Photographs
# North, East, and South Dams

## INSPECTION CHECKLIST

| | | | |
|---|---|---|---|
| **Facility:** | Highmont North, East, and South Dam | **Inspection Date:** | August 05, 2020 |
| **Weather:** | Sunny | **Inspector(s):** | Pablo Urrutia, P.Eng.<br>Narges Solgi, EIT |
| **Freeboard (pond level to dam crest):** | Large freeboard > 6.2 m based on June 24th survey | | |

### 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

**Comments:**

- Refer to Inspection Observations Section.

## INSPECTION 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 inspection 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 access road was observed; rutting is managed under routine maintenance (Photo I-A-4 to Photo I-A-6).
- **Left and Right Abutments**: Good physical condition. No signs of erosion, deterioration, horizontal displacement, or cracking.
- **Downstream Slope**:
  - Good physical condition. Downstream slope well vegetated throughout, providing adequate erosion protection for future service life (Photo I-A-8 to Photo I-A-18).
  - 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-28 to Photo I-A-30).
  - There is vegetation growth in the Highmont spillway channel (downstream of approach channel and rock chute) which should be cleared as part of routine maintenance before freshet, including vegetation obstructing culverts crossing dam (Photo I-A-21).
- **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-30 and Photo I-A-31).
  - No seepage was observed along downstream toe of East Dam.
  - No seepage was observed along downstream toe of South Dam.

## INSPECTION PHOTOGRAPHS

LEGEND:

- HGH = Highmont Tailings Facility.
- HGH-2020-## refers to 2020 AFPR waypoints shown on Figure 3, Figure 4, and Figure 5.
- Photographs taken during inspection on August 05, 2020.

**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-2020-01)**

**Photo I-A-2 View of tailings impoundment and beach from East Dam (HGH-2020-02)**


**Photo I-A-3 View of tailings impoundment and beach from South Dam (HGH-2020-03)**

**Photo I-A-4 North Dam crest is in good condition. No signs of distress, settlement or depression; minor rutting observed is managed under routine maintenance (HGH-2020-01)**

**Photo I-A-5 North Dam crest access road to S1 Diversion. Minor rutting observed is managed under routine maintenance (HGH-2020-04)**


**Photo I-A-6 North Dam crest near right abutment. Crest is in good condition. Minor rutting observed in access road is managed under routine maintenance (HGH-2020-05)**

**Photo I-A-7 East Dam crest. Crest is in good condition. No signs of deformation or distress were observed (HGH-2020-02)**

**Photo I-A-8 View of North Dam downstream slope looking northwest. Vegetation was about 0.5 m tall which made inspection difficult, but no signs of distress or deformation were observed (HGH-2020-06)**

**Photo I-A-9 View of North Dam downstream toe and S1 Pond. No signs of distress or deformation were observed (HGH-2020-06)**

**Photo I-A-10 View of North Dam downstream slope looking east (HGH-2020-06)**

**Photo I-A-11 View of North Dam downstream slope from S8 Pond access road (HGH-2020-07)**

**Photo I-A-12 East Dam downstream slope. Slope is vegetated and in good condition (HGH-2020-08)**

**Photo I-A-13 View of South Dam downstream slope looking northeast. Slope is vegetated and in good condition (HGH-2020-09)**

**Photo I-A-14 South Dam downstream slope and view of S3 Pond downstream of the dam with two pools of water. South Dam slope is vegetated and in good condition (HGH-2020-09)**

**Photo I-A-15 View of South Dam downstream slope looking southwest. Slope is vegetated and in good condition (HGH-2020-09)**

**Photo I-A-16 View of South Dam downstream slope at right abutment looking east. Slope is vegetated and in good condition (HGH-2020-03)**

**Photo I-A-17 South Dam downstream slope and view of S4 Pond from South Dam. S4 embankment is breached (HGH-2020-03)**

**Photo I-A-18 View of South Dam downstream slope at right abutment looking northwest. Slope is vegetated and in good condition (HGH-2020-03)**

**Photo I-A-19 Highmont Spillway approach channel, concrete lock-block control sill – Spillway was not flowing at the time of the inspection. Water ponded downstream of sill is controlled by level at spillway flow control gate (HGH-2020-10)**

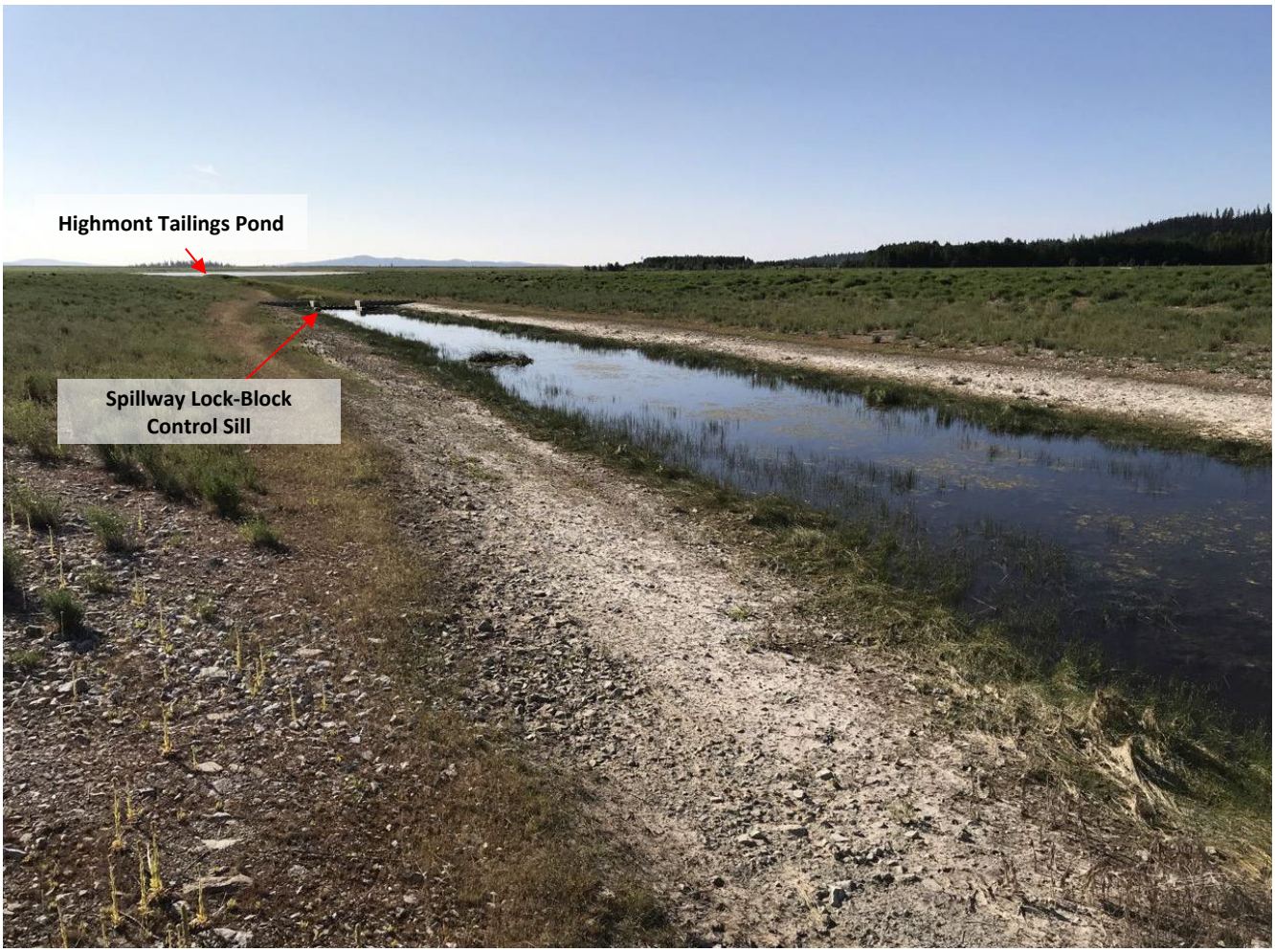


**Photo I-A-20 Approach channel. Road culverts are partially submerged, section upstream of culverts is clear of debris and vegetation (HGH-2020-11)**

**Photo I-A-21 Area downstream of approach channel culverts and upstream of flow control gate – Culverts and channel are partially obstructed by vegetation which should be removed as part of routine maintenance (HGH-2020-12)**

**Photo I-A-22 Spillway flow control gate. Valve is operational and could move up and down (tested for slight movement). Sliding gate is slightly open (HGH-2020-13)**

**Photo I-A-23 Downstream area of spillway flow control gate (HGH-2020-14)**

**Photo I-A-24 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-2020-15)**

**Photo I-A-25 Highmont Spillway channel, S1 Pond diversion control (HGH-2020-15)**

**Photo I-A-26 Highmont Spillway channel, downstream of S1 Pond diversion and control. No flow downstream of S1 diversion. Minor vegetation was observed in the channel (HGH-2020-15)**

**Photo I-A-27 Highmont Spillway channel upstream of spillway drop (HGH-2020-16)**

**Photo I-A-28 Highmont Spillway channel downstream of spillway drop. Channel is in good condition. North Dam downstream toe is visible. No signs of distress or deformations (HGH-2020-16)**

**Photo I-A-29 North Dam downstream slope and toe, downstream of Highmont Spillway. North dam toe is in good condition. Spillway stilling basin is heavily vegetated (HGH-2020-17)**

**Photo I-A-30 North Dam downstream slope and toe, downstream of Highmont Spillway. Water is ponded upstream of toe access road. Spillway stilling basin is heavily vegetated (HGH-2020-17)**

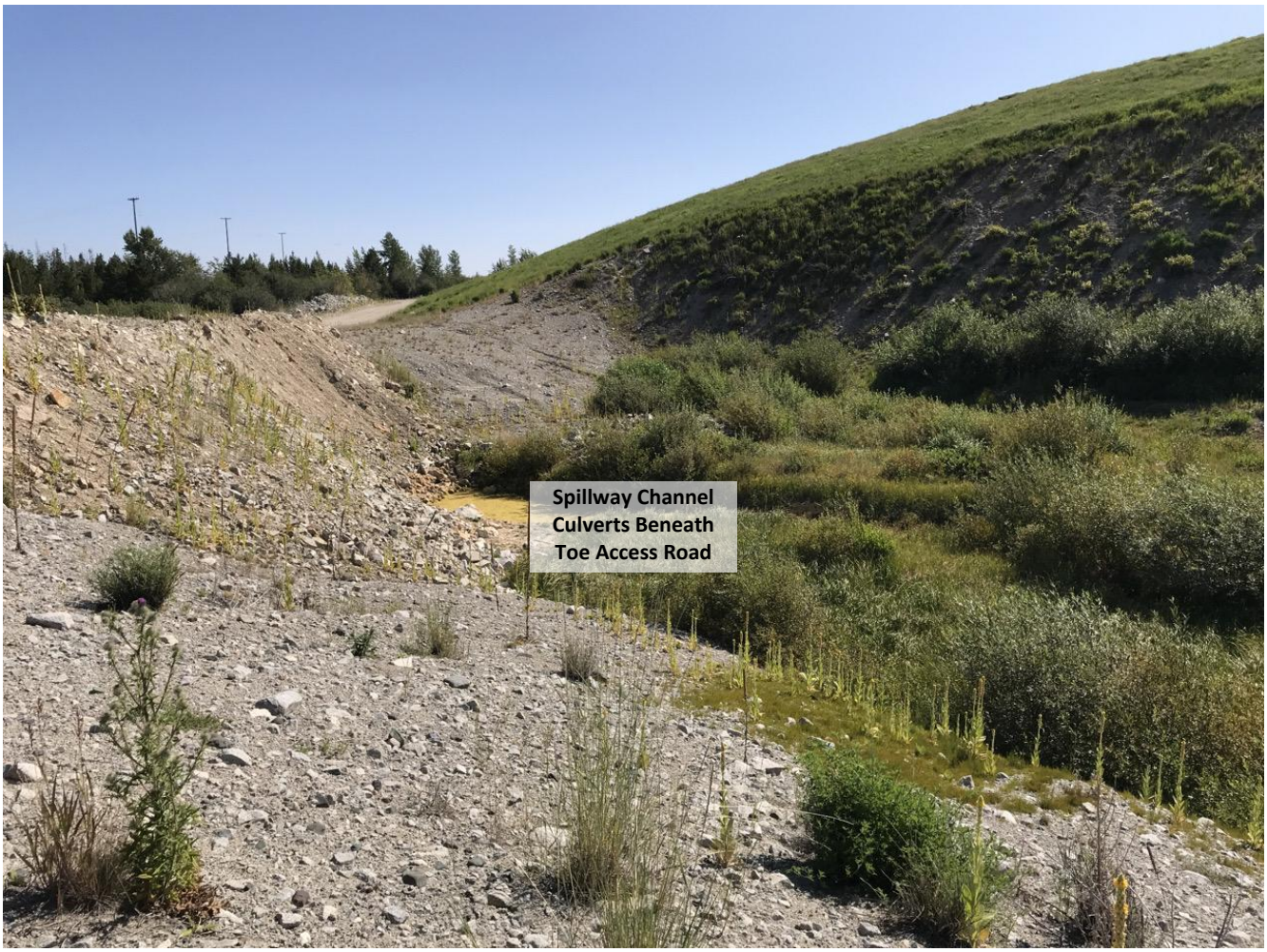


**Photo I-A-31 Water is ponded downstream of spillway drop. Vegetation obstructing spillway channel (HGH-2020-18 and HGH-2020-19)**

**Photo I-A-32 Riprap at spillway stilling pond and channel with maximum size of approximately 1 m (HGH-2020-18)**

**Photo I-A-33 North Dam toe access road crossing culverts. Culverts are misshapen (HGH-2020-17)**

# APPENDIX I-B

## Annual Facility Performance Report Inspection Checklist, Observations and Photographs Seepage Recovery Dams

# Appendix I-B
# Annual Facility Performance Report
# Inspection Checklist, Observations and Photographs
# Seepage Recovery Dams

## INSPECTION CHECKLISTS

### Seepage Recovery Pond S1

| | | | |
|---|---|---|---|
| **Facility:** | Highmont Seepage Recovery Dam S1 | **Inspection Date:** | August 05, 2020 |
| **Weather:** | Sunny | **Inspector(s):** | Pablo Urrutia, P.Eng.<br>Narges Solgi, EIT |
| **Freeboard (pond level to dam crest):** | 2.5 m based on maximum water elevations on August 5th 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 Inspection Observations Section.

## Seepage Recovery Pond S2

| | | | |
|---|---|---|---|
| **Facility:** | Highmont Seepage Recovery Dam S2 | **Inspection Date:** | August 05, 2020 |
| **Weather:** | Sunny | **Inspector(s):** | Pablo Urrutia, P.Eng.<br>Narges Solgi, EIT |
| **Freeboard (pond level to dam crest):** | 2.6 m based on maximum water elevations on August 5th 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 Inspection Observations Section.

## Seepage Recovery Pond S3

| | | | |
|---|---|---|---|
| **Facility:** | Highmont Seepage Recovery Dam S3 | **Inspection Date:** | August 05, 2020 |
| **Weather:** | Sunny | **Inspector(s):** | Pablo Urrutia, P.Eng.<br>Narges Solgi, EIT |
| **Freeboard (pond level to dam crest):** | 2.5 m based on maximum water elevations on August 5th 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:**

- Area around outlet control is heavily vegetated and may cause safety concern to personnel who require access to the outlet control.
- Refer to Inspection Observations Section.

## Seepage Recovery Pond S5

| | | | |
|---|---|---|---|
| **Facility:** | Highmont Seepage Recovery Dam S5 | **Inspection Date:** | August 05, 2020 |
| **Weather:** | Sunny | **Inspector(s):** | Pablo Urrutia, P.Eng.<br>Narges Solgi, EIT |
| **Freeboard (pond level to dam crest):** | 3.8 m based on maximum water elevations on August 5th 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 Annual Facility Performance Report recommendation RE: flood routing.
- Refer to Inspection Observations Section.

## Seepage Recovery Pond S8

| | | | |
|---|---|---|---|
| **Facility:** | Highmont Seepage Recovery Dam S8 | **Inspection Date:** | August 05, 2020 |
| **Weather:** | Sunny | **Inspector(s):** | Pablo Urrutia, P.Eng.<br>Narges Solgi, EIT |
| **Freeboard (pond level to dam crest):** | 1.2 m based on maximum water elevations on August 5th 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 Inspection Observations Section.

## INSPECTION 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 combination provides adequate erosion protection based on performance over the service life (Photo I-B-2).
- **Pond**: At the time of inspection 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). Algae build-up on the trash rack should be cleared as part of THVCP routine monitoring and maintenance. If the outlet is obstructed, it does not impact flood routing assumptions.
- **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.
- **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-8 and Photo I-B-10).
- **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 was removed after the site visit as part of routine maintenance (Photo I-B-14 and Photo I-B-15).

- **Spillway**: Good physical condition. Spillway approach channel is partially blocked (appears to be from a temporary access over the channel). Bushes and small trees were present at the spillway inlet. Though this did not pose an immediate dam safety concern, THVCP removed the vegetation after the site visit (Photo I-B-16 and Photo I-B-17).
- **Seepage**: Seepage is not monitored downstream of the dam. However, a small pond of water at the downstream toe was observed. The pond is similar in size to the pond noted during the previous Annual Facility Performance Reports (AFPRs) and is likely to consist of surface runoff and seepage (Photo I-B-18).

### Seepage Recovery Pond S3

- **Crest**: Good physical condition. No indicators of significant concern observed (e.g. cracking, slumping, horizontal displacement) (Photo I-B-20 to Photo I-B-22).
- **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-23 to Photo I-B-25).
- **Pond**: At the time of the inspection, 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-27).
- **Seepage**: Seepage is not monitored downstream of the dam. No ponding 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-28).

### Seepage Recovery Pond S5

- **Crest**: Good physical condition. No signs of significant erosion, deterioration, displacement, or cracking (Photo I-B-31). The low point downstream of the outlet just south of Viewpoint HGH-2020-39 should be levelled (Photo I-B-32)
- **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-33).
- **Pond**: During inspection pond 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-34 to Photo I-B-36).

- **Low-level Outlet and Spillway**: As observed during the 2016 through 2019 AFPRs, the Low-Level Outlet valves were closed and the inlet of the spillway pipes were obstructed by sand bags (Photo I-B-37, Photo I-B-38, and Photo I-B-40).

  Spillway pipe valve is blocked and too low. It will not be accessible during a flood event.

  Area around outlet control into the sub-cell where inflow reports to S5 Pond is heavily vegetated.

- **Seepage**: Change of vegetation downstream toe of the perimeter crest suggests there has been temporary ponding at the toe likely due to the run-off (Photo I-B-42). No seepage was observed.

### Seepage Recovery Pond S8

- **Crest**: Good physical condition. No signs of significant erosion, deterioration, displacement, or cracking (Photo I-B-43 and Photo I-B-44).
- **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-45 and Photo I-B-46).
- **Pond**: At the time of inspection the pond appeared lower in elevation when compared to the 2019 inspection. Less than 2 m below the crest of the dam (Photo I-B-47 and Photo I-B-48).
- **Spillway**: The outlet pipe was clear of debris (Photo I-B-49).
- **Seepage**: None observed.

## INSPECTION PHOTOGRAPHS

LEGEND:

- HGH = Highmont Tailings Facility.
- HGH-2020-## refers to 2020 AFPR waypoints shown on Figure 3, Figure 4 and Figure 5.
- All photographs taken during inspection on August 5th, 2020

### Seepage Recovery Pond S1

**Photo I-B-1 S1 Pond: Overview of crest looking west towards left abutment (HGH-2020-20)**

**Photo I-B-2 S1 Pond: S1 Pond dam downstream slope (HGH-2020-21)**

**Photo I-B-3 S1 Pond: View of S1 Pond, Spillway intake, and Low-Level Outlet (LLO) (HGH-2020-20)**

**Photo I-B-4 S1 Pond: Low-Level Outlet (LLO) to the left of spillway intake. Pond level was about 1 m below inlet. Vegetation partially obstructing intake; will be cleared during routine maintenance (HGH-2020-20)**

**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-2020-20)**

**Photo I-B-6 S1 Pond: Spillway channel upstream of pipe intake, looking toward the pond (HGH-2020-22)**

## Seepage Recovery Pond S2

**Photo I-B-7 S2 Pond: View of S2 Pond embankment crest, looking toward left abutment (HGH-2020-23)**

**Photo I-B-8 S2 Pond: View of S2 Pond embankment crest from left abutment (HGH-2020-24)**

**Photo I-B-9 S2 Pond: View of S2 Pond left flank and Highmont spillway channel (HGH-2020-25)**

**Photo I-B-10 S2 Pond: View of downstream slope. Slope is in good condition (HGH-2020-23)**

**Photo I-B-11 S2 Pond: Overview of upstream slope riprap. Slope is in good condition (HGH-2020-26)**

**Photo I-B-12 S2 Pond: S2 Pond with view of downstream slope of Highmont North Dam in the background (HGH-2020-23)**

**Photo I-B-13 S2 Pond: Low Level Outlet (HGH-2020-26)**

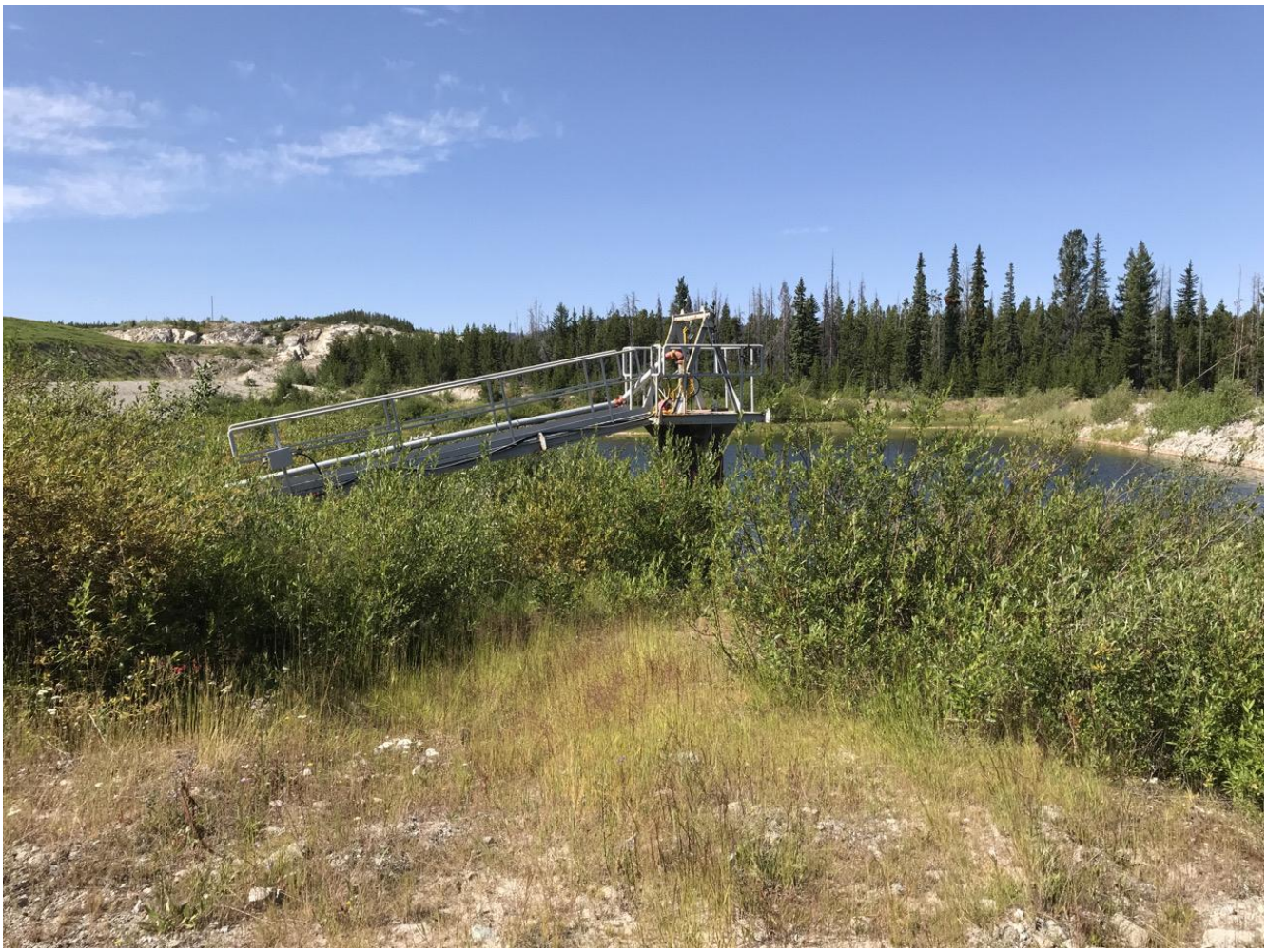


**Photo I-B-14 S2 Pond: Till plug (~1.2 m high and ~ 1m wide) is placed in S2 inlet channel. Highmont TSF Spillway diversion channel is heavily vegetated. Vegetation was removed after the site visit as part of routine maintenance (HGH-2020-27)**

**Photo I-B-15 S2 Pond: S2 Pond inlet and channel from Highmont Spillway Diversion. Channel and the inlet are heavily vegetated. Vegetation was removed after the site visit as part of routine maintenance (HGH-2020-28)**

**Photo I-B-16 S2 Pond: S2 Pond Spillway approach channel; remnant of a temporary access built over the channel remains in place which has reduced the spillway flow channel and should be removed as part of routine maintenance before freshet. Vegetation was removed after site visit as part of routine maintenance (HGH-2020-29)**

**Photo I-B-17 S2 Pond: View of Highmont spillway channel. Channel is in good condition. Excess vegetation was removed after site visit as part of routine maintenance (HGH-2020-30)**

**Photo I-B-18 S2 Pond: Ponded water at downstream toe, similar in size to the pond noted during AFPRs from previous years (HGH-2020-23)**

## Seepage Recovery Pond S3

**Photo I-B-19 S3 Pond: Access road to S3 was partially obstructed by a fallen tree (HGH-2020-31)**

**Photo I-B-20 S3 Pond: Overview of dam crest from right abutment (HGH-2020-32)**

**Photo I-B-21 S3 Pond: Overview of dam crest from mid dam, looking toward left abutment (HGH-2020-33)**

**Photo I-B-22 S3 Pond: Overview of dam crest from left abutment (HGH-2020-34)**

**Photo I-B-23 S3 Pond: Overview of downstream slope from right abutment (HGH-2020-32)**

**Photo I-B-24 S3 Pond: Overview of downstream slope with small trees from mid dam (HGH-2020-33)**

**Photo I-B-25 S3 Pond: Overview of downstream slope from left abutment (HGH-2020-34)**

**Photo I-B-26 S3 Pond: Overview of upstream slope from right abutment (HGH-2020-32)**

**Photo I-B-27 S3 Pond: Impoundment and Highmont South Dam slope in the background. View from S3 Pond left abutment, looking northwest (HGH-2020-34)**

**Photo I-B-28 S3 Pond: View of blocked spillway inlet at right abutment (HGH-2020-35)**

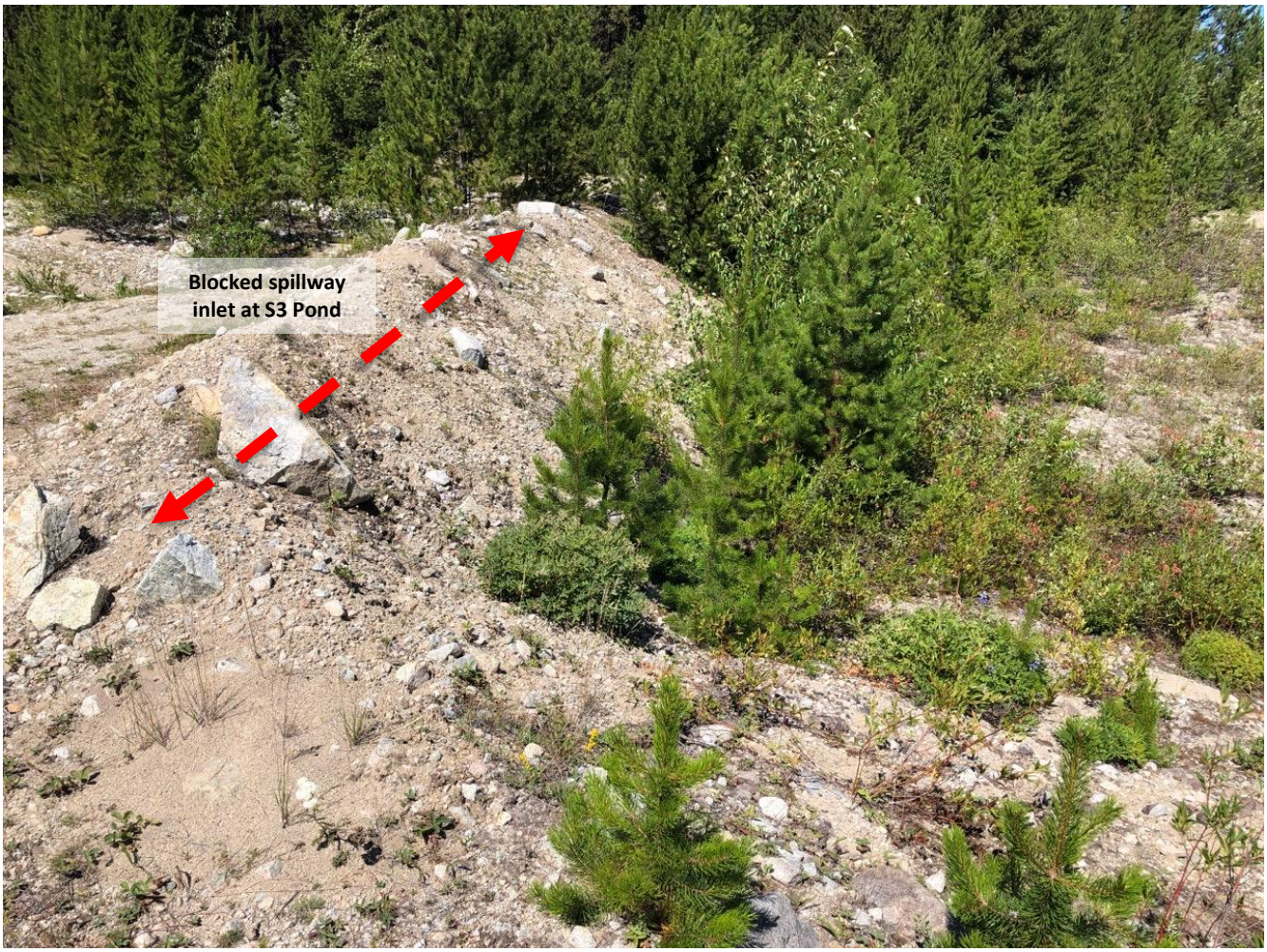


**Photo I-B-29 S3 Pond: Catwalk and outlet pump to Highmont Distribution Box, personal flotation device is in place (HGH-2020-36 and HGH-2020-37)**

**Photo I-B-30 S3 Pond: S3 inlet pipe valve works. System is clear and easily understandable (HGH-2020-38)**

## Seepage Recovery Pond S5

**Photo I-B-31 S5 Pond: Overview of crest. Minor rutting observed on crest and access road is managed under routine maintenance (HGH-2020-39)**

**Photo I-B-32 S5 Pond: View of access road on the divider dyke. Minor rutting observed on crest of divider dyke is managed under routine maintenance (HGH-2020-39)**

**Photo I-B-33 S5 Pond: Downstream slope of perimeter crest, looking north (HGH-2020-40)**

**Photo I-B-34 S5 Pond: S5 Pond north outlet pipe, permanently sealed. Metal plates placed at intake and pipes filled with till in 2015 (HGH-2020-41)**

**Photo I-B-35 S5 Pond: Overview of Pumping Sub-cell. Water was ponding in the spillway channel (HGH-2020-42)**

**Photo I-B-36 S5 Pond: Overview of S5 Pond basin (HGH-2020-43 and HGH-2020-44)**

**Photo I-B-37 S5 Pond: Pumping Sub-cell spillway channel. Water was ponding in the channel (HGH-2020-42)**

**Photo I-B-38 S5 Pond: Pumping Sub-cell Outlet #2 (South). Metal plates placed at intake and pipes filled with till in 2015 (HGH-2020-45 and HGH-2020-46)**

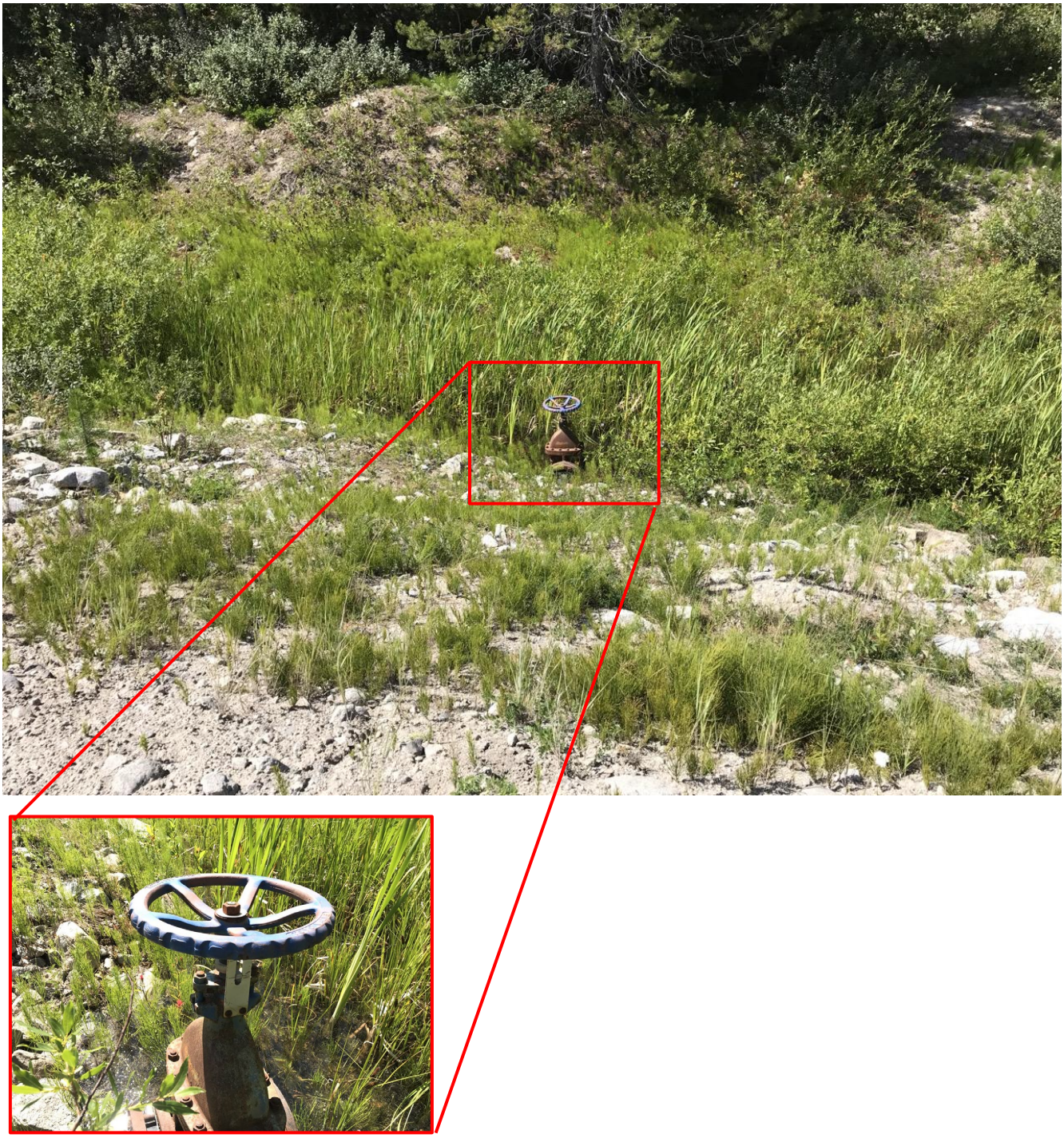


**Photo I-B-39 S5 Pond: Overview of downstream slope and Outlet #2 pipe daylighting at toe, looking east (HGH-2020-45)**

**Photo I-B-40 S5 Pond: Pumping Sub-cell two Overflow pipes, partially blocked at intake (HGH-2020-47)**

**Photo I-B-41 S5 Pond: Overview of downstream slope and S5 Overflow outlet pipes daylighting at toe, looking east (HGH-2020-47)**

**Photo I-B-42 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 (HGH-2020-48)**

## Seepage Recovery Pond S8

**Photo I-B-43 S8 Pond: Overview of crest from left abutment. Minor rutting observed on crest is managed under routine maintenance. Crest elevation at the low point should be confirmed. Pipe is still in place and should be removed so it is not used as currently aligned (HGH-2020-07)**

**Photo I-B-44 S8 Pond: view of crest from right abutment (HGH-2020-49)**

**Photo I-B-45 S8 Pond: Downstream slope, looking east from left abutment. THVCP confirmed there are no potential hookups for the pipe in the current location. Therefore, the pipe presents no risk to the S8 Pond (HGH-2020-07)**

**Photo I-B-46 S8 Pond: View of downstream slope (HGH-2020-50)**

**Photo I-B-47 S8 Pond: View of S8 Pond impoundment. Highmont North Dam downstream slope is visible on right hand side of picture (HGH-2020-07)**

**Photo I-B-48 S8 Pond: View of impoundment, catwalk and outlet pump to S1 Pond (HGH-2020-50)**


**Photo I-B-49 S8 Pond: Overview of overflow pipe trash rack. Rack is clear of debris. Current water level is below the invert (HGH-2020-49)**

# APPENDIX II

## Climate and Instrumentation

# APPENDIX II-A

## Climate Data

# Appendix II-A
# Climate Data

THVCP provided weather data from the L-L Dam climate station (El. 1186 m) which is the nearest climate station to the site but is at a lower elevation than Highmont TSF catchment (>El. 1487 m, i.e. dam crest). Climate data was adjusted for elevation, using the recommended adjustment factors from L-L Dam to Highmont/Bethlehem and Trojan Area (Average El. 1550 m), from Golder (2019). To support key precipitation trends and impacts on observed dam performance, data from Kamloops Pratt Road (Environment Canada Station No. 116C8P0, El. 729.0 m) was reviewed for comparison. Previous Annual Facility Performance Reports (AFPRs) compared the Highmont TSF data with Kamloops Airport (Environment Canada Station No. 1163781, El. 345 m) data, but this station was missing too much data in 2020. Precipitation records from L-L Dam (adjusted) and Kamloops Pratt Road between October 2019 and September 2020 are tabulated and plotted in Table II-A.1 and Figure II-A.1, respectively. Precipitation normals, reported in Table II-A.1, are based on the Highland Valley Lornex Synthetic Record, adjusted for elevation to the Highmont/Bethlehem and Trojan Area using Golder (2019).

Seasonal snowpack depth is not measured at the L-L Dam weather station. Instead, monthly measurements at the Highland Valley snow survey station (Station No. 1C09A) near the Trojan TSF are used by THVCP to monitor snowpack. 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 2020 snowpack depths based on available records are summarized in Table II-A.2.

The following observations were noted for the reporting period (refer to Figure II-A.1):

- More than 10% of the L-L Dam weather station precipitation data were missing in March, June, and July. Due to these data gaps, the 2020 climate data from site was augmented with data from a regional weather station to support a comparison with historic normals.
- All storm events during 2020 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: 23.1 mm on May 30; 18.2 mm on May 17; and 12.9 mm on September 19.
- January through April precipitation was significantly less than historic normals except the precipitation in February which was higher than average.
- May precipitation was almost twice as much as the historic normals.
- Figure II-A.1 indicates low precipitation at site during June and July; however, this is due to L-L Dam Weather Station data gaps during this period. THVCP inspection reports and regional climate station data indicate precipitation during this period was above historic normals.
- Snowpack depth measurements, from the Highland Valley station, indicate the snow had been melted by May 1, 2020.

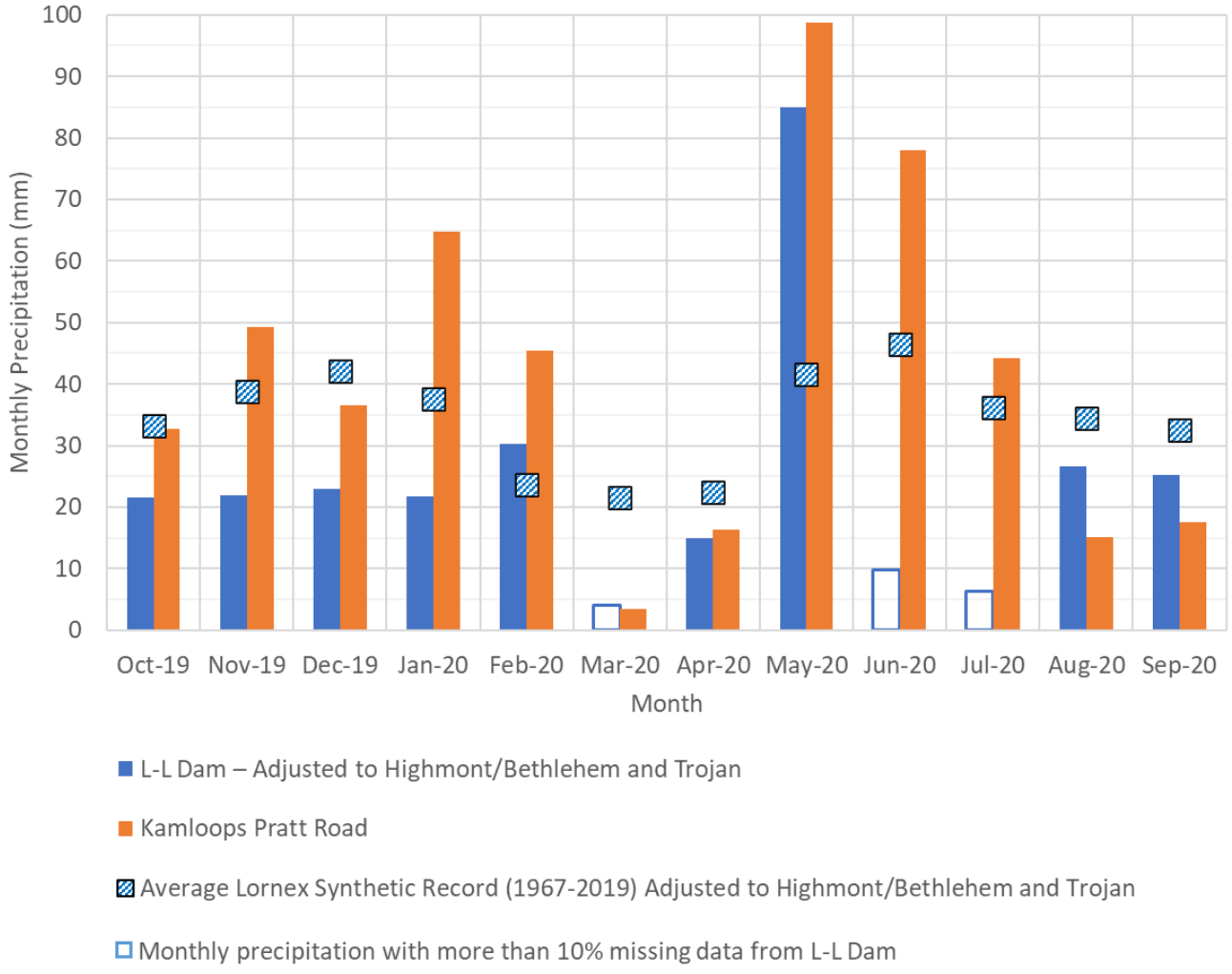
- Seasonal rise and fall of pond levels are associated with freshet. The time of year when pond levels start to fall is associated with the end of freshet, in recent years this has started in April or May (Figure 5.1 of the main text). In 2020, pond levels did not start to fall until mid to late June. This timing indicates that the 2020 response was driven primarily by precipitation, rather than 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] | Average Lornex Synthetic Record Adjusted to Highmont/Bethlehem and Trojan Area [2] | Kamloops Pratt Road Weather Station |
| Oct 2019 | 100 | 21.5 | 33.3 | 32.8 |
| Nov 2019 | 100 | 21.9 | 38.9 | 49.2 |
| Dec 2019 | 97 | 22.9 | 42.1 | 36.6 |
| Jan 2020 | 100 | 21.8 | 37.5 | 64.8 |
| Feb 2020 | 100 | 30.3 | 23.7 | 45.4 |
| Mar 2020 | 89 | 4.1 [4] | 21.5 | 3.4 |
| Apr 2020 | 100 | 15.0 | 22.4 | 16.4 |
| May 2020 | 100 | 85.1 | 41.7 | 98.8 |
| Jun 2020 | 32 | 9.8 [4] | 46.5 | 78.0 |
| Jul 2020 | 11 | 6.3 [4] | 36.3 | 44.2 |
| Aug 2020 | 100 | 26.6 | 34.4 | 15.2 |
| Sep 2020 | 100 | 25.2 | 32.6 | 17.6 |
| Annual Total | - | - | 410.8 | 502.4 |

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 2019).
2. Estimated by Golder (2019) using appropriate adjustment factors and average precipitation measured at Highland Valley Lornex climate station (Environment Canada ID No. 1123469 at El. 1268 m from 1976 to 2011). Golder (2019) infilled the data gaps prior to November 2011 and created a long-term synthetic precipitation record. 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 (2019) for detailed information.
3. Review period for the Highmont TSF Annual Facility Performance Report is from October 2019 through September 2020.
4. Monthly precipitation with more than 10% missing data.

## Figure II-A-1 Monthly Precipitation




## Table II-A-2 Historical Average and 2020 Snowpack Depths

| Survey Period | Years of Record[1] | Historic Average Snowpack Depth[2] (mm SWE[3]) | 2020 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 | 54 | 91.2 | 100 | 10% |
| April 1st | 52 | 100.8 | Not surveyed | N/A |
| May 1st | 53 | 28.1 | 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.

# APPENDIX II-B

## Instrumentation Summary and Plots

# Appendix II-B
# Instrumentation Summary and Plots

## II-B-1 PIEZOMETERS

Piezometric readings from 2011 to 2020 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 2020 Annual Facility Performance Report (AFPR), refer to Table II-B-1.

**Table II-B-1 Piezometric Levels during the review period and 2021 thresholds**

| Instrument ID | Piezometric Levels during the review period [1] (m) | | Proposed 2021 Threshold Value (m)[2] |
|---|---|---|---|
| | Maximum | Minimum | |
| S1 | 1431.7 | 1431.5 | 1432.4 |
| S2 | 1451.8 | 1451.1 | 1452.5 |
| S2-1 | 1479.9 | 1479.8 | 1481.4 |
| S2-2 | 1480.5 | 1480.2 | 1482.0 |
| S2-3 | 1482.1 | 1481.6 | 1483.4 |
| S2-4 | 1481.8 | 1480.0 | 1482.9 |
| S3-1 | 1481.5 | 1481.1 | 1482.0 |
| S3-2 | 1482.5 | 1481.8 | 1483.0 |
| PW-A | 1479.3 | 1479.1 | 1480.5 |
| PW-C (TALL) | 1482.2 | 1480.6 | ***1482.7*** |
| P-D | 1481.6 | 1479.8 | 1482.2 |
| P-E | 1481.3 | 1481.0 | 1482.6 |
| P-G | 1482.0 | 1480.1 | ***1482.5*** |
| PW-H | 1480.8 | 1480.6 | ***1481.3*** |
| P-I | 1481.1 | 1480.9 | 1482.7 |
| PW-J | 1481.6 | 1480.0 | ***1482.1*** |
| P-K | 1481.4 | 1479.6 | 1482.2 |
| PW-L | 1481.3 | 1481.0 | ***1481.8*** |
| P-M | 1481.9 | 1481.2 | 1483.5 |
| P-N | 1481.0 | 1479.7 | 1481.9 |
| P-O | 1479.5 | 1479.5 | 1482.4 |
| PW-P | 1481.1 | 1479.9 | ***1481.6*** |
| HM-PS-01 (13-SRK-14) | 1478.4 | 1478.2 | 1480.5 |
| HM-PS-02 (13-SRK-14) | 1477.7 | 1477.6 | 1480.5 |
| HM-PS-03 (13-SRK-13) | 1478.1 | 1477.9 | 1480.5 |

Notes:
1. Oct 2019 through Sep 2020.
2. ***Bold Italics*** indicate revised threshold for 2021.

## 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, THVCP 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 2020 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.

KCB estimated change from initial survey for vertical displacement by adding the incremental vertical displacement over the reporting period to the cumulative vertical displacement from the last total station survey. This assumes negligible vertical displacement occurred between the last total station survey (October 17, 2019) and the date of the GPS RTK baseline survey (November 26, 2019), which is reasonable given the proximity of the two survey dates.

**Table II-B-2 2020 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 | 7, parallel to dam crest (toward northwest) | -10 | 7, parallel to dam crest (toward northwest) | -17 |
| P3 | 10, downstream (toward west) | +13 | 10, downstream (toward west) | +11 |
| P4 | 23, upstream (toward north) | -13 | 23, upstream (toward north) | -40 |
| P5 | 11, upstream (toward southwest) | -9 | 11, upstream (toward southwest) | -6 |
| P6 | 9, upstream (toward west) | +10 | 9, upstream (toward west) | -18 |
| P7 | 10, parallel to dam crest (toward northwest) | -7 | 10, parallel to dam crest (toward northwest) | -41 |

Notes:
1. Incremental displacements are calculated between the November 2019 and September 2020 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 2020 incremental displacement to displacement between October 2019 surveys and earliest historic readings

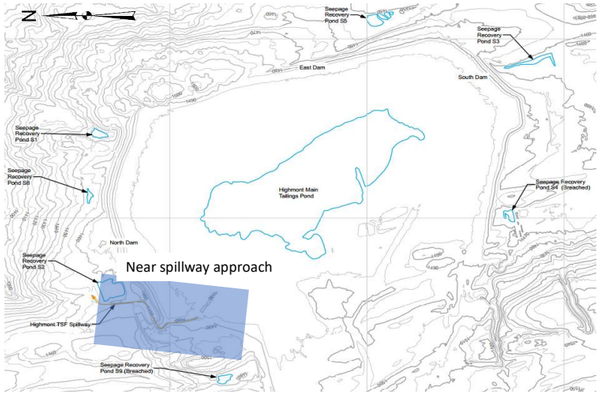
The current survey movement thresholds were set based on typical variance and error using the total station method; refer to Table II-B-3. These thresholds are being revised by KCB and THVCP for 2021 based on the RTK survey method. The survey readings for this review period do not indicate any increased 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 | n/a | | 75 |

Notes:
1. Thresholds are being revised by KCB and THVCP based on the GPS Real Time Kinematics (RTK) method. The presented thresholds are not applicable to the GPS RTK survey data from the 2020 AFPR review period.

# INSTRUMENTATION PLOTS

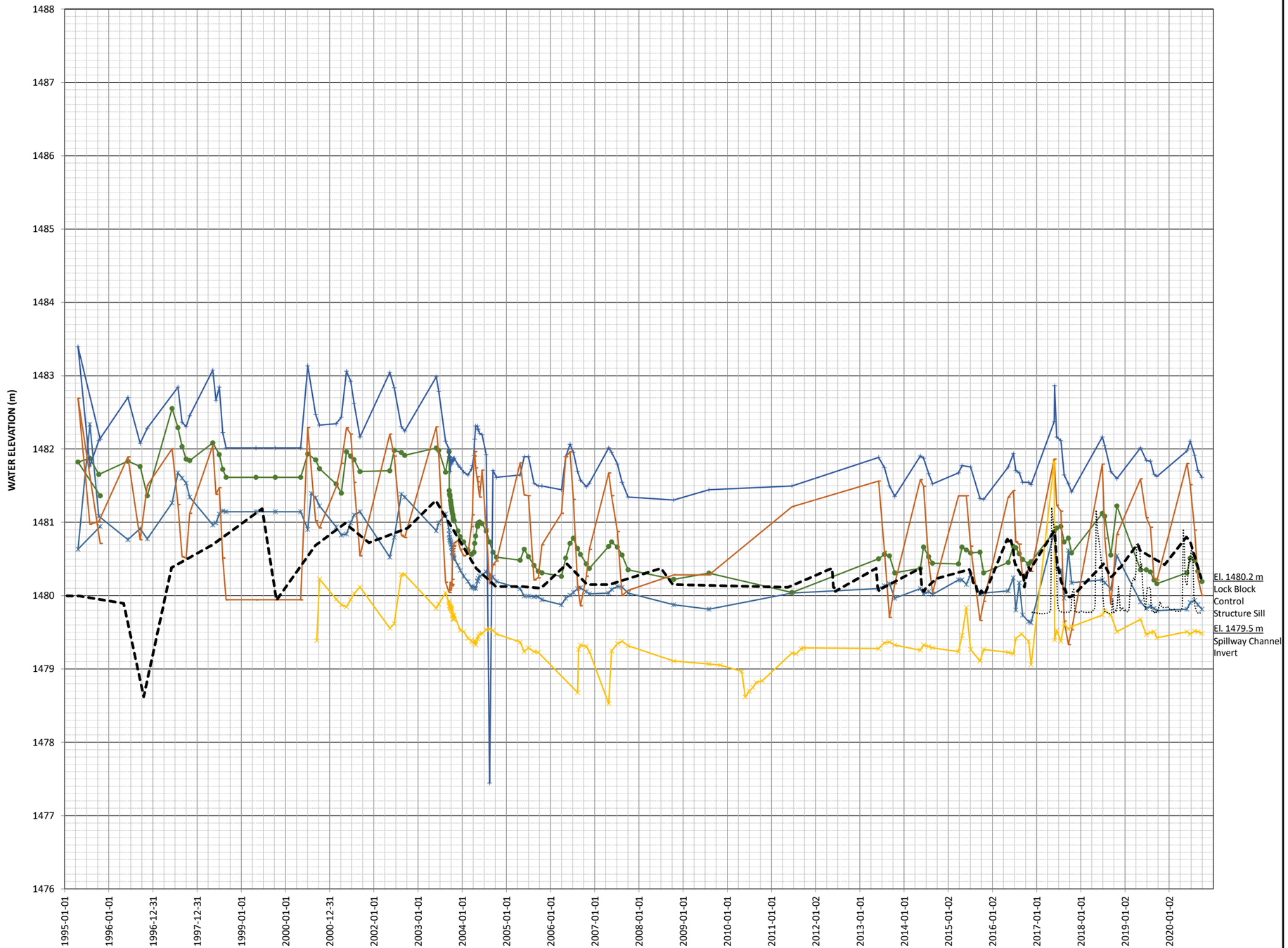




**LEGEND:**

- 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 Pond Level
- Highmont Spillway (Tranducer Data)

| PIEZOMETER ID | 2020 THRESHOLD EL. (m) |
|---|---|
| P-O | 1482.4 |
| S2-1 | 1481.4 |
| S2-2 | 1482.0 |
| S2-3 | 1483.4 |
| S2-4 | 1482.9 |






CLIENT: Highland Valley Copper / Teck

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PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

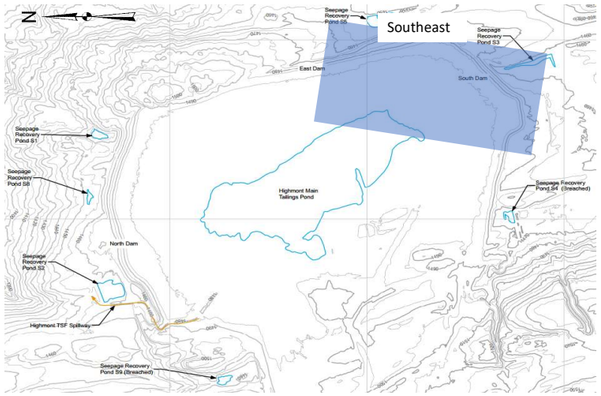
TITLE: HIGHMONT TSF PIEZOMETRIC DATA 2011-2020

NEAR SPILLWAY APPROACH

PROJECT No. M02341B83

FIG No. II-B-1

January 5, 2021
Z:\MVCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\320 Piezometer Data\Highmont\[201130 Highmont Piezo.xlsx]SPILLWAY

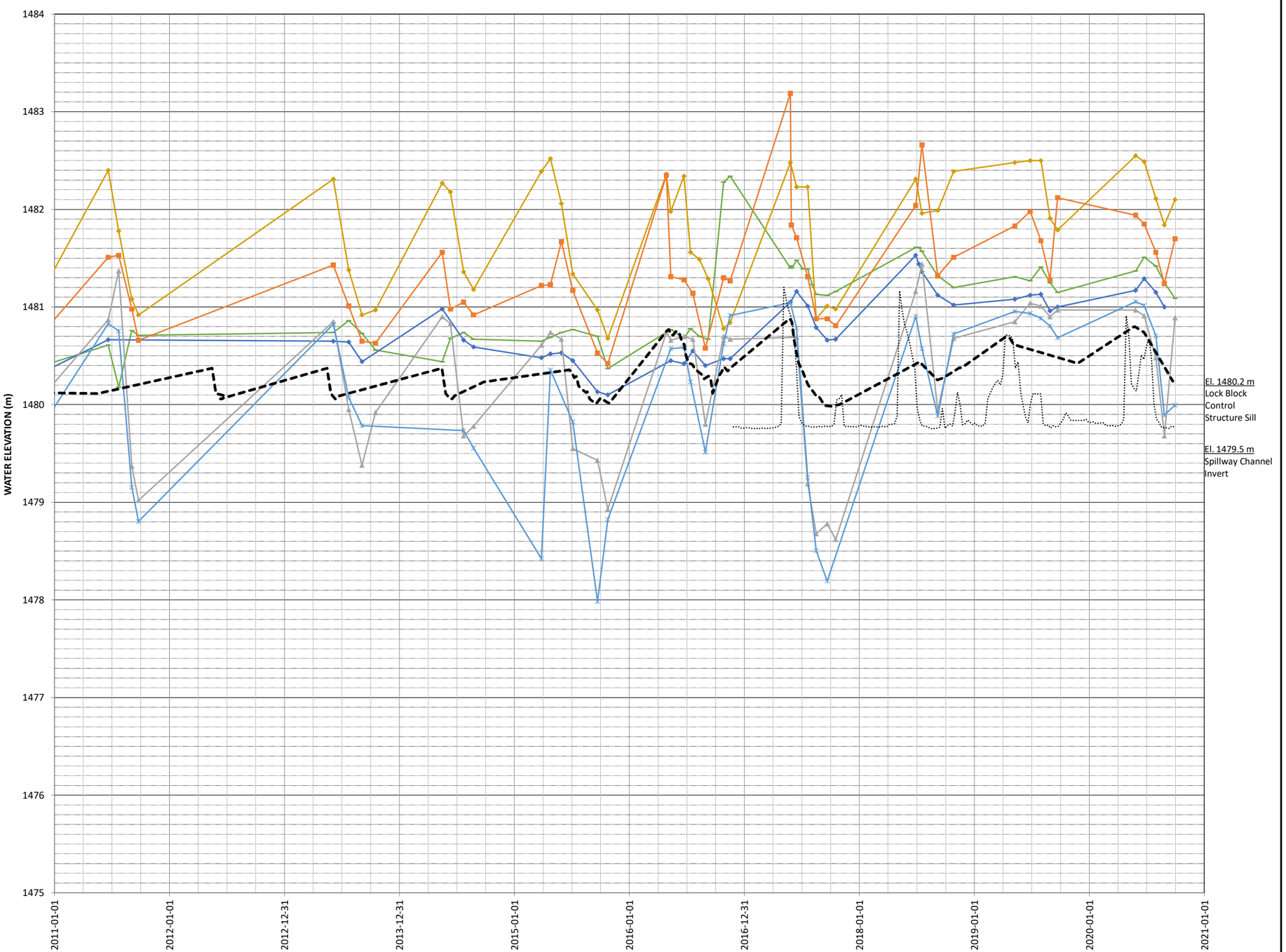




**LEGEND:**

- 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 Pond Level
- Highmont Spillway (Tranducer Data)

| PIEZOMETER ID | 2020 THRESHOLD EL. (m) |
|---|---|
| PW-L | 1481.5 |
| P-M | 1483.5 |
| P-N | 1481.9 |
| S3-1 | 1482.0 |
| S3-2 | 1483.0 |
| PW-P | 1481.5 |




Notes:
1- PW-L was reported dry on Sep 30, 2020.



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PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

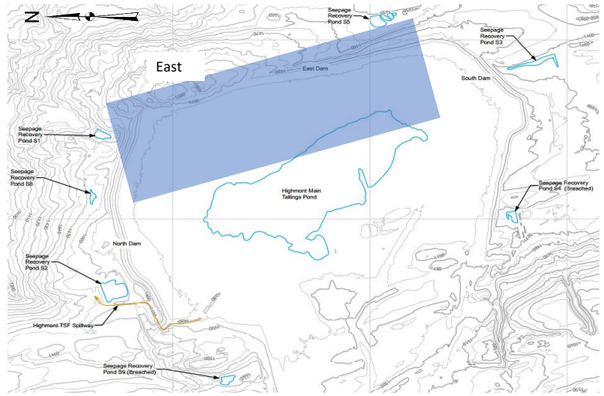
TITLE: HIGHMONT TSF PIEZOMETRIC DATA 2011-2020

SOUTH EAST

PROJECT No. M02341B83

FIG No. II-B-2

January 5, 2021
Z:\MVCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\320 Piezometer Data\Highmont\[201130 Highmont Piezo.xlsx]SPILLWAY

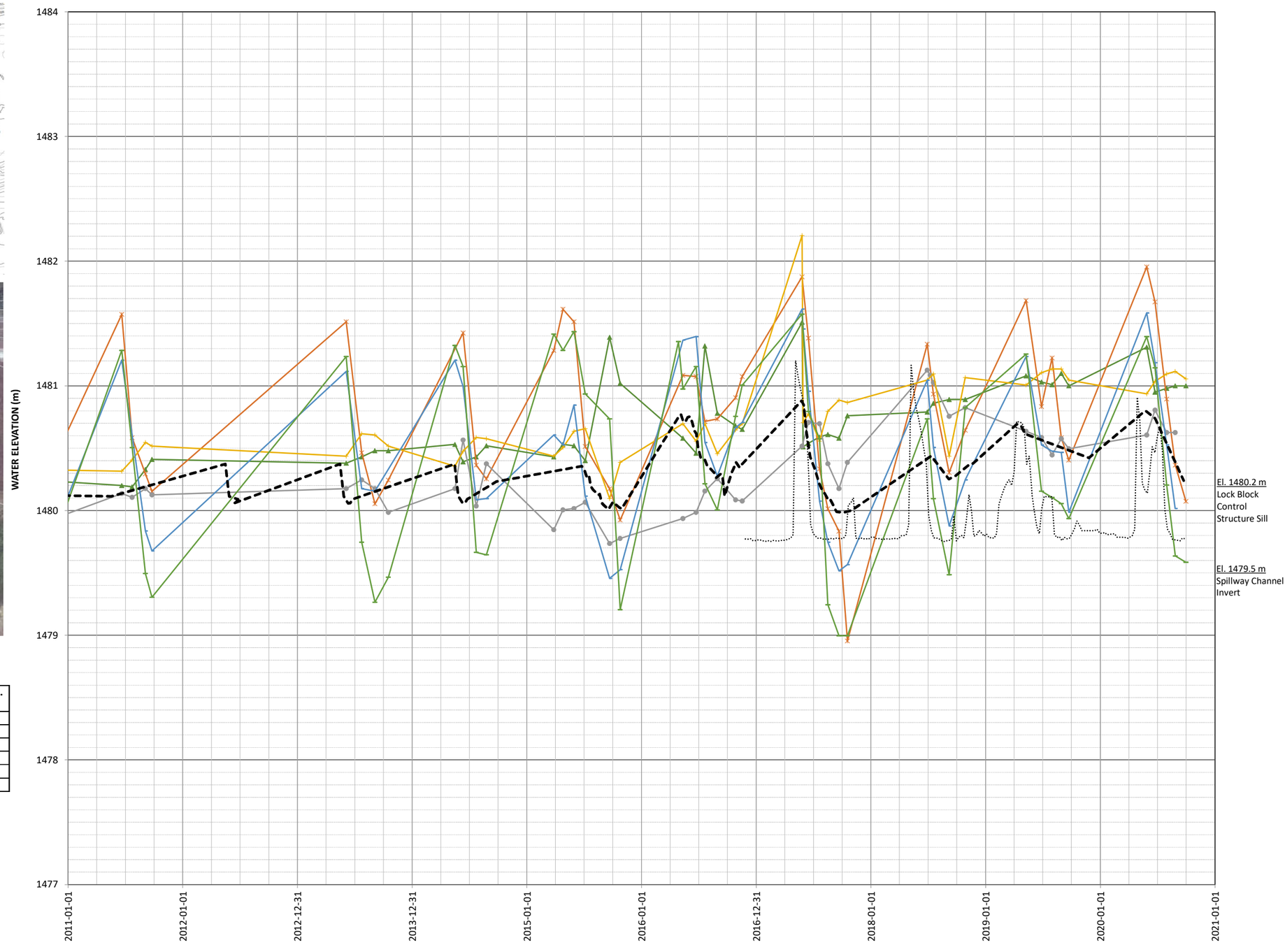




**LEGEND:**

- 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 Pond Level
- Highmont Spillway (Tranducer Data)

| PIEZOMETER ID | 2020 THRESHOLD EL. (m) |
|---|---|
| P-E | 1482.6 |
| P-G | 1482.4 |
| P-K | 1482.2 |
| PW-H | 1481.1 |
| P-I | 1482.7 |
| PW-J | 1481.9 |




Notes:
1- PW-H and PW-J were reported dry on Sep 30, 2020.



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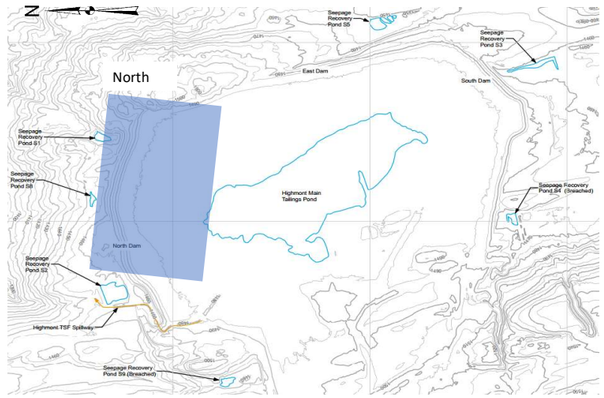
PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

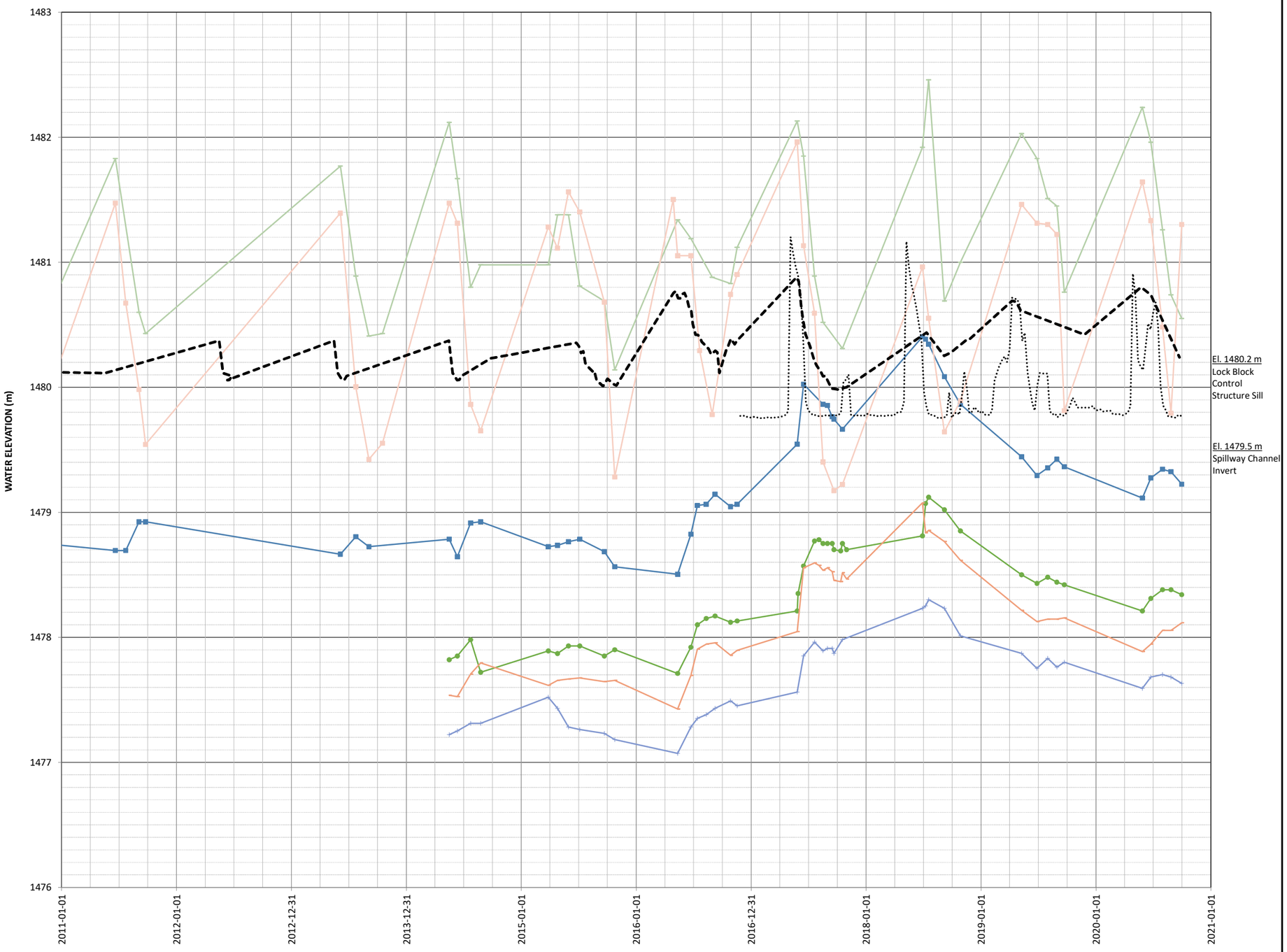
TITLE: HIGHMONT TSF PIEZOMETRIC DATA
2011-2020
EAST

PROJECT No. M02341B83
FIG No. II-B-3

January 5, 2021
Z:\MVCR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\320 Piezometer Data\Highmont\[201130 Highmont Piezo.xlsx]SPILLWAY








**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 Pond Level
- Highmont Spillway (Tranducer Data)

| PIEZOMETER ID | 2020 THRESHOLD EL. (m) |
|---|---|
| PW-A | 1480.5 |
| PW-C (TALL) | 1482.6 |
| 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 |



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2020 ANNUAL FACILITY PERFORMANCE REPORT

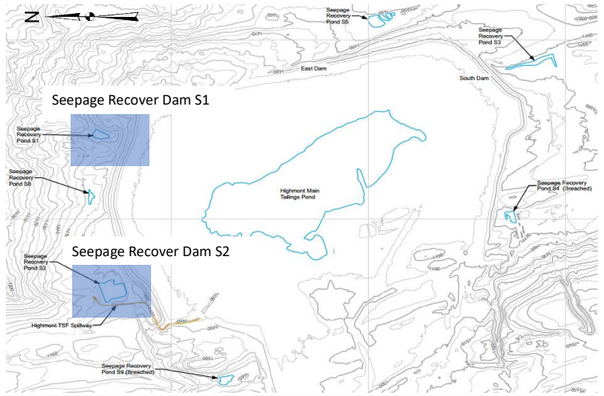
TITLE: HIGHMONT TSF PIEZOMETRIC DATA
2011-2020

NORTH

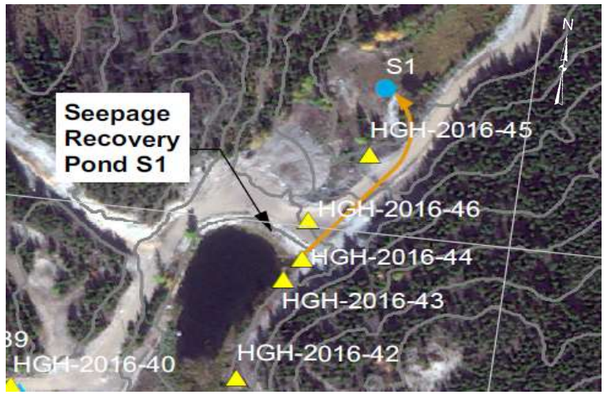
PROJECT No. M02341B83

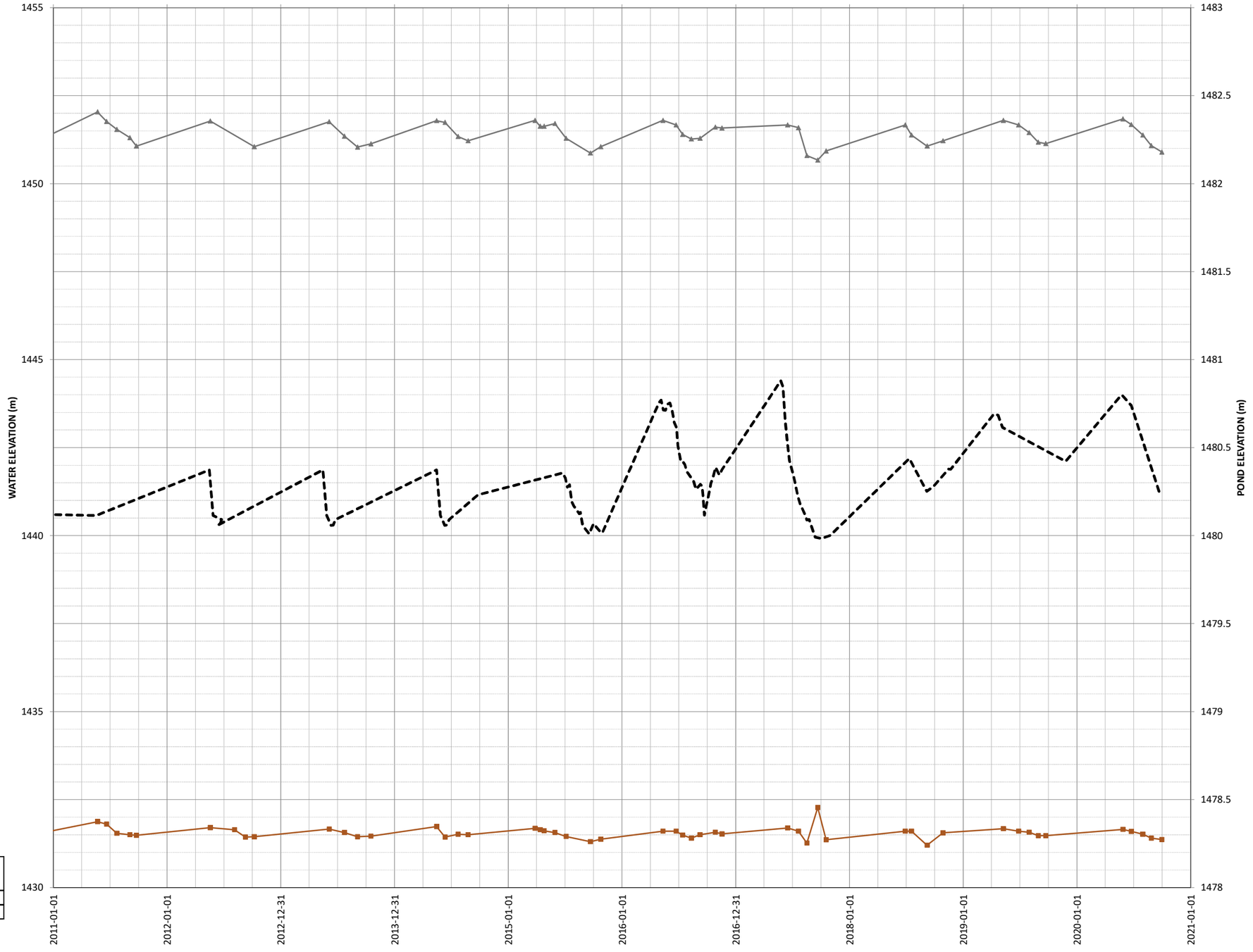
FIG No. II-B-4

January 5, 2021
Z:\MV\CR\M02341B83 - HVC 2020 Dam Safety Support\300 Design\320 Piezometer Data\Highmont\[201130 Highmont Piezo.xlsx]SPILLWAY








**LEGEND:**

- Highmont Pond Level
- S1 (Tip El. unknown m, )
- S2 (Tip El. unknown m, )

| PIEZOMETER ID | 2020 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.



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PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

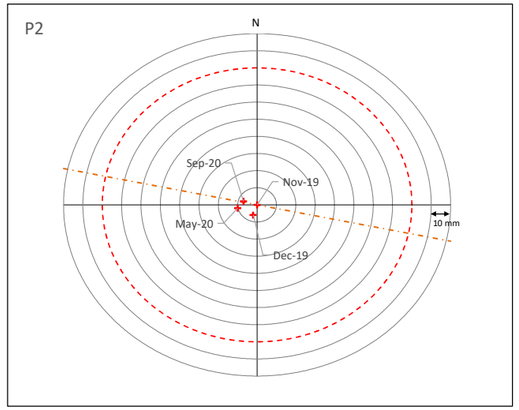
TITLE: HIGHMONT TSF PIEZOMETRIC DATA
2011-2020

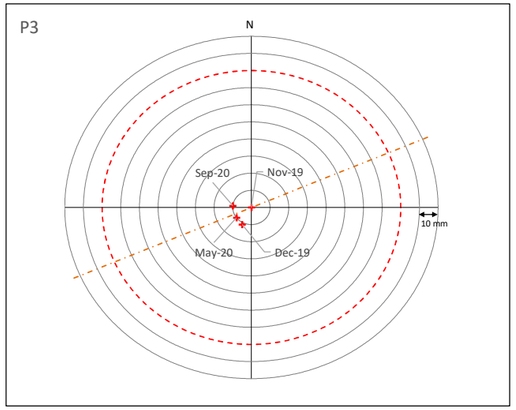
SEEPAGE PONDS

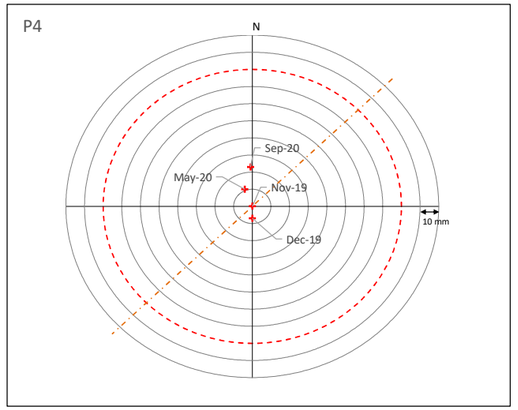
PROJECT No. M02341B83

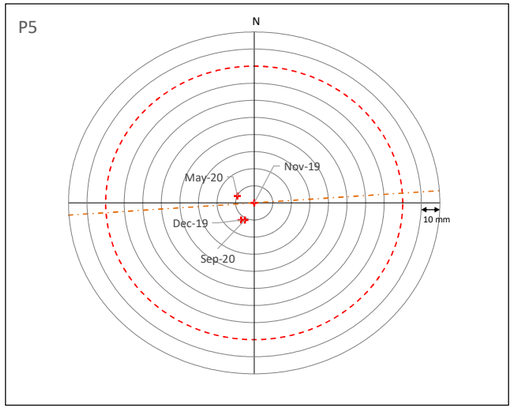
FIG No. II-B-5

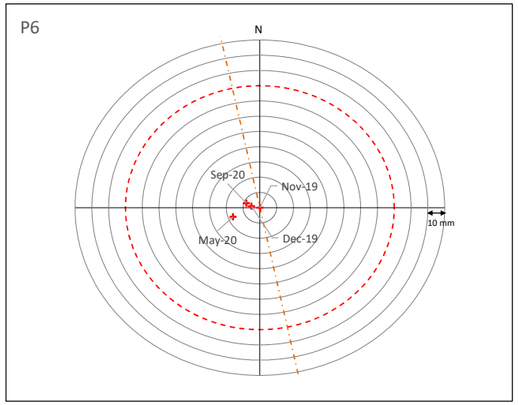
January 5, 2021
Z:\MV\CRM\M02341B83 - HVC 2020 Dam Safety Support\300 Design\320 Piezometer Data\Highmont\[201130 Highmont Piezo.xlsx]SPILLWAY

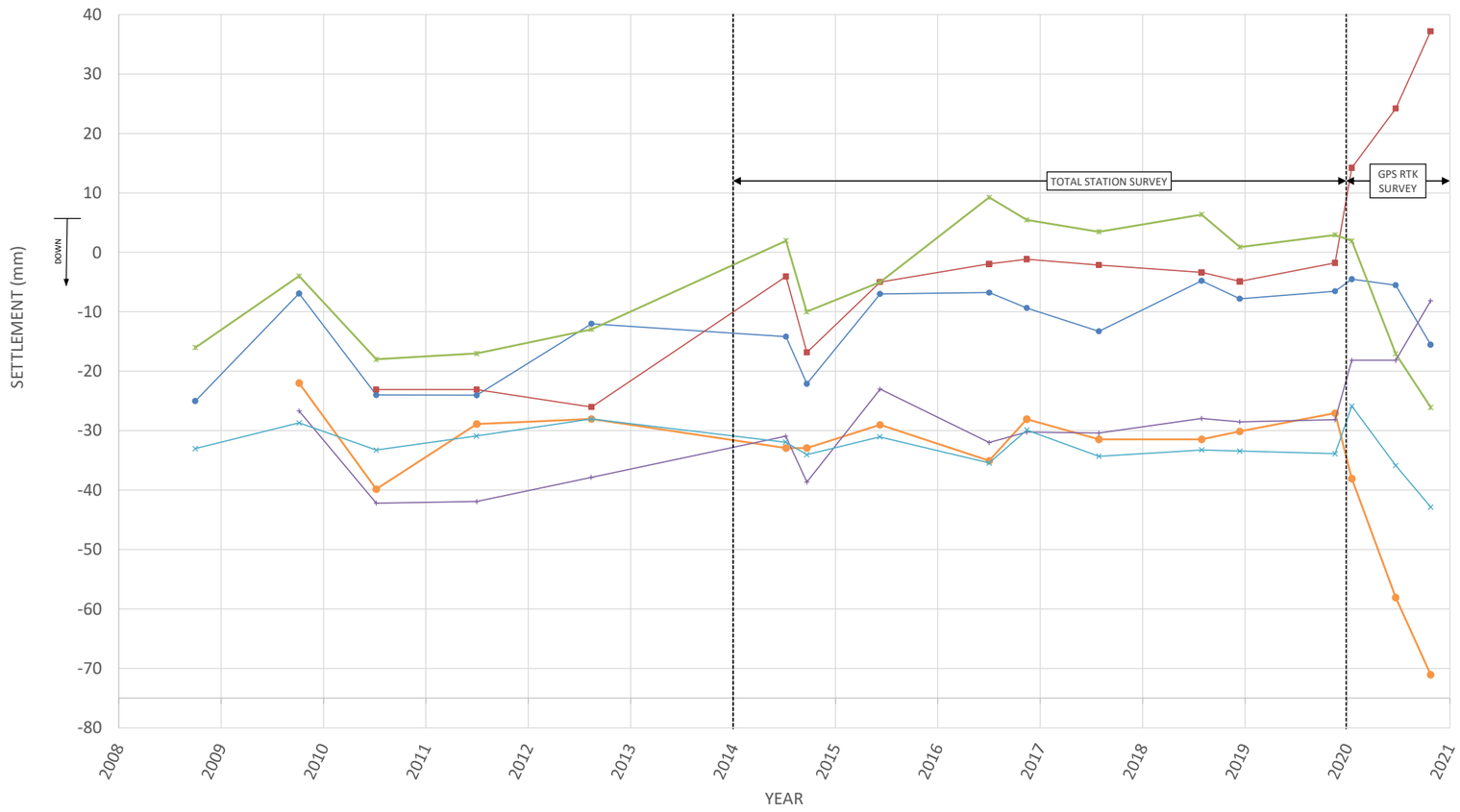



DAM CENTERLINE ORIENTATION

THRESHOLD HORIZONTAL DISPLACEMENT FROM ORIGINAL POSITION

| 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 | | | 150 |
| P6 | | | 75 |
| P7 | N/A | | 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. 2020 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

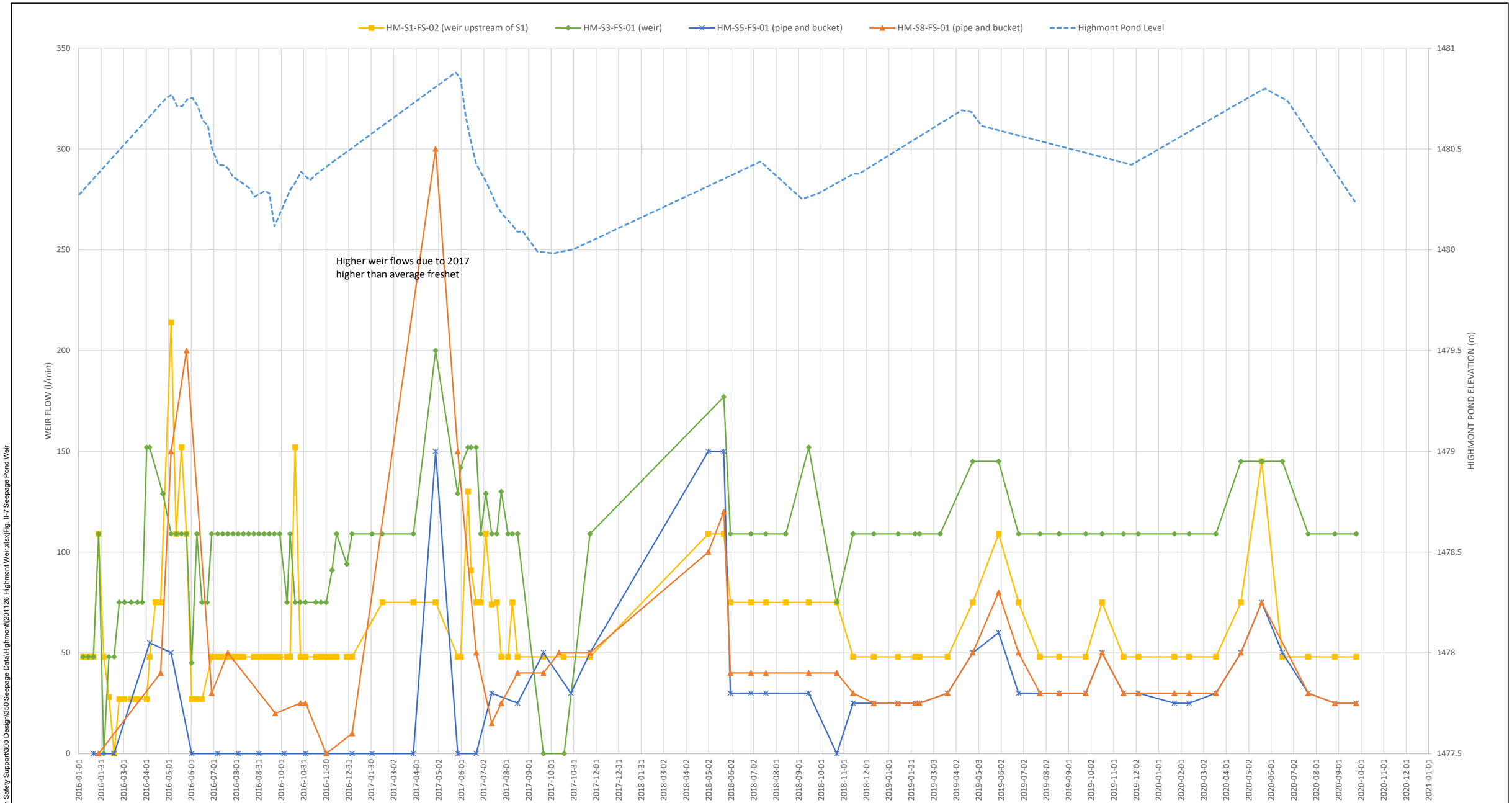
PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: HIGHMONT DAM
SURVEY MONUMENT READINGS

PROJECT No. M02341B83

FIG No. II-B-6

November 28, 2020
Z:\MV\CRM\02341B83 - HVC 2020 Dam Safety Support\300 Design\340 Dam Movement Monitoring\347 Survey Monuments\Highmont\[201127 HighmontDamMonitoring.xlsm]Summary



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PROJECT: HIGHMONT TAILINGS STORAGE FACILITY
2020 ANNUAL FACILITY PERFORMANCE REPORT

TITLE: SEEPAGE PONDS
WEIR FLOWS

PROJECT No. M02341B83

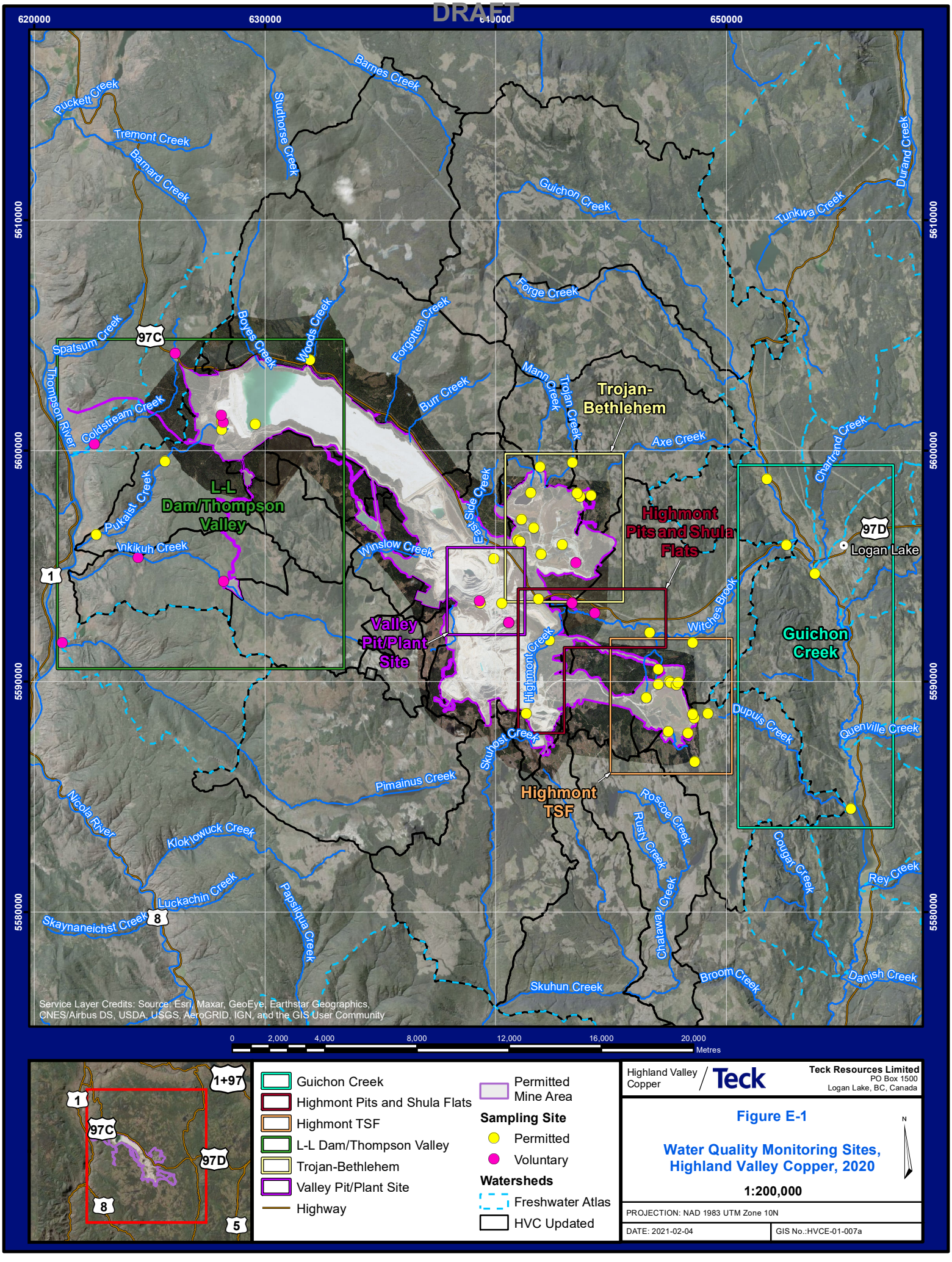
FIG No. II-B-7

November 30, 2020
Z:\MVCRM\02341B83 - HVC 2020 Dam Safety Support\300 Design\350 Seepage Data\Highmont\[201126 Highmont Weir.xlsx]Fig. II-7 Seepage Pond Weir

# APPENDIX III

## Map of Water Quality Monitoring Points

DRAFT







- Guichon Creek
- Highmont Pits and Shula Flats
- Highmont TSF
- L-L Dam/Thompson Valley
- Trojan-Bethlehem
- Valley Pit/Plant Site
- 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

## Figure E-1

## Water Quality Monitoring Sites, Highland Valley Copper, 2020

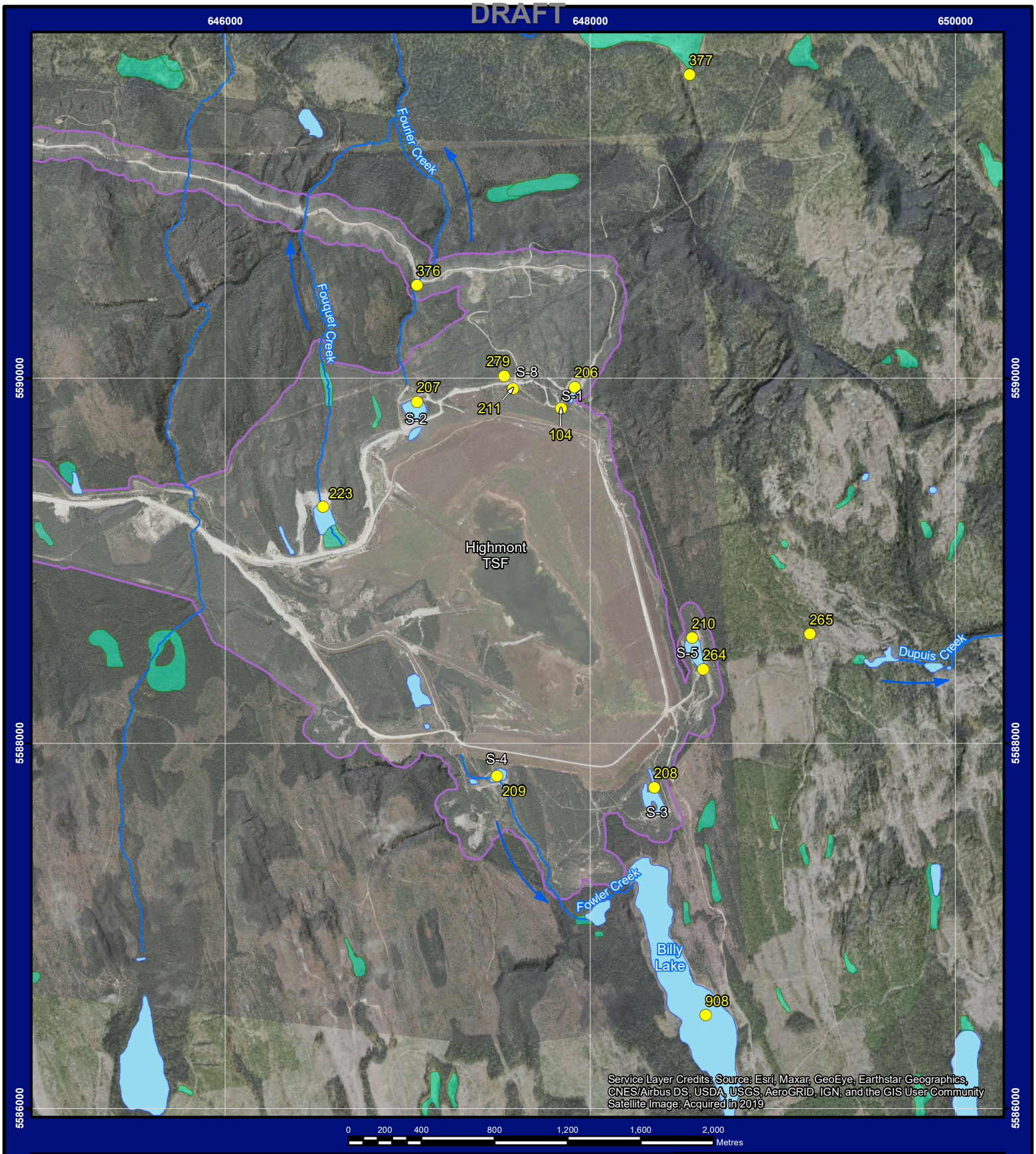
**1:200,000**

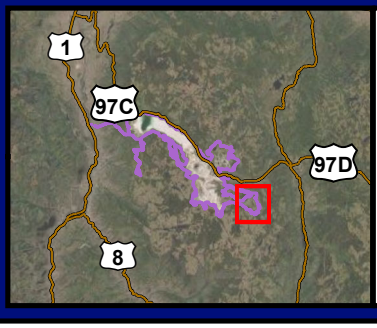
PROJECTION: NAD 1983 UTM Zone 10N

DATE: 2021-02-04

GIS No.:HVCE-01-007a

DRAFT




**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

## Figure 3.2-57
## Water Quality Monitoring Sites in the Highmont TSF Area, Highland Valley Copper, 2020

**1:27,500**

N

PROJECTION: NAD 1983 UTM Zone 10N

DATE: 2021-03-08

GIS No.:HVCE-01-007f

# APPENDIX IV

## DSR Recommendations – THVCP Workplan

# Appendix IV
# DSR Recommendations – THVCP 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** | | | | |
| *GEN-001* | *Inconsistencies between seepage pond crest elevations reported in the OMS Manual, DSI reports and responses to recommendations.*<br>*Correct inconsistencies in the OMS Manual.* | *3* | *CLOSED* | *Clarified in the OMS Manual update started in 2020.* |
| 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.<br>Update stability analyses to include sensitivities to the phreatic surface.<br>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 | OPEN<br>(2021) | Will be completed as part of planned stability analysis, which will include a review of foundation characterization and piezometric sensitivity analyses. Scheduled for 2021. |
| 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.<br>Update stability analyses to include sensitivities to the phreatic surface.<br>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 | OPEN<br>(2021)<br>Refer to DSR Recommendation HD-001. | Will be completed as part of planned stability analysis, which will include a review of foundation characterization and piezometric sensitivity analyses. Scheduled for 2021. |
| HD-003 | The PMF is not in accordance with CDA (2013) requirements.<br>Update the PMF for the Highmont TSF and determine which PMF event (summer/autumn PMF or spring PMF) is most critical. | 3 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |
| HD-004 | Normal freeboard requirements were not evaluated.<br>Establish a maximum normal operating water level and evaluate the required and available normal freeboard. | 3 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |
| HD-005 | Highmont TSF erosion protection in the spillway channel is sized for the 200-year peak flow and not IDF.<br>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 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |
| *HD-006* | *Provide additional details in the OMS manual on the operations of the spillway gate.*<br>*Signage should be added to the spillway gate controls indicating which turn direction to open and close the gate and identify which seepage pond water is being diverted to in each position.* | *3* | *CLOSED* | *Clarified in the OMS Manual update started in 2020.* |
| *HD-007* | *The current (2016) OMS Manual does not include the maximum normal operating water level.*<br>*Include maximum water levels in the OMS manual.* | *4* | *CLOSED* | *Clarified in the OMS Manual update started in 2020.* |
| HD-008 | The culvert crossing in the Highmont TSF spillway channel poses a risk of overtopping into seepage pond S2.<br>Evaluate options to modify the Highmont spillway channel to ensure flows do not overtop into S2. | 3 | OPEN<br>(2021)<br>Refer to DSI Recommendation HD-2017-01. | Scheduled after Flood routing update, in 2021. |
| **S1 Pond** | | | | |
| *S1-001* | *The current (2016) OMS Manual does not include the maximum normal operating water level for seepage pond S1.*<br>*Include maximum water levels in OMS manual.* | *4* | *CLOSED* | *Clarified in the OMS Manual update started in 2020.* |
| S1-002 | Inflow design flood is not based on most recent hydrology analysis<br>Update the inflow design flood and flood routing analysis using the latest hydrology. | 4 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |
| S1-003 | Normal freeboard requirements were not evaluated.<br>Evaluate the required and available normal freeboard. | 4 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |

| ID No. | Recommended Action | DSR Assigned Priority[1] | Status (Scheduled completion) | Workplan To Complete |
|---|---|---|---|---|
| | **S2 Pond** | | | |
| *S2-001* | *The operating water level used in the flood analysis for S2 (KCB 2015) is greater than the maximum normal operating pond level published in the OMS manual (2016).*<br>*Confirm that the maximum normal operating water level in the OMS Manual.* | *4* | *CLOSED* | *Clarified in the OMS Manual update started in 2020.* |
| S2-002 | Inflow design flood is not based on most recent hydrology analysis.<br>Update the inflow design flood and flood routing analysis using the latest hydrology. | 4 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |
| S2-003 | Normal freeboard requirements were not evaluated.<br>Evaluate the required and available normal freeboard. | 4 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |
| *S2-004* | *Risk of overtopping if the till plug in Highmont TSF spillway channel is not removed.*<br>*Include a protocol in the OMS manual on the till plug located in the Highmont spillway.* | *4* | *CLOSED* | *Clarified in the OMS Manual update started in 2020.* |
| | **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.<br>Undertake site investigations and test work to characterize the S3 foundation materials.<br>Re-run stability analyses using revised material properties.<br>Based on the results of the stability analysis, evaluate whether any foundation improvement is needed. | 2 | OPEN<br>(2021) | Stability review completed in 2021 by KCB. THVCP to determine path forward in 2021 to address foundation in-situ density uncertainty, which may include site investigations. |
| S3-002 | Inflow design flood is not based on most recent hydrology analysis.<br>Update the inflow design flood and flood routing analysis using the latest hydrology. | 4 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |
| S3-003 | Normal freeboard requirements were not evaluated.<br>Evaluate the required and available normal freeboard. | 4 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |
| S3-004 | Significant vegetation (including trees) observed on crest and downstream slope.<br>Continue to remove trees, however grassy vegetation on slopes can be left in place, provided steady-state conditions continue. | 3 | OPEN<br>(2021) | Will be completed as part of planned maintenance prior to 2021 Freshet. |
| | **S5 Pond** | | | |
| S5-001 | Under current operation, seepage pond S5 is not able to contain the EDF.<br>Identify pond upgrades necessary to meet EDF compliance. | 4 | OPEN<br>(2021)<br>Refer to AFPR Recommendation S5-2018-01 and S5-2018-02. | Flood routing assessment scheduled for 2021. |
| S5-002 | Inflow design flood is not based on most recent hydrology analysis<br>Update the inflow design flood and flood routing analysis using the latest hydrology. | 4 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |
| S5-003 | Under current operations, the minimum freeboard requirement is not being met.<br>Identify pond upgrades necessary for freeboard compliance. | 4 | OPEN<br>(2021)<br>Refer to AFPR Recommendation S5-2018-01 and S5-2018-02. | Flood routing assessment scheduled for 2021. |
| S5-004 | Normal freeboard requirements were not evaluated.<br>Evaluate the required and available normal freeboard. | 4 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |
| *S5-005* | *Road and crest material have a high fines content and plasticity, making it slippery and a possible safety hazard for vehicles.*<br>*Address safety hazard by, for example, adding coarse road surfacing material to improve trafficability.* | *2* | *CLOSED* | *THVCP incorporated maintenance works in routine maintenance plan.* |

| ID No. | Recommended Action | DSR Assigned Priority[1] | Status (Scheduled completion) | Workplan To Complete |
|---|---|---|---|---|
| **S8 Pond** | | | | |
| *S8-001* | *Unknown spillway invert elevation and if spillway invert is sufficiently high enough to contain the EDF without discharge to the downstream environment.*<br>*Provide details of the EDF and spillway invert elevation in the OMS and annual DSI reports.* | *4* | *CLOSED* | *Clarified in the OMS Manual update started in 2020.* |
| S8-002 | Inflow design flood is not based on most recent hydrology analysis.<br>Update the inflow design flood and flood routing analysis using the latest hydrology. | 4 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |
| S8-003 | Available minimum freeboard does not meet the minimum freeboard requirement adopted by THVCP.<br>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 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |
| S8-004 | Normal freeboard requirements were not evaluated.<br>Evaluate the required and available normal freeboard. | 4 | OPEN<br>(2021)<br>Refer to AFPR Recommendation HD-2018-02. | Flood routing assessment scheduled for 2021. |

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.