

Teck Highland Valley Copper Partnership

2021 Annual Facility Performance Report

7-Day Pond Tailings Storage Facility



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March 28, 2022

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

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

Dear Mr. Bale:

2021 Annual Facility Performance Report 7-Day Pond Tailings Storage Facility

We are pleased to submit the 2021 Annual Facility Performance Report for the 7-Day Pond Tailings Storage Facility, for the period from October 2020 through September 2021.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

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

PU:cd



Teck Highland Valley Copper Partnership

2021 Annual Facility Performance Report

7-Day Pond Tailings Storage Facility



EXECUTIVE SUMMARY

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (HVC) to complete the 2021 Annual Facility Performance Report¹ (AFPR) of the 7-Day Pond Tailings Storage Facility (TSF) for the period of October 2020 to September 2021. We have also reported on some key events that occurred during the reporting period of this document.

The 7-Day Pond TSF is located 180 m north of the Highland Mill and Bulk Flotation Building (Mill), and is used as storage for tailings and water from the Mill during upset conditions.

The 7-Day Pond TSF Structures

The 7-Day Pond TSF is contained by the East Berm and pit waste dumps, which also act as access routes around the perimeter of the facility. The AFPR review covers the East Berm.

Immediately downstream of the East Berm there are two vegetated areas of approximately 17,000 m² combined (referred to herein as "the treed areas"), which are fully contained by access road fills. The 7-Day Pond TSF and treed areas are the low points of the surrounding catchment. Therefore, the 7-Day Pond TSF does not have a failure mode that could endanger the fixed population downstream of the dam.

During the review period, key staff² were as follows:

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

Operation and Construction

During the review period, the 7-Day Pond TSF was operated to comply with the design basis and specified operational conditions of the approved design (KCB 2019b), including operating with adequate capacity to store the inflow design flood (IDF) (92,100 m³). The following poins summarize the operation and construction activities by HVC during the review period.

- Approximately 3,700 m³ of tailings were discharged into the impoundment.
- There was no need to excavate tailings from the impoundment to increase storage capacity.
- The East Berm crest was raised to El. 1261.5 m (up to 1.5 m raise) between October and November 2020.
- Since installation of the fixed dewatering system in 2020, the facility has been operated without any significant ponding, which benefits dam safety and operations by reducing the zone of saturated tailings, increasing flood storage, and increasing freeboard.

¹ Past Annual Facility Performance Reports were referred to as Dam Safety Inspections (DSI).

² Following the definitions in the Global Industry Standard on Tailings Management (GISTM 2020).

August 2021 Forest Fires

The site was under a temporary evacuation order from August 12 to 17, 2021 due to forest fires in the region. Prior to the evacuation, HVC and KCB prepared a modified monitoring program that prioritized surveillance activities. The forest fires did not reach the site, and there was no impact to the 7-Day Pond TSF. While the site was under evacuation order, HVC was able to maintain a small site presence to manage essential site operations (e.g., water management). Appropriate monitoring was maintained throughout this period.

November Regional Flooding

In November 2021, a combination of rainfall and early season snowmelt led to significant regional flooding and damage to public and private infrastructure, which impacted communities closest to the HVC site. The magnitude of the event was less at the HVC mine site and had no effect on the 7-Day Pond TSF. Regardless, HVC responded as they would have during any above-average flood on site, which included increased frequency of inspections, pond level monitoring, and reporting.

The 7-Day Pond TSF is designed to manage the IDF (1/3 between 1,000-year and probable maximum flood), which is significantly greater than the regional flooding that occurred in November 2021.

Surveillance Program

The current Operation, Maintenance and Surveillance (OMS) Manual and the Emergency Preparedness and Response Plan (EPRP³) (HVC 2021) are suitable for the facility. The next routine review and update of the document is planned for 2022. A trial exercise of the HVC-site EPRP (using a hypothetical scenario at different TSF on-site) was completed on January 18, 2022; both HVC and KCB representatives participated.

The 7-Day Pond TSF surveillance program is appropriate for this facility and includes:

- visual inspection;
- routine performance reviews; and
- a Trigger-Action-Response-Plan (TARP).

During the review period, all surveillance activities were completed as prescribed in the OMS Manual (HVC 2021) or as agreed with KCB.

7-Day Pond TSF Performance

The performance of the facility during the review period was acceptable. Key observation types from the performance review completed as part of the AFPR are:

• No observations that would indicate unacceptable dam behaviour were recorded during visual inspections by the HVC dam inspector, the EoR, or others working in the area.



³ EPRP = Dam Emergency Plan (DEP).

- HVC operated the 7-Day Pond TSF with a minimal pond by using the fixed pumping system installed in 2020.
- The minimum freeboard measured at the 7-Day Pond TSF during the review period was 3.5 m, which is greater than the target minimum freeboard adopted by HVC for the facility (0.5 m).

Design Basis

Consequence classification is not part of HVC's tailings management governance, and they have instructed KCB not to include it when reporting on the 7-Day Pond TSF. Potential consequences from credible failure modes are managed through a rigorous risk management process. 7-Day Pond TSF cannot cause a failure that could pose a life-safety risk to fixed population downstream of the dam, and is therefore managed to an appropriate level for Teck's requirements, and current regulations. This approach:

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

The 7-Day Pond TSF is designed to manage a 2,475-year return period earthquake and store a 72-hour duration IDF with a return period of 1/3 between the 1,000-year and probable maximum flood.

Recommendations

There were no outstanding recommendations related to facility performance at the start of the review period and none were identified during the 2021 AFPR.



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CLARIFICATIONS REGARDING THIS REPORT

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the exclusive use of Teck Highland Valley Copper Partnership (Client) for the specific application to the 2021 Dam Safety Support Project, and it may not be relied upon by any other party without KCB's written consent.

KCB has prepared this report in a manner consistent with the level of care, skill and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered. KCB makes no warranty, express or implied.

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

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



TABLE OF ABBREVIATIONS

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



1 INTRODUCTION

Klohn Crippen Berger Ltd. (KCB) was engaged by Teck Highland Valley Copper Partnership (HVC) to complete the 2021 Annual Facility Performance Report (AFPR) of the 7-Day Pond Tailings Storage Facility (TSF) on the Highland Valley Copper mine site (HVC Mine Site). The facility stores tailings and water discharged from the Highland Mill (Mill) during upset conditions. Refer to Figure 2 for a layout of the facility. The review period for the 2021 AFPR is between October 2020 and September 2021.

The AFPR scope of work consisted of:

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

The site visit was completed by KCB representatives Mr. Pablo Urrutia, P.Eng., and Mr. Delton Breckenridge, EIT on July 29, 2021. During the site visit, the weather was sunny and smoky due to wildfires near the HVC Mine Site, but the smoke did not impede the site visit.

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

The pond is operated under the general British Columbia Ministry of Energy, Mines and Petroleum Resources (EMPR) geotechnical permit M-11 for the mine (Mine ref. 0300010 HVC). The 7-Day Pond TSF, referred to as the Emergency Tailings Pond, is also permitted under the British Columbia Ministry of Environment (MOE) effluent permit PE-376 to receive upset condition discharges from the Mill.



2 FACILITY DESCRIPTION

The HVC Mine Site is located near Logan Lake, approximately 45 km south of Kamloops, in the British Columbia Interior. The 7-Day Pond TSF is located approximately 1 km southeast of the Valley Pit, adjacent to the Highland Mill, as shown on Figure 1.

The facility is used as storage for tailings and water discharged from the Mill during upset conditions. Mill Operations Department controls the discharge of tailings, as well as contributing sources of water, which include overflow from the thickeners, Sewage Treatment Plant (STP) effluent, and other pumped flows/surface runoff, as needed.

Containment of the pond is provided by the East Berm and pit waste dumps on all sides of the facility. In its current configuration, the minimum flood storage containment level is El. 1261.5 m. Road surfacing fill raises the low point to El. 1261.8 m, but this is not considered in flood storage estimates. Typical geometry and dimensions of the East Berm are summarized in Table 2.1. Based on the October 2021 7-Day Pond TSF surface, provided by HVC, the facility has capacity to store up to 132,000 m³ of water and/or tailings below the freeboard limit (0.5 m).

Immediately downstream of the East Berm there are two vegetated areas, which are fully contained by access road fills, referred to herein as the treed areas. The 7-Day Pond TSF and treed areas are the low points of the surrounding catchment.

Tailings are discharged at the south end of the 7-Day Pond TSF, forming a beach which slopes to the north and a semi-permanent pond within the basin. A fixed pumping system was installed at the low point of the beach (Figure 2) in 2020 and is operated, as required, to maintain a low pond volume. The pumping system is operated by the Mill. Since this system has been installed, HVC have operated the facility with very limited ponding, as discussed in Section 5.3.

Table 2.1Summary of Approximate Dam Geometry

Dam	Construction Method	Nominal Crest Elevation (m)	Max. Dam Height (m)	Crest Length (m)	Min. Crest Width (m)	Upstream Slope	Overall Downstream Slope
East Berm	Unknown (believed single raise)	1261.5 ⁽²⁾	6	200	8	1.5H:1V	1.5H:1V

Notes:

1. All dimensions are based on the Photosat survey dated September 27th, 2020 and on an aerial survey completed on November 2nd, 2020, provided by HVC.

2. Crest elevation reported as top of general fill which is used to measure flood compliance. Road surfacing material raises the low point of the berm crest to ~El. 1261.8 m.

3 ACTIVITIES DURING REVIEW PERIOD

During the review period, the 7-Day Pond TSF was maintained within the design basis and specified operational conditions of the approved design.

Tailings Deposition

Based on a comparison between surveys from October 2020 and October 2021, provided by HVC, approximately 3,700 m³ of tailings (net) were deposited in the impoundment over that period.

East Berm Crest Raise

The 7-Day Pond TSF East Berm (Figure 2) was raised with sand and gravel fill to the existing crest levels (maximum of 1.5 m raise), between October and November 2020, to increase the available flood storage to store the inflow design flood (IDF; refer to Table 4.1) (KCB 2021a). Although this was completed within the review period, this construction was discussed in the 2020 AFPR (KCB 2021b) and not repeated herein.



4 WATER MANAGEMENT

4.1 Overview

A schematic of the tailings and water management system for the 7-Day Pond TSF is shown on Figure 3. Inflow and outflow rates/volumes are not monitored. The primary outflows from the facility are:

- Seepage from the 7-Day Pond TSF reports to the Valley Pit where it becomes part of pit water management. When needed, Mill Operations deploys portable pumps to draw down the water level in the 7-Day Pond TSF; pumped outflows are returned to the Mill.
- Dewatering pump system that reclaims water back to the mill and is operated on an as needed basis to maintain operating pond levels in the impoundment and reduce seepage losses.

4.2 Climate

HVC provided climate data from the L-L Dam Weather Station (El. 1186.0 m), for the 2021 AFPR review period, for KCB to review. KCB adjusted the L-L Dam Weather Station data to the Lornex Area, using the adjustment factors provided in Golder (2021). These adjustment factors were selected as their elevation is consistent with the 7-Day Pond TSF catchment. The adjusted data over the review period were then compared to typical average values, refer to Appendix II. In addition, KCB downloaded Kamloops Pratt Road station (El. 729.0 m) climate data from Environment Canada and was provided the Shula Weather Station (El. 1208 m) data by HVC, to review and compare precipitation trends against the L-L Dam Weather Station data. The Kamloops Pratt Road Weather Station was used for comparison rather than the Kamloops Airport Station (El. 345.3 m) as the elevation at the Pratt Road Station is closer to L-L Dam Weather Station (El. 1186.0 m).

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

- All storm events 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: 21.1 mm on October 23, 2020; 14.5 mm on December 21, 2020; and 16.5 mm on August 16, 2021.
- In Figure 4.1, all months, except for October 2020 and August 2021 reported 9% to 93% decreases relative to average precipitation. October 2020 precipitation increased 67% relative to the historic normals; August 2021 precipitation increased 40%.
- The L-L Dam Weather Station database included some gaps in 2020 measurements. HVC managed to improve the monitoring program and, as Figure 4.1 indicates, there were no data gaps in the 2021. In addition, consistency in trends between the Kamloops Pratt Road Station, the Shula Weather Station data for 2021, and the L-L Weather Station provides confidence in the L-L Weather Station data.

- Snowpack depth measurements, from the Highland Valley Station (El. 1268 m), indicate snow melted during April 2021, and was gone by May 1st. In comparison, the HVC site-wide water balance assumes 30% of snowmelt occurs in March and 70% in April (Golder 2020a).
- Figure 4.2 shows a comparison between snow water equivalent (SWE) and temperature at the HVC site from January to June 2021. The following observations are inferred from these data:
 - The daily temperature recorded between January and June 2021 is within the historical monthly average records (between 2000 and 2019).
 - The snowpack was depleted over a period of three weeks (April 9 to April 29), which is a quicker rate than the forecast snowmelt pattern from the HVC site-wide water balance, which is based on Golder (2020a).
 - The rise in temperature above 0°C in April coincides with the snowmelt period manually recorded at the Highland Valley station.
 - Rain was not a major factor in 2021 snowmelt, as the maximum daily precipitation recorded close to the snowpack depletion period is less than 6 mm/day.
- Based on measured reservoir levels at other water and tailings storage facilities on site, seasonal rise and fall of pond levels is associated with freshet. At these facilities, pond levels dropped in May 2021, coincident with completion of snowmelt, which is consistent with historic trends. Rainfall measured from March through May, when reservoir levels were rising, was approximately 35% of the historical average during that same period. Note that these trends are not necessarily observed at 7-Day Pond TSF, though, as the 7-Day Pond TSF pond levels are governed primarily by operational controls (fixed pumping system).





Figure 4.1 Monthly Precipitation

- Average Lornex Synthetic Record (1967-2019) Unadjusted
- L-L Dam (2020-2021) Adjusted to Lornex Area for months with more than 10% missing data
- □ Kamloops Pratt Road (2020-2021) Unadjusted for months with more than 10% missing data

Note:

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





Notes:

1. SWE is manually measured at the Highland Valley snow pillow station (1C09A) typically once per month.

2. Daily average temperature data at the L-L Dam Station for 2021 was provided by HVC.

3. The average maximum and minimum monthly temperatures at the L-L Dam Station were developed by Golder (2021).

4.3 Water Balance

Figure 3 is a simplified water schematic for the pond. Inflows and outflows are not measured but outflows are sufficient to prevent accumulation of water in the impoundment over an annual basis and maintain sufficient flood capacity to store the IDF (Table 4.1). Refer to Section 5.3 for further discussion of pond levels during the review period.

4.4 Flood Management

Following completion of the East Berm crest raise in November 2020 (Section 3), the 7-Day Pond TSF has adequate capacity to store the IDF (Table 4.1) and meet the minimum flood freeboard required by the Health, Safety and Reclamation Code (HSRC) (EMLCI 2021a).

The 7-Day Pond TSF applicable design criteria and flood characteristics are summarized in Table 4.1.

Table 4.1 Inflow Design Flood for 7-Day Pond TSF

Dam	Outflow/Storage	Inflow De	IDE Douth		
		Required ⁽¹⁾	Design Event	IDF Depth	IDF Volume
East Berm	Stored	1/3 rd between the 1,000-year and PMF	1/3 rd between the 1,000-year and PMF	180.7 mm ⁽²⁾	92,100 m ³

Notes:

1. Per HSRC (EMLCI 2021a) for tailings and water retaining facilities.

2. Based on Golder (2016).

5 REVIEW OF MONITORING RECORDS AND DOCUMENTS

5.1 Monitoring Plan Compliance

An Operation, Maintenance and Surveillance (OMS) Manual was prepared in 2021 in accordance with the most recent industry guidance documents (MAC 2019). The OMS Manual, which documents existing routine activities and surveillance requirements, was reviewed as part of the preparation of this AFPR. The document includes operational procedures for routine tailings excavation, including preparation of a work plan prior to the work which must be approved by the HVC QP.

The 7-Day Pond TSF surveillance program is appropriate for the facility. It 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 EPRP. At 7-Day Pond TSF, there were no exceedances of any of the TARP levels during the review period.

HVC compliance with the surveillance program in the OMS Manual is summarized in Table 5.1. The site was under a temporary evacuation order from August 12th to 17th, 2021 due to forest fires in the region. Prior to the evacuation, HVC and KCB prepared a modified monitoring program that prioritized surveillance activities, while it was safe for people to do so. The forest fires did not reach site and there was no impact to the 7-Day Pond TSF. While the site was under evacuation order, HVC was able to maintain a small site presence to manage essential site operations (e.g., water management). Appropriate monitoring was maintained throughout this period.



Table 5.1Monitoring Activities

TSF Monitoring	Facility	Minimum Frequency	Responsibility	Documentation	2021 Frequency Compliance	Notes for the Review Period
			Inspectio	ns		
Routine Visual Inspection ⁽¹⁾		Quarterly	HVC	HVC Inspection Reports	Yes	-
Event-Driven Inspection	7-Day Pond	Event Driven ⁽²⁾	HVC	HVC Inspection Reports	N/A	No event-driven inspections were triggered during 2021.
Annual Facility Performance Report	15F	Annually	КСВ	Inspection Report by KCB	Yes	This report
Dam Safety Review		Every 5 years	HVC	Report	n/a	Next DSR is due in 2023.
			Instrumentation N	Monitoring		
Pond level	7-Day Pond TSF	Monthly	HVC	HVC Inspection Reports	Yes	See Section 5.3.
Surveys						
Survey	7-Day Pond TSF	Annually	HVC	Data reviewed by KCB as part of AFPR	Yes	-

Notes:

1. Visual inspections include pond level measurements and observations for any evidence of unusual conditions and/or dam safety concerns (e.g., settlement, sinkholes, slope sloughing, erosion, seepage, piping, etc.).

2. HVC staff are to complete an event-driven inspection in response to one of the following events:

- Earthquake greater than magnitude 5 within 100 km of the site, or any earthquake felt at site.

- Rainfall event greater than the 10-year, 24-hour duration storm; 39.9 mm (Golder 2020b).



5.2 Routine Visual Inspection

The purpose of routine visual inspections is to identify conditions that might indicate changes to the East Berm performance. Based on the available records, no unusual conditions were identified that triggered an action in the Trigger-Action-Response-Plan (TARP).

5.3 Pond Level and Freeboard

During the review period, HVC has managed to operate 7-Day Pond TSF with a minimal pond by use of the fixed pumping system installed in 2020. Key observations, based on historical pond levels and during the review period (Figure 5.1), are as follows:

- There has been no significant pond at the 7-Day Pond TSF during the reporting period.
- The pond level is only surveyed when access to the pond is safe (pond level at or above about El. 1258.0 m). Visual inspections of the pond to estimate its level and assess safe accessibility to survey were conducted on a monthly basis. These visual inspections confirmed that minimal ponded water has been present at the facility during the review period.
- April 2021 and October 2021 pond surveys measured pond levels at about the same elevation (El. 1257.96 and 1258.03 m). In between these reading, the pond level was too small for safe survey access (i.e., pond level was below ~El. 1258.0 m).

Typical ranges for normal operating conditions, set by HVC, for freshet ("Normal flood conditions") and non-freshet ("Normal – non-freshet"), as well as threshold for elevated pond level which, if exceeded, initiate escalating levels of action, are summarized in Table 5.2 and shown on Figure 5.1.

Table 5.2	7-Day Pond TSF 1	Typical Reference	Operating Range	es and Thresholds
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Typical Operating Ranges and Thresholds	Definition	Elevation
Operating Range: Normal – non-freshet	Operating normal range outside of summer/rainy season.	Up to 1258.4 m
Operating Range: Normal flood conditions – e.g., freshet	Elevated level that is allowable and seasonally normal.	1258.4 m to 1259.4 m
Threshold: Level 1 – Unusual Condition	Flood level where the dam is operated with less than the capacity required to store IDF (Table 4.1) with the minimum required freeboard (Section 1.1); warrants increased pond level monitoring.	>1259.4 m
Threshold: Level 2 – Emergency Condition	Pond has less than 0.5 m freeboard under current pond level but there is not an imminent overtopping scenario.	>1261.0 m
Threshold: Level 3 – Crisis Condition	Pond level is approaching crest and overtopping is imminent (<0.2 m freeboard).	>1261.3 m



Figure 5.1 7-Day Pond TSF Pond Levels with Alert Level Ranges

Notes: 1. In Figure 5.1, the shift in alert levels due to the crest raise is shown for reference.

HVC has adopted 0.5 m as the target minimum flood freeboard⁴ for 7-Day Pond TSF. This exceeds the minimum freeboard required to accommodate wind and wave run-up based on the method proposed by CDA (2019), which is recommended by HSRC (EMLCI 2021a). The following is of interest:

- Based on the October 2021 survey:
 - 7-Day Pond TSF has an available storage capacity of about 132,000 m³ below elevation 1261.0 m (i.e., below the minimum target freeboard of 0.5 m). This storage capacity is intended to accommodate the IDF (92,100 m³; see Table 4.1), leaving about 40,000 m³ for a combination of tailings and the facility's pond (if any):
 - Assuming an annual net tailings deposition of about 4,000 m³ and no substantial pond (similar to the 2021 AFPR review period, Section 3), no crest raise or tailings excavation will be required for the remainder of the HVC permitted life-of-mine.
 - 7-Day Pond TSF can store the IDF (92,100 m³; see Table 4.1); while maintaining minimum target freeboard for pond levels at or below El. 1259.4 m.
- Based on measured pond levels, the minimum flood freeboard available during the review period was >3.5 m. Pond levels during the review period are discussed further in Section 5.3.

5.4 Geotechnical Instrumentation

There are no geotechnical instruments at the 7-Day Pond TSF. None are recommended at this time.

⁴ Vertical distance between the peak IDF (Table 4.1) flood level and low point of the perimeter crest.

5.5 Seepage

Seepage from the 7-Day Pond TSF is collected in the Wishing Well Sump located in the Valley Pit. This sump also collects water from other sources, and water is pumped from the sump to the thickeners. No Seepage was observed from the East Berm downstream slope during the 2021 Annual Facility Performance Report site visit.

5.6 Water Quality

Permit PE-376 water sampling requirements do not include sampling sites downstream of the 7-Day Pond TSF. Limited sampling points exist downstream of the 7-Day Pond TSF. In addition, seepage from this facility is ultimately captured in the Valley Pit dewatering system, as presented in the hydrogeological conceptualization included in the 2021 Highland Valley Copper Groundwater Quality Report (Golder, 2022). 7-Day Pond TSF seepage in 2021 was captured and reclaimed for use as mill process water.



6 SITE VISIT OBSERVATIONS AND PHOTOGRAPHS

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

- The East Berm was in good physical conditions.
- No pond was observed in the TSF at the time of the site visit.

7 ASSESSMENT OF DAM SAFETY

7.1 Review of Potential Downstream Consequences

Consequence classification is not part of HVC's tailings management governance, and they have instructed KCB not to include it when reporting on the 7-Day Pond TSF. Potential consequences from credible failure modes are managed through a rigorous risk management process. HVC provided the following regarding the change:

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

The 7-Day Pond TSF IDF (1/3rd between 1,000-year and PMF over 72-hour) and design earthquake (2,475-year return period) were specified by KCB to meet equivalent requirements under HSRC (EMLCI 2021a). This is also consistent with Teck's internal guidance for facilities which, under their current configurations, have no failure modes that could pose a life-safety risk to fixed population downstream of the dam.

HVC and KCB reviewed the conditions and land use downstream of the 7-Day Pond TSF on April 15, 2021 and did not identify any significant changes.

7.2 Status of 2018 Dam Safety Review Recommendations

A DSR site visit of the 7-Day Pond TSF was completed by SRK Consulting (SRK) in 2018 and the final report was issued in March 2019 (SRK 2019). The report concluded the facility is well-managed with a high level of technical stewardship and appropriate operating procedures. The failure modes are understood and effectively controlled. All recommendation from the 2018 DSR (SRK 2019) have been addressed.

HSRC requires a DSR be undertaken every five years for tailings dams; therefore, HVC have scheduled the next DSR for 2023.

7.3 Failure Mode Review

Management and status of failure modes, and related controls, which have the greatest influence on design and performance are summarized herein.

Overtopping

Following the crest raise of the East Berm in 2020, the 7-Day Pond TSF has adequate capacity to store the IDF (Table 4.1), required under HSRC, with adequate freeboard. Overtopping risks are further managed by the following:

- the pumping system installed in 2020, which is operated to maintain pond levels well below threshold levels to increase available storage and reduce seepage to the pit (e.g., facility operated with excess flood storage during the review period; Section 5.3); and
- the facility's OMS Manual and TARP, which include procedures for routine tailings excavation (i.e., increasing storage capacity) and outline the actions to be taken by HVC to respond to elevated pond levels, including implementation of additional preventative controls, if required.

Slope Stability – Foundation / Dam Fill / Earthquake

Based on site investigations (KCB 2019a), the East Berm is founded on competent Glacial Till material. The fill and foundation materials are not susceptible to significant strength loss or liquefaction based on comparison to similar materials under similar conditions around the site. Slope stability met or exceeded the CDA (2019) guidelines for static (\geq 1.5), pseudo-static (\geq 1.0), and post-earthquake stability (\geq 1.2), and comply with requirements of HSRC (EMLCI 2021a).

7.4 Emergency Preparedness and Response

The emergency preparedness and response plan (EPRP) for the 7-Day Pond TSF forms a part of the OMS Manual (HVC 2021). The EPRP is consistent with other tailings facilities at the site and site emergency procedures, and is appropriate for the current structure.

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

On January 18, 2022, participants from HVC's operation team (including site management), the HVC QP, and the EoR participated of a trial exercise of the HVC-site EPRP (using a hypothetical scenario at different TSF on-site).



8 SUMMARY

Based on the review of measured performance and observations summarized herein, KCB conclude the 7-Day Pond TSF performed as expected, and within design requirements, during the review period from October 2020 through September 2021. The changes made to the facility during the review period (i.e., crest raise) have improved or added additional dam safety controls which reduce the key potential risks associated with the structure.

All the recommendations related to facility performance identified during past AFPRs and the DSR (SRK 2019) have been closed. No recommendations, related to facility performance, were identified during the 2021 AFPR.



9 CLOSING

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

KLOHN CRIPPEN BERGER LTD.

B.C Permit to Practice No. 1000171



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

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Figure 1	Mine Site Plan
Figure 2	7-Day Pond – Plan
Figure 3	Flow Schematic





oen Berger				
-	SCALE AS SHOWN	PROJECT No. M02341C12	FIG No.	1



pen Berger				
-	SCALE AS SHOWN	PROJECT No. M02341C12	FIG No.	2



NOT FOR CONSTRUCTION



	Description	Status
ne	36" dia. HDPE pipe	Operational
to	36" HDPE Pipeline	Operational
	HDPE pipe, semi-regular flow from thickener overflow (majority) and surface water around the Mill (minor component).	Operational
()	 36" dia. HDPE pipe, irregular flow from: i) overflow from MOP (connects U/S of discharge point); ii) overflow from sump in Mill which collects excess surface water from cleaning activities. 	Operational
/ater	Irregular open channel overflow from 325 ft Thickeners	Operational
	36" HDPE Pipelines	Operational
Pit	Seepage reports to Wishing Well Sump in Valley Pit	N/A
ion	HDPE pipeline and portable pump (deployed when needed)	N/A
in	6" HDPE pipe with control valve, capped	Operational
e	Regular, treated effluent in trench running south to north and discharging at the NE corner of the pond	Operational
sher	1x HDPE pipe, irregular flow	Operational
ash	Surface runoff from truck wash collected by drainage ditch	Operational



APPENDIX I

Annual Facility Performance Report

Site Visit Checklist, Observations and Photographs

Appendix I Annual Facility Performance Report Site Visit Checklist, Observations and Photographs

SITE VISIT CHECKLIST

Facility:	7-Day Pond TSF		Site Visit Date:	July 29, 2021
Weather:	Sunny / Smoky		Inspector(s):	Pablo Urrutia, P.Eng. Delton Breckenridge, EIT
Freeboard (pond level to dam crest):		No significant free water was ponding at the time of the site visit		

Outlet Condition Survey

Description	Outlet Controls?	Was it flowing?	Flow rate	Visual Review?	Testing / Detailed Site Visit?
Portable Pump not installed at the time of the site visit	N/A	N/A	N/A	N/A	N/A

Are the following components of the facility in <u>SATISFACTORY CONDITION</u>?

(check one if applicable)

WASTE DUMP WALLS	Yes/No
U/S Slope	🛛 Yes 🗌 No
Crest	🛛 Yes 🗌 No

Were any of the following POTENTIAL PROBLEM INDICATORS found?

INDICATOR	WASTE DUMP WALLS
Piping	🗌 Yes 🛛 No
Sinkholes	🗌 Yes 🛛 No
Seepage	🗌 Yes 🛛 No
External Erosion	🗌 Yes 🛛 No
Cracks	🗌 Yes 🛛 No
Settlement	🗌 Yes 🛛 No
Sloughing/Slides	🗌 Yes 🛛 No
Animal Activity	🗌 Yes 🛛 No
Excessive Growth	🗌 Yes 🔀 No
Excessive Debris	🗌 Yes 🛛 No

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

No dam safety deficiencies observed.

Comments / Notes:

• Refer to Site Visit Observations section.



SITE VISIT OBSERVATIONS

- Crest: The haul road which forms the crest of the dam around 7-Day Pond TSF was in good physical condition. No indicators of significant concern were observed (e.g., cracking, slumping) (Photo I-1 and Photo I-2).
- Upstream and Downstream Slopes: Upstream slopes were in good physical condition. The upstream slopes were not vegetated, but no indicators of significant concern were observed (e.g. animal activity, cracking, slumping, surface erosion features). The visible parts of the downstream slope of the haul road forming the east containment of the impoundment were in good physical condition (Photo I-3).
- **Tailings Beach and Pond**: Impoundment was being excavated at the time of the site visit and there was no pond. No tailings deposition was in place (Photo I-1).
- **Outflow Pump**: Had not been installed at the time of the site visit.
- Seepage: None observed.



SITE VISIT PHOTOGRAPHS

LEGEND:

- SDP = 7-Day Pond.
- SDP-2021-## refers to 2021 Annual Facility Performance Report waypoint shown on Figure 2.
- All photographs taken during the site visit July 29, 2021.
- Photo I-1 7-Day Pond. Two inflow pipes present, one pipe discharging clear water at the time of the site visit. (SDP-2021-01)





Photo I-2 7-Day Pond crest (SDP-2021-02)





Photo I-3 Treed area downstream (D/S) of 7-Day Pond retaining berm formed by east perimeter access road and water pipelines along downstream side of east perimeter access road crest (SDP-2021-03)





Photo I-4 7 Day Pond east perimeter access road. Structure within TSF impoundment is part of permanent dewatering-pump system (SDP-2021-03)





APPENDIX II

Climate Data



Appendix II Climate Data

HVC provided weather data from the L-L Dam Weather Station (El. 1186.0 m), for the 2021 AFPR review period, for KCB to review. KCB adjusted the L-L Dam Weather Station data using the Lornex Area adjustment factors provided in Golder (2021). KCB selected these adjustment factors as their elevation is consistent with the 7-Day Pond TSF catchment (>El. 1261.5 m, i.e. dam crest). To support key precipitation trends and impacts on observed dam performance, KCB downloaded data from the Kamloops Pratt Road Weather Station (Environment Canada Station No. 116C8P0, El. 729.0 m, 73 km away), and was provided data from the Shula Weather Station (El. 1208 m, station located on HVC property) by HVC, to review and compare precipitation trends against the L-L Dam Weather Station data. The Kamloops Pratt Road Weather Station (El. 729.0 m) was used for comparison rather than the Kamloops Airport Station (El. 345.3 m), as the elevation at the Pratt Road Station is closer to L-L Dam Weather Station (El. 1186.0 m).

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

- All storm events during the review period were less than the 10-year return period rainfall event (40 mm in 24 hours). The largest 24-hour rainfall events measured at the L-L Dam Weather Station during the review period were: 21.1 mm on October 23, 2020; 14.5 mm on December 21, 2020; and 16.5 mm on August 16, 2021.
- In Figure II-1, all months, except for October 2020 and August 2021 reported 9% to 93% decreases relative to average precipitation. October 2020 precipitation increased 67% relative to the historic normals; August 2021 precipitation increased 40%.
- The L-L Dam Weather Station database included some gaps in 2020 measurements. HVC managed to improve the monitoring program and, as Figure II-1 indicates, there were no data gaps in the 2021 measurements. In addition, consistency in trends between the Kamloops Pratt Road Station, the Shula Weather Station data for 2021, and the L-L Weather Station provides confidence in the L-L Weather Station data.
- In Table II-2, snowpack depth measurements from the Highland Valley Station (El. 1268 m) indicate the snow had melted during April 2021, and was gone by May 1st. In comparison, the water balance assumes 30% of snowmelt occurs in March and 70% in April (Golder 2020a).
- Based on measured reservoir levels at other water and tailings storage facilities on site, seasonal rise and fall of pond levels is associated with freshet. At these facilities, pond levels dropped in May 2021, coincident with completion of snowmelt, which is consistent with historic trends. Rainfall measured from March through May, when reservoir levels were rising, was approximately 35% of the historical average during that same period. Note that these trends are not necessarily observed at 7-Day Pond TSF, though, as the 7-Day Pond TSF pond levels are governed primarily by operational controls.



Table II-1 Monthly Precipitation

	Availability of Data (%)	Precipitation (mm)				
Month	L-L Dam Weather Station	L-L Dam Weather Station Data Adjusted to Lornex Area (2020 to 2021) ⁽¹⁾	Average Lornex Synthetic Record Unadjusted ⁽²⁾ (1967 to 2019)	Unadjusted Kamloops Pratt Road Weather Station (2020 to 2021)	Unadjusted Shula Weather Station ⁽⁵⁾ (2020-2021)	
Oct 2020	99	49.6	29.7	69.6	33.9	
Nov 2020	100	25.1	34.7	34.2 (4)	5.2 ⁽⁴⁾	
Dec 2020	100	29.4	37.6	54.0	N/A ⁽⁶⁾	
Jan 2021	100	23.6	33.5	24.4	24.9	
Feb 2021	100	13.4	21.2	18.0	18.7	
Mar 2021	100	9.0	19.2	15.0	12.3	
Apr 2021	100	10.5	20.0	10.0 (4)	11.9	
May 2021	100	7.5	37.2	7.6	10.9	
Jun 2021	100	3.0	41.5	17.0 (4)	4.4	
Jul 2021	100	5.1	32.4	11.6	5.9	
Aug 2021	100	43.0	30.7	45.8	32.6	
Sep 2021	100	26.5	29.1	37.2 (4)	40.7	
Annual Total	-	245.9	366.8	344.4	201.4	

Notes:

1. Available data from L-L Dam climate station was adjusted by a L-L Dam-to-Lornex Area adjustment factor of 0.91 (Golder 2021).

 Estimated by Golder (2021) using appropriate adjustment factors and average precipitation measured at Highland Valley Lornex climate station (Environment Canada ID No. 1123469 at El. 1268 m from 1967 to 2011). Golder (2021) infilled the data gaps prior to November 2011 and created a long-term synthetic precipitation record to the end of 2019. Monthly average of the synthetic record is shown herein, refer to Golder (2021) for detailed information.

3. Review period for the 7-Day Pond TSF Annual Facility Performance Reports is from October 2020 through September 2021.

4. Monthly precipitation with more than 10% missing data.

5. 2021 monthly precipitation data provided to KCB as summarized data for the given month; therefore, the completeness of the data was not independently verified.

6. HVC noted that the data set was not complete enough to report, and as a result it was not counted.



Figure II-1 Monthly Precipitation

- Kamloops Pratt Road (2020-2021) Unadjusted
- Shula (2020-2021) Unadjusted
- Average Lornex Synthetic Record (1967-2019) Unadjusted
- L-L Dam (2020-2021) Adjusted to Lornex Area for months with more than 10% missing data
- Kamloops Pratt Road (2020-2021) Unadjusted for months with more than 10% missing data

Note:

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

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

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

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

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

Table II-2Historical Average and 2021 Snowpack Depths

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

Notes:

1. At the Highland Valley snow survey station (Station No. 1C09A) near the Bethlehem TSF. Data prior to 1966 were not included as the station was moved to its current location in 1965.

2. Calculated based on available period on record.

3. SWE = snow water equivalent.





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

Notes:

1. SWE is manually measured at the Highland Valley snow pillow station (1C09A), typically once per month.

2. Daily average temperature data at the L-L Dam Station for 2021 was provided by HVC.

3. The average maximum and minimum monthly temperatures at the L-L Dam Station were developed by Golder (2021).

