Klohn Crippen Berger

Teck Metals Ltd.

Pine Point Mine Tailings Impoundment Area

2021 Annual Facility Performance Review

CANADA BEST MANAGED COMPANIES Platinum member

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November 2021

Klohn Crippen Berger

November 2, 2021

Teck Metals Ltd.
Kimberley Operations
601 Knighton Road
Kimberley, British Columbia
V1A 1C7

Ms. Michelle Unger
Pine Point Site Manager

Dear Ms. Unger:

Pine Point Mine Tailings Impoundment Area
2021 Annual Facility Performance Review

We are pleased to submit the 2021 Annual Facility Performance Review for the Pine Point Mine Tailings Impoundment Area.

Please contact us if you have any questions regarding this report.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Daniel Klassen

Daniel Klassen, P.Eng.
Project Manager

DK/CM/MT: jc

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CANADA BEST MANAGED COMPANIES Platinum member

Teck Metals Ltd.

Pine Point Mine Tailings Impoundment Area

2021 Annual Facility Performance Review

EXECUTIVE SUMMARY

This report presents the 2021 Annual Facility Performance Review (AFPR) for Teck Metals Ltd.'s (Teck) Pine Point Mine Tailings Impoundment Area (TIA) by Klohn Crippen Berger Ltd. (KCB). This report was prepared to fulfill the requirements of a Geotechnical Inspection Report as stated in the Water License MV2017L2-0007 (Part F, Cl.7) (valid to October 24, 2027). The annual inspection of the TIA facilities was conducted on July 21, 2021 by the incoming Engineer of Record (EoR), Mr. Daniel Klassen, P.Eng., and Mr. Bob Chambers, P.Eng., of KCB. Routine and any event driven inspections were carried out by the Tailings Surveillance Officer, Mr. Clell Crook, C.E.T., of Maskwa Engineering Ltd. Mr. Crook conducted 11 event-driven inspections on a weekly basis from May 9 to June 23, 2021. The driver for inspections was the Main Pond water level exceeding the normal operating water level (NOWL) during the freshet for the year – a foreseeable situation in any given year. Another inspection was carried out on August 27, 2021 while the Tailings Surveillance Officer was on site to troubleshoot instrumentation issues. The transition of the EoR role from Ben Wickland of Golder Associates to Daniel Klassen of KCB was completed on September 28, 2021. This report summarizes the 2021 annual inspection observations and the performance of the TIA during the September 2020 to August 2021 reporting period.

This executive summary is provided in accordance with Teck's "Guideline for Tailings and Water Retaining Structures" (Teck 2019) and in anticipation for meeting the requirements of the Global Industry Standard on Tailings Management (GISTM) by the 2023 reporting year per requirement.

Summary of Facility Description

Pine Point Mine operated from 1964 to 1988, and has been closed since 1988. The facility has been in active care and maintenance during the monitoring period. The TIA includes the following:

- North, East, West, and South Dykes, impounding approximately 50 to 60 million tonnes of lead-zinc tailings, covering an area of approximately 700 ha. The tailings surface is currently covered with approximately 0.15 m of gravel material.
- Currently, the Main Pond is maintained within the TIA on a permanent basis, and is contained between the North Dyke and the covered tailings surface to the south.
- The Polishing Pond is a serpentine pond that is used to treat and release water from the Main Pond. The Polishing Pond was constructed within the TIA North Dyke.
- The Main Pond Spillway and the Polishing Pond Spillway are both reinforced concrete channels that allow water to discharge from the TIA at El. 202.5 m, which is 1 m below the minimum crest elevation of 203.5 m.

Summary of Key Hazards

KCB understands that Teck's long-term goal for all tailings facilities, where physically possible, 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.

Key observations related to the potential hazards associated with the TIA which could be potentially credible mechanisms for failure are summarized as follows:

Overtopping: There is a permanent Main Pond in the TIA which drains into the Polishing Pond via a culvert. The water level in the Main Pond is actively managed by annual seasonal water treatment campaigns at the Polishing Pond, where treated water is discharged over the Polishing Pond Spillway via five siphon lines. The pond level following the 2020 water treatment campaign was El. 200.8 m, which was approximately 0.5 m higher than historical levels after water treatment (Golder 2021a), meaning that the TIA had reduced capacity to store the 2021 freshet. In May 2021, the pond level reached approximately El. 202.1 m, which was above the El. 201.9 m alert level. Due to the high pond level, water treatment began on June 9 and the pond dropped below the alert level on June 21. By September 12, at the end of the 2021 water treatment campaign, the pond level was at El. 200.1 m, which is lower than historical levels after water treatment (typically El. 200.3 m; Golder 2021a). The pond level during the monitoring period was greater than or equal to 1.4 m below the minimum dyke crest level of El. 203.5 m, which met the water license freeboard requirement of 1 m.

The Main Pond Spillway and Polishing Pond Spillway are designed to discharge to the downstream environment to manage the risk of overtopping the TIA dykes. Site personnel also measure the pond level during routine inspections, and personnel can remotely view the pond level and measuring staff gauge via a web camera near the staff gauge. The camera system's battery is located below the high-water level of the Main Pond, and the camera should be relocated to prevent damage to the battery. The spillway capacity and freeboard limits were assessed for the 2021 freshet (Golder 2021a), and Golder is in the process of updating the freeboard limits for normal operations (as requested by Teck).

Internal Erosion and Piping: The Main Pond is adjacent to the North Dyke, and does not pond against the South, East, or West Dykes. Limited records from the construction of the dykes are available, however historical cross sections from 1981 suggest the dykes were constructed in two zones: an upstream zone comprising stiff to very stiff clayey silt, and a downstream zone comprising dense sands with some gravel. KCB recommends reviewing the filter compatibility of the dyke fill based on data from the 2018 and 2020 site investigations. The dykes are inspected for seepage and no evidence of internal erosion has been observed to date.

Surface Erosion: There are no significant erosion features on the crest or slopes of the dykes. Minor erosion rills were observed on some of the dykes – very common for this nature of facility. A few small areas of the surface cover within the TIA have eroded, exposing tailings. The erosion observed in these areas is not significant and is monitored during routine inspections. The upstream slope of the North Dyke is in contact with the Main Pond, and some areas of the slope are protected from erosion by riprap. The areas without riprap have experienced some minor slumping, and repairs and placement of additional riprap are planned to address this.

Based on the observations above, Teck is managing the potential failure mechanisms for the TIA appropriately in light of the available information, and is taking appropriate steps to address relevant data gaps. A failure modes assessment should be performed to determine if any of these are credible.

Summary of Key Observations and Significant Changes

There has been no construction or any other significant changes to the TIA between October 2020 and August 2021. Site investigations, instrument installations and maintenance activities completed in September 2020 were discussed in the 2020 AFPR (Golder 2020).

There are 20 vibrating wire piezometers (VWPs) at several locations around the dam, two of which are directly measuring the Main Pond water level and one that is measuring barometric pressure. Calibration of the VWPs measuring the Main Pond water level and barometric pressure is in progress. Piezometers are set up to record data twice per day, and can be accessed remotely in real-time by site personnel. There were no significant changes in the measurements made from these instruments in 2021, however some VWPs appeared to have malfunctioned and recorded erroneous data. Piezometer readings also show seasonal fluctuations between spring and summer/fall.

Overall, the dam is in good condition with no significant changes observed, which indicates no changes to stability.

OMS Manual and ERP

The OMS Manual was last revised in May 2020 (Teck 2020a) and the ERP for the Pine Point Mine was last revised March 31, 2020 (Teck 2020b). A 2021 revision of the OMS Manual was in progress at the time of writing.

Dam Safety Review

A Dam Safety Review (DSR) of the Pine Point Mine TIA was performed by SRK in 2014 (SRK 2016). There are no requirements to complete a DSR for the Pine Point Mine TIA based on the relevant permits and licenses for the site; however, the 2019 CDA Technical Bulletin on Application of Dam Safety Guidelines to Mining Dams suggest a frequency of DSRs ranging from 5 to 10 years, depending on the consequences of failure and changes in the dam or surroundings (CDA 2019). The previous DSR recommended assessing the need to conduct a DSR at not longer than 10-year intervals, with the next DSR to take place not later than 2024 (SRK 2016) based upon that recommendation. We understand that while there is no regulatory requirement for any DSR for the TIA, Teck does use these reviews as part of their internal governance program for all of their facilities that do retain fluids and can have a credible failure up to the point they are deemed a stable landform.

Summary of Recommendations

The deficiencies and recommendations related to the safety of the TIA are summarized in the following table used by Teck and consistent with the regulatory requirement for such inspections in British Columbia. Aligned with the noted good condition of the facility and no observed or computed stability concerns, none of the issues are high priorities. The levels of priority assigned to each item in the table are based on priority ratings developed by Teck as follows:

Priority 1 A high probability or actual TIA 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 TIA 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 TIA safety issues.

Priority 4 Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks.

Summary of Deficiencies and Recommendations

Structure	ID No.	Deficiency or Non Conformance	Applicable Regulation or OMS Reference	Recommended Action	Priority	Recommended Deadline/ Status
Previous Recommendations Ongoing						
North Dyke	2019-01	VWP faulty readings. PP-VWP-2018-01B PP-VWP-2018-02A PP-VWP-2018-02B PP-VWP-2018-08 PP-VWP-2018-09	None	Troubleshoot VWP calibration / data acquisition and data reduction. Faulty or damaged instruments should be repaired or replaced.	4	CLOSED – Replaced by 2021-01 (PP-VWP-2018-01B now showing consistent readings)
TIA Instrumentation	2019-02	Instrumentation installed in 2018 requires integration into OMS procedures.	Cl. 4.2 and 4.3 of OMS Manual	Establish procedures for frequency of data acquisition and review. Establish baseline readings and levels for alert and emergency response, with corresponding update of OMS Manual.	4	Deadline updated to Q4 2022 to allow time for completion of 2021-03
TIA	2020-03	Freeboard limits require update for 2019 storage curve, 2020 climate assessment, review of design criteria, and evaluation of spillway.	Cl. 2.7.3.2.3 of OMS Manual	a) Define interim freeboard limits (support 2020-02). b) Review flood storage capacity, water handling practices, determine capacity of spillway and update freeboard limits. Incorporate these changes in the OMS Manual.	3	a) Q1, 2021 / completed b) Draft report by Q4, 2021 / in progress
2021 Recommendations						
TIA Instrumentation	2021-01	VWP anomalous readings. PP-VWP-2018-02A PP-VWP-2018-02B PP-VWP-2018-05 PP-VWP-2018-08 PP-VWP-2018-09 PP-VWP-2020-11A	None	Troubleshoot VWP calibration / data acquisition and data reduction. Assess the importance of these instruments for TIA surveillance and repair or replace faulty or damaged instruments where necessary.	4	Q4 2022
North Dyke	2021-02	Absence of riprap on the upstream slope, resulting in erosion damage.	None	Adequately sized riprap should be placed in locations that do not have riprap protection.	2	Q4 2021 / in progress
TIA	2021-03	Previous stability assessments were based on limited site	None	Update stability assessments and review filter compatibility for the dykes based on the 2018 and 2020 site investigation data.	4	Q4 2023

Structure	ID No.	Deficiency or Non Conformance	Applicable Regulation or OMS Reference	Recommended Action	Priority	Recommended Deadline/ Status
		characterization data.				
TIA	2021-04	Failure modes have not been evaluated to determine if they are credible.	None	Perform a credible failure modes assessment.	4	Q4 2022
Main Pond Spillway, Polishing Pond Spillway	2021-05	The spillways are vulnerable to blockage by woody debris.	None	Develop a plan to manage debris in the pond and add to the OMS Manual.	3	Q4 2022
TIA Instrumentation	2021-06	The remote camera system for monitoring the staff gauge is vulnerable to water damage during high pond levels.	None	Relocate the remote camera system to above the high-water level of the Main Pond.	4	Q4 2022

TABLE OF CONTENTS

EXECUTIVE SUMMARY ii

CLARIFICATIONS REGARDING THIS REPORT 1

1 INTRODUCTION 2
- 1.1 Purpose, Scope of Work and Methodology 2
- 1.2 Regulatory Requirements 2
- 1.3 Facility Description 3
- 1.4 Background Information and History 4
  - 1.4.1 General 4
  - 1.4.2 Construction 4

2 SITE ACTIVITIES – FALL 2020 TO SUMMER 2021 6

3 CLIMATE DATA AND WATER BALANCE 7
- 3.1 Climate Data 7
- 3.2 Water Balance 8
- 3.3 Water Discharge Volumes 9
- 3.4 Water Quality 9
- 3.5 Pond Management 9

4 SITE OBSERVATIONS – JULY 2021 10
- 4.1 Visual Inspection 10
- 4.2 Instrumentation Review 13
  - 4.2.1 Vibrating Wire Piezometers 13
  - 4.2.2 Flow and Water Level Measurements 16

5 DAM SAFETY ASSESSMENT 17
- 5.1 Design Basis Review 17
- 5.2 Dam Safety Review 17
- 5.3 Failure Modes Review 17
- 5.4 Potential Consequence of Failure 19
- 5.6 Operational Performance 21
- 5.7 OMS Manual and ERP Review 21

6 CONCLUSIONS AND RECOMMENDATIONS 22

7 CLOSING 22

REFERENCES 25

TABLE OF CONTENTS
(continued)

List of Tables

Table 1.1 Dyke Configurations 4
Table 3.1 Site Climate Data Summary from 2018 to 2021 and Comparison to Average Values 7
Table 3.2 Summary of TIA Water Balance Flows under Current Conditions, Without Climate Change (Barr 2021) 8
Table 4.1 September 2020 to August 2021 Piezometer Readings 15
Table 5.1 Design Criteria Based on CDA (2019) 17
Table 6.1 Summary of Deficiencies and Recommendations 22

List of Figures

Figure 1.1 Site Location Plan
Figure 1.2 Site Layout
Figure 1.3 North Dyke Downstream Slope Gradient
Figure 1.4 East and North Dyke Downstream Slope Gradient
Figure 1.5 West Dyke Downstream Slope Gradient
Figure 1.6 South Dyke Downstream Slope Gradient
Figure 3.1 Main Pond - Water Level Management
Figure 4.1 July 2021 Observation Locations
Figure 4.2 Instrumentation and Monitoring Well Plan

List of Appendices

Appendix I Facility Data Sheet
Appendix II July 2021 Photographs
Appendix III July 2021 Inspection Form
Appendix IV Vibrating Wire Piezometer and Main Pond Level Plots
Appendix V TIA Dyke Historical Cross-Sections

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 Metals Ltd. (Client) for the specific application to the 2021 Annual Facility Performance Review of the Pine Point Tailings Impoundment Area, 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.

1 INTRODUCTION

1.1 Purpose, Scope of Work and Methodology

This report presents the 2021 Annual Facility Performance Review (AFPR) for Teck Metals Ltd.'s (Teck) Pine Point Mine Tailings Impoundment Area (TIA) by Klohn Crippen Berger Ltd. (KCB). This report was prepared to fulfill the requirements of a Geotechnical Inspection Report as stated in the Water License MV2017L2-0007 (Part F, Cl.7) (valid to October 24, 2027). The following activities were undertaken by KCB:

- Site inspection by the Engineer of Record (EoR) Mr. Daniel Klassen, P.Eng., and Mr. Bob Chambers, P.Eng. (Project Senior Reviewer), both of KCB, on July 21, 2021. Note that the Engineer of Record (EoR) at the time of the inspection was Dr. Ben Wickland, P.Eng. of Golder Associates. The transition of the EoR role from Dr. Wickland to Mr. Klassen was completed on September 28, 2021.
- Review and update of the list of outstanding recommendations from the previous AFPR.
- Review instrumentation and confirm that readings are within acceptable limits.

KCB was accompanied by the Tailings Surveillance Officer, Mr. Clell Crook, C.E.T., (Maskwa Engineering Ltd), Mr. Clell Crook Jr. (Maskwa), and Ms. Morgan Lypka, P.Eng. (Teck). Maskwa conducted the spring inspections of the TIA.

The inspection was conducted and this report was prepared in accordance with the Teck Guideline for Tailings and Water Retaining Structures (Teck 2019). This report covers a reporting period from October 2020 to August 2021. A monitoring period of 11 months was used because the previous AFPR covered a 13-month period extending to September 2020 (Golder 2020). Climate data was reviewed from September 1, 2020 to August 31, 2021.

1.2 Regulatory Requirements

The following regulations, permits, and licenses are applicable to the TIA:

- Mackenzie Valley Resources Management Act, S.C. 1998, c.25 (2017);
- Mackenzie Valley Waters Act, S.N.W.T, 2015, C.1 (2016);
- Northwest Territories Mine Health and Safety Act, S.N.W.T, c.25 (1995);
- Northwest Territories Mine Health and Safety Regulations, R-125-95 and amendments (2018);
- Water License MV2017L2-0007 (Type B) (valid to 24 October 2027); and
- Type A Land Use Permit MV2019X0006 and amendment granted 17 September 2020 to incorporate lease boundary L-2000009T (valid to 15 May 2024) and amendment 9 September 2021 for the installation of evaporators and associated land upgrades for the infrastructure.

KCB has also reviewed the performance of the TIA relative to the following contemporary guidance documents:

- Teck's Guideline for Tailings and Water Retaining Structures (TWRS) (Teck 2019).
- "Dam Safety Guidelines 2007 (revised in 2013)", by the Canadian Dam Association (CDA 2013);
- "Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams", by the Canadian Dam Association (CDA 2019);
- "Tailings Management: Good Practice Guide", by the International Council on Mining and Metals (ICMM 2021); and
- "A Guide to the Management of Tailings Facilities" version 3.2, by the Mining Association of Canada (MAC 2021).

1.3 Facility Description

Pine Point Mine is located in Northwest Territories about 7 km south of Great Slave Lake and 75 km east of the town of Hay River. The TIA is approximately 200 metres above sea level (masl) and occupies terrain that gently slopes towards the northwest at slopes generally less than 1%.

The mine was operated from 1964 to 1988 by Teck. Teck is no longer responsible for the open pits and underground workings, but Teck maintains responsibility of the TIA, which was constructed in 1965 and operated up to 1988. Since 1988, the TIA has been in the active care phase of closure, as defined by CDA (2019).

A mine site plan and the general arrangement of the TIA are presented in Figures 1.1 and 1.2, respectively.

The TIA covers approximately 700 ha and is contained on four sides by earth fill dykes and natural topography (see Figure 1.2). The South and East Dykes terminate into the existing topography on the east side of the TIA. Due to local topography, the TIA only requires a small portion of the east side to be retained behind the East Dyke.

Approximately 50 to 60 million tonnes of tailings are stored in the TIA (Golder 2020), with a remaining Main Pond capacity of approximately 930,000 m^3, measured to the maximum operating water level (MOWL) of 201.8 m. The dykes are approximately 8.8 km long, and up to 9 m high. The original dyke was designed and constructed in the mid 1960s, and the last three raises were completed in 1976, 1981, and 1987. The dykes are constructed of a stiff clayey silt upstream zone and a sand and gravel downstream zone (see Appendix V). Dyke configurations are summarized in Table 1.1.

The downstream slopes of the dykes vary between 2H:1V and 1.5H:1V in localised areas, and this is marked on the plan for each dyke in Figures 1.3 to 1.6.

Table 1.1 Dyke Configurations

Dyke Name	Max. Height (m)	Length (km)	Min. Crest Width (m)	Typical Crest Width (m)	Upstream Slope (typical)	Downstream Slope (typical)	Min. Crest Elev.[1] (m)
North	9	2.9	7.3	8.0	2H:1V	2H:1V	203.5
West	9	2.4	4.5	6.0	2H:1V	2H:1V	203.5
South	6	2.5	3.5	5.0	2H:1V	2H:1V	208.0
East	2	0.8	4.0	6.5	2H:1V	2H:1V	203.5
Polishing Pond	3	0.2	6.0	6.0	2H:1V	2H:1V	202.4

Note: 1. Elevations to be verified. KCB understands that Golder is compiling survey data on the dykes and that this work is still in progress.

Since transitioning into closure, the tailings surface has been covered with approximately 0.15 m of locally borrowed alluvial gravel to control wind erosion of tailings.

Water management for the TIA includes a serpentine Polishing Pond located adjacent to the North Dyke, separated from the main reservoir storage area by an internal dyke. A culvert passes through the internal dyke and is fitted with a gate valve to control the flow into the Polishing Pond. Two concrete spillways are present on the North Dyke of the TIA: the Main Pond Spillway connects the Main Pond to the downstream environment and the Polishing Pond Spillway connects the Polishing Pond to the downstream environment (see Figure 1.2). The Main Pond Spillway invert is typically dry, whereas treated water is annually conveyed via siphons through the Polishing Pond Spillway into the surrounding environment during the annual water treatment campaigns. The water treatment typically occurs over 4 to 6 weeks every summer. A lime solution ($Ca(OH)_2$) is prepared in a slurry tank and pumped into the water flowing in the culvert between the Main Pond and the Polishing Pond.

A facility data sheet that summarizes key information for the TIA is presented in Appendix I.

1.4 Background Information and History

1.4.1 General

The design and construction history, from construction of the starter dykes to closure, is summarized below.

1.4.2 Construction

The chronology of significant construction activities is as follows:

- The original dyke configuration was constructed in the mid 1960s. There are no documents which outline or detail the original design and construction of the TIA dykes.
- There are no documents which outline or detail dyke raises prior to 1976.
- 1976 raising of the North and West Dykes by 2.1 m and an additional raise and extension of the East Dyke.

- 1981 raising of the West Dyke by up to 3 m and foundation stripping along the toe of the South Dyke to install a cut-off key.
- 1987 raising of the South, West, and North Dykes with an earthfill cap in the order of about 0.15 m to 1.0 m.
- 1988 closure of the mine, followed by placement of approximately 0.15 m of gravel to cover the tailings surface in 1990 and 1991.
- 2008 regrading and widening (to about 7.3 m) of the North Dyke in conjunction with placement of 6-inch minus gravel along about 750 m of the upstream face of the North Dyke.
- 2012 construction of reinforced concrete headwalls in the Main Pond Spillway and the Polishing Pond Spillway.

2 SITE ACTIVITIES – FALL 2020 TO SUMMER 2021

The TIA is a closed facility in the active care phase of closure. Teck continues to manage the water level in the Main Pond and treatment of water in the Polishing Pond. Scheduled and event-driven inspections and maintenance work are carried out on an as-required basis. Requirements for routine inspection and monitoring, pond elevation trigger levels, and event-driven inspections are presented in the Operation, Maintenance and Surveillance (OMS) Manual (Teck 2020a).

The following inspections were carried out during the reporting period:

- Event-driven inspections were carried out by the Tailings Surveillance Officer on a weekly basis between May 9 and June 23, 2021, during the period when the Main Pond water level was above the Normal Operating Water Level (NOWL) of El. 201.9 m (see Section 3.5 for description of NOWL). Another inspection was carried out on August 27, 2021, while the Tailings Surveillance Officer was on site to troubleshoot issues with instrumentation. These site inspections did not identify any safety issues for the TIA and the dykes were generally observed to be in good condition.
- The annual inspection of the TIA was carried out on July 21, 2021, by Daniel Klassen and Bob Chambers of KCB.

The following activities were completed during the reporting period:

- Dewatering of sludge/treatment ponds was undertaken from October 6 to 12, 2020, and clean out of these ponds was completed from October 13 to 17, 2020. The cells were monitored, surveyed and refilled with water from October 18 to 29, 2020.
- Water treatment and discharge via the siphon lines was carried out from June 9, 2021 to September 12, 2021, with a total treated volume of 1,120,000 m^3.
- The reference elevation at the base of the Main Pond staff gauge was updated from El. 200.03 m to El. 199.92 m, based on confirmatory surveys completed in May 2021.
- General maintenance of VWP instruments and data loggers was completed throughout the reporting period.
- The following field activities were also completed in relation to closure and reclamation planning:
  - Groundwater and surface water monitoring in October 2020, July 2021 and September 2021;
  - Surface water samples (under ice) December 2020, January, February and March 2021
  - Installation of SoilVUE probes July 2021;
  - Sediment core samples from the Main Pond in September 2021;
  - Climate station maintenance;
  - Snow depth monitoring monthly from December 2020 to March 2021; and
  - Archaeological survey of two areas that were considered to have “high potential” for historical resources in September 2021.

3 CLIMATE DATA AND WATER BALANCE

3.1 Climate Data

Site-specific average monthly temperatures, rainfall, snowfall and precipitation were developed from regional climate datasets as part of water balance modelling work (Barr 2021); the values are presented in Table 3.1. The site climate is defined in the Consolidated Climate and Hydrology report (Golder 2021c). A meteorological station was installed at the TIA in October 2018 and has been operating since. The 2018 to 2021 monthly precipitation and average air temperature are also presented in Table 3.1.

According to the comparison, 2020 to 2021 precipitation was above average while average air temperature was similar to average conditions.

Table 3.1 Site Climate Data Summary from 2018 to 2021 and Comparison to Average Values

	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Year
Average Air Temperature (°C)													
Average Temperature[2]	**8.3**	**0.6**	**-11.4**	**-19.7**	**-23.6**	**-20.2**	**-14.2**	**-2.7**	**6.8**	**13.4**	**16.4**	**14.7**	**-2.6**
Oct 1, 2018 to Sept 30, 2019	9.0[1]	-0.9	-11.4	-15.5	-22.9	-24.5	-7.4	-1.3	5.5	12.9	16.3	13.5	-2.2
Sept 1, 2019 to Aug 31, 2020	9.0	1.1	-9.3	-22.7	-22.8	-20.5	-17.4	-7.3	3.7	14.0	16.9	15.7	-3.3
Sept 1, 2020 to Aug 23, 2021	8.5	-0.8	-12.7	-16.4	-17.1	-26.0	-15.3	-6.7	4.5	15.2	17.7	15.1	-2.8
Rainfall, Snowfall, and Precipitation (mm)													
Average Rainfall[2]	**39**	**15**	**1**	**1**	**0**	**0**	**0**	**3**	**17**	**29**	**47**	**52**	**204**
Average Snowfall[2]	**1**	**18**	**32**	**20**	**20**	**14**	**16**	**9**	**3**	**0**	**0**	**0**	**133**
Average Precipitation[2]	**41**	**33**	**33**	**21**	**20**	**14**	**16**	**12**	**21**	**29**	**47**	**52**	**337**
Oct 1, 2018 to Sept 30, 2019 Precipitation[3]	51[1]	14	0	12	6	4	20	13	1	13	32	38	204
Sept 1, 2019 to Aug 31, 2020 Precipitation[3]	51	0	0	0	11	11	2	7	14	17	91	80	283
Sept 1, 2020 to Aug 23, 2021 Precipitation[3]	71	13	10	12	20	13	19	5	6	31	94	72	366

Notes:

1. Sept 2018 data was not available, so Sept 2019 data was applied to get an approximate annual precipitation and mean temperature for year 2018-2019.
2. The site-specific average monthly temperature, rainfall, snowfall and precipitation are from Barr (2021). The site-specific climate data was developed using regional climate datasets from six Environment Canada climate stations. Snowfall includes wind-induced undercatch adjustment.
3. KCB has assumed that the "daily rainfall" parameter in the climate data download includes both rainfall and snowfall snow water equivalent, since there is data even when temperature is below zero.

3.2 Water Balance

Previous water balance work by Golder for the TIA Main Pond from 1993 to 2017 was prepared for the OMS Manual (Teck 2020a) and estimated using a spreadsheet model accounting for inflows (annual precipitation) and outflows (evaporation, evapotranspiration, and infiltration which were combined into a single term called total losses, and surface release of treated discharge). Annual equivalent precipitation was 542 mm. Net water released (treated discharge) was 28 mm or 252,000 m^3 using the assumed watershed area of 900 ha, or about 5% of the equivalent precipitation. The total losses, including evaporation, evapotranspiration, and infiltration was calculated by difference as 514 mm.

An updated water balance and water quality model for the TIA was prepared in GoldSim (Barr 2021). Based on LiDAR data the total contributing area to the Main Pond within the footprint of the surrounding dykes was revised to be about 690 ha, with about 48 ha (~7%) of the footprint being "semi-contributing" (i.e., contribute runoff flow only during large runoff or freshet events).

The model was calibrated to pond level measurements and discharge rates from the pond during treatment or the emergency decant in May 2018. A summary of the inflows and outflows into the TIA Main Pond is presented in Table 3.2.

Note that the water balance assumes that the east diversion ditch (see Figure 1.2) is directing non-contact water away from the TIA. However, this ditch has some known restrictions, including culverts not functioning, high points, etc. The magnitude of non-contact water that could be entering the TIA from this ditch is not clear at this stage. Maintenance work on the east diversion ditch is planned for fall 2021 to remove restrictions and improve the functionality of the ditch.

Table 3.2 Summary of TIA Water Balance Flows under Current Conditions, Without Climate Change (Barr 2021)

Model Flow Path	Average Year Annual Volume	Annual Average Flow	Wet Year Annual Volume	Dry Year Annual Volume
Inflows to the TIA Main Pond				
Precipitation to the pond	0.15 Mm^3 (375 mm/yr)	410 m^3/day	0.19 Mm^3 (425 mm/yr)	0.10 Mm^3 (300 mm/yr)
Runoff from tailings	0.62 Mm^3	1,700 m^3/day	0.79 Mm^3	0.39 Mm^3
Run-on from East Drainage Area (EDA)[1]	0.27 Mm^3	740 m^3/day	0.33 Mm^3	0.17 Mm^3
Saturated flow from tailings	0.01 Mm^3	25 m^3/day	0.01 Mm^3	0.01 Mm^3
Total inflows to the TIA Main Pond	**1.05 Mm^3**	**2,875 m^3/day**	**1.32 Mm^3**	**0.67 Mm^3**
Outflows from the TIA Main Pond				
Evaporation	0.33 Mm^3 (655 mm/yr)	900 m^3/day	0.36 Mm^3 (645 mm/yr)	0.27 Mm^3 (665 mm/yr)
Discharge	0.56 Mm^3	1,535 m^3/day	0.80 Mm^3	0.27 Mm^3
Seepage	0.16 Mm^3	440 m^3/day	0.16 Mm^3	0.13 Mm^3
Total outflows from the TIA Main Pond	**1.05 Mm^3**	**2,875 m^3/day**	**1.32 Mm^3**	**0.67 Mm^3**

Notes:
1. Includes some runoff from the coarse tailings in the southern portion of the TIA that drain to a ditch that also collects EDA runoff

3.3 Water Discharge Volumes

Water treatment and discharge at the TIA was carried out from June 9 to September 12, 2021, with a total treated volume of 1,120,000 m^3. For comparison, 383,451 m^3 of treated water was released from July 1, 2020 to September 16, 2020 (Golder 2020). The increased water treatment undertaken in 2021 was in part due to a higher Main Pond water level at the onset of freshet, compared to previous years. The water level was at El. 201.9 m at the start of water treatment and El. 200.1 m on September 12, 2021, at the completion of the water treatment campaign.

3.4 Water Quality

The Pine Point Mine is permitted to discharge water from the TIA if the water quality meets the effluent quality criteria under Type B Water License MV2017L2-0007, a copy of which is presented in Appendix D of the OMS Manual (Teck 2020a). Water quality results are submitted to the Mackenzie Valley Land and Water Board as part of the Annual Water License Report in March the year following the operational period covered.

3.5 Pond Management

The Main Pond water level is managed via treatment at the Polishing Pond, and discharge through siphon lines over the Polishing Pond Spillway to the receiving environment. The water level limits defined for managing the Main Pond (per the OMS Manual) are shown in Figure 3.1, and are described as follows:

- Alert Water Level: defined as El. 201.6 m. The site manager should be informed immediately, and water treatment should start as early as practicable. A site inspection should take place within one week after the initial alert level observation (Teck 2020a).
- Maximum Operating Water Level (MOWL): defined as El. 201.8 m. This is the maximum operating pond elevation. Actions to reduce the water level within the pond should commence as a matter of urgency (Teck 2020a).

The pond level following the 2020 water treatment campaign was El. 200.8 m, which was approximately 0.5 m higher than historical levels after water treatment (Golder 2021a), meaning that the TIA had reduced capacity to store the 2021 freshet. Based on this, an interim plan to manage the 2021 freshet was developed, which included developing a new Normal Operating Water Level (NOWL) which temporarily superseded the Alert Water Level and MOWL defined above during 2021 freshet. The NOWL range was defined from El. 200.0 m (Polishing Pond culvert inlet) to El. 201.9 m. Exceeding the NOWL required mobilization of staff to site to lower the pond by treatment and release, and regular inspection of the dykes (Golder 2021a).

As noted above (Section 3.3), the pond level following the 2021 water treatment campaign was El. 200.1 m, which is lower than historical levels after water treatment (typically El. 200.3 m; Golder 2021a). The water level in the Main Pond during the monitoring period was greater than or equal to 1.4 m below the minimum dyke crest level of El. 203.5 m, which met the water license freeboard requirement of 1 m.

4 SITE OBSERVATIONS – JULY 2021

4.1 Visual Inspection

The TIA was inspected during the July 21, 2021 site visit, including the following areas:

- South Dyke
- West Dyke
- North Dyke
- East Dyke
- Main Pond Spillway
- Polishing Pond Dykes
- Polishing Pond Spillway

Weather during the site visit was cloudy with sunny periods, and about 22°C. Site observations and recommendations are presented in the following sub-sections. Observation locations referred to in the following sub-sections are identified in Figure 4.1. Selected photographs taken during the inspection are presented in Appendix II, and the TIA inspection form is presented in Appendix III.

South Dyke

- The South Dyke crest, and upstream and downstream slopes were in good condition (Photos II-1 to II-11).
- The upstream tailings surface is dry. The tailings surface near the dyke has a granular cover, but exposed tailings were observed at the east side (Photo II-2), and also in a few locations further west where Maskwa reports flow has previously been observed during freshet, which has apparently eroded parts of the cover (Photo II-9).
- Ponding was observed downstream of the toe in some areas (Photo II-10).
- Minor rutting of the crest was observed near the east end of the dyke (Photo II-1).
- Minor rills were observed on both upstream and downstream slopes in some areas (Photos II-2 to II-6). These are relatively small and do not require repairs unless their condition worsens.
- During the August 27 inspection, Maskwa observed an erosion rill that cut into the crest of the dyke approximately 45 m west of the central access ramp (Maskwa 2021d). Repair of this erosion will be undertaken as part of routine maintenance.
- There is minor vegetation on the upstream and downstream slopes (Photos II-8, II-10 to II-11), but it is not approaching the criteria for removal described in the OMS Manual (Teck 2020) (trunk diameter larger than 100 mm on the South or East Dykes, or larger than 20 mm on the North or West Dykes).

West Dyke

- The West Dyke crest, and upstream and downstream slopes were in good condition (Photos II-12 to II-17).
- The upstream tailings surface is dry. Some areas of erosion of the tailings cover were observed, similar to the South Dyke (Photo II-14).
- Two locations of more severe erosion of the tailings near the central portion of the West Dyke were noted by Maskwa during the August 27 inspection (Maskwa 2021d):
  - 16 m long, 2.5 m to 5 m wide, 0.55 m deep, located 5 m from the upstream toe; and
  - 18 m long, 1 m to 3 m wide, 0.45 m deep, located 7 m from the upstream toe.

  This erosion does not affect the dyke and is not a TIA safety concern. However, these areas will continue to be monitored.
- Ponding was observed downstream of the toe in some areas, including two larger ponds at the north end. Minor seepage with red staining was observed at the dam toe flowing into these larger ponds (Photo II-16). The seepage water was clear.
- Minor rills were observed on the downstream slope at a few locations. One larger rill was observed at the northwest corner on the downstream slope (see Location 1 in Figure 4.1; Photo II-17), up to 1 m wide and 0.4 m deep, which Maskwa indicated was not present during the spring 2021 inspection. This rill is not an immediate concern, but should continue to be monitored, and could be repaired on an opportunistic basis if equipment is already on site for another purpose.
- There is minor vegetation on the upstream and downstream slopes, but it is not approaching the removal criteria.

North Dyke

- The North Dyke crest, and upstream and downstream slopes were generally in good condition (Photos II-18 to II-28), apart from some minor erosion and slumping of the upstream slope as noted below.
- The Main Pond was in contact with the upstream slope of the North Dyke across most of its length, apart from a ~300 m zone near the northwest corner (see west edge of pond in Photo II-19). About 700 m of this length is protected by riprap with a typical diameter of around 15 cm to 20 cm and appeared to be in good condition (see Location 2 in Figure 4.1; Photo II-23). Areas without riprap have experienced minor erosion at the toe of the upstream slope (see Location 3 in Figure 4.1), leading to slumping and 30 cm to 50 cm head scarps partway up the slope (Photos II-20 to II-21, and II-25 to II-28). In some locations this has exposed a well-graded fill zone (probably glacial till) which may be the upstream low permeability zone in the dyke. This erosion is not currently a major issue, but it may be prudent to repair it before the condition deteriorates. KCB understands that Teck is already planning to repair these areas in 2021.

Recommendation/Action:

The absence of riprap in parts of the North Dyke upstream slope has resulted in erosion damage. Adequately sized riprap should be placed in locations that do not have riprap protection.

- During the August 27 inspection, Maskwa observed an erosion rill that cut into the crest of the dyke approximately at the location of the dogleg (Maskwa 2021d). The erosion rill was approximately 0.6 m wide and 0.3 m deep. Repair of this erosion will be undertaken as part of routine maintenance.
- Ponds were observed downstream of the toe in some areas (Photo II-24). No active seepage was observed at the downstream toe, but red staining was observed on the surface in a wet area near one of the downstream ponds.
- There is minor vegetation on the upstream and downstream slopes, but it is not approaching the removal criteria.
- Maskwa noted that bubbles were observed at the west side of the pond on June 2, 2021, and that bubbles had previously been observed in this area in 2018 (Maskwa 2021c). This is a common observation in tailings ponds and is not a cause for concern.

East Dyke

- The East Dyke crest, and upstream and downstream slopes were in good condition (Photos II-29 to II-31).
- Ponding was observed both upstream and downstream of the dyke in some areas (Photos II-29, II-31).
- Minor rills were observed on the downstream slope at some locations (Photo II-30).
- Vegetation on the downstream and upstream slopes of the East Dyke is larger than was observed on the other dykes (Photo II-29), with trunk diameters around 20 mm but not approaching the removal criteria of 100 mm for the East Dyke.

Main Pond Spillway

- The concrete Main Pond Spillway structure appeared to be in good condition (Photo II-32).
- Minor vegetation is growing along the base of the channel, but not enough to significantly affect the flow capacity.
- The erosion and slumping of the North Dyke upstream slope noted above is also occurring locally on either side of the spillway concrete wing walls, leaving 50 cm head scarps on either side (Photo II-32). Maskwa also observed minor erosion on the slope below the spillway inlet during the August 27 inspection after the pond had been drawn down further (Maskwa 2021d).
- Maskwa observed woody debris floating in the pond at the inlet of the Main Pond Spillway during the May 26 inspection (Maskwa 2021b). This was removed shortly after (Maskwa

2021c). There are dead trees in the Main Pond, and it is possible that debris mobilized during an extreme flood could reduce the flow capacity of one or both spillways.

Recommendation/Action:

Develop a plan to manage debris in the pond and add to the OMS Manual.

Polishing Pond Dykes

- The Polishing Pond Dykes were in good condition (Photos II-33 and II-34).
- Water treatment was in progress at the time of the inspection. Both ends of the culvert between the Main Pond and the Polishing pond were submerged, the culvert valve was open, and flow was observed bubbling up above the outlet in the Polishing Pond. Lime solution was being added to the water at the culvert inlet, and air was being injected into the middle of the culvert to promote mixing. The main pond level was observed at the staff gauge (see location in Figure 4.2) at 201.41 m in the morning, and had dropped to 201.40 m in the afternoon. This water level is 1.4 m above the culvert inlet, and is below the revised, temporary NOWL of 201.9 m for the 2021 freshet period (Golder 2021a).
- The remote camera system that is used for monitoring the staff gauge is located on the Polishing Pond Dyke close to the Main Pond, and the lower part of the unit is located below the high water level of the pond. Maskwa noted in the May 10 inspection that the pond level was approaching the camera system (Maskwa 2021a), so efforts were undertaken to waterproof it and prevent flooding of the battery.

Recommendation/Action:

Relocate the remote camera system to above the high-water level of the Main Pond.

Polishing Pond Spillway

- The concrete Polishing Pond Spillway structure appeared to be in good condition (Photos II-35 and II-36).
- Five siphon pipes run from the Polishing Pond over the spillway to the downstream end of the spillway, and the valves were open and all five were flowing at the time of the inspection (Photo II-35). The water treatment operator estimated the flow rate at 20,000 m^3/day.
- There were no signs of erosion at the discharge point.

4.2 Instrumentation Review

4.2.1 Vibrating Wire Piezometers

There are 20 vibrating wire piezometers (VWPs) at multiple locations around the dam as shown in Figure 4.2 and listed in Table 4.1. The VWPs are typically installed in dyke fill, natural foundation material, or tailings. Two piezometers are dedicated to measuring the Main Pond water level and one piezometer measures the barometric pressure. The VWPs record measurements twice per day and

are connected to a remote monitoring system, enabling site personnel to review data in real time using GeoExplorer software.

Maximum piezometer readings recorded between September 2020 to August 2021 are included in Table 4.1. There are no alert level thresholds associated with the TIA VWPs. There is an open recommendation (2019-02) to establish alert levels for these instruments, and this will be done in conjunction with planned stability analyses of the TIA.

The readings indicate that the piezometric surface ranges from approximately 1.6 m to 4.7 m below the gravel cover of the tailings for VWPs installed in the central area of the TIA, consistent with the measurements from 2019 and 2020. These nested VWP tips are installed in tailings and foundation materials, likely close to the natural ground interface (based on tip elevations). VWPs installed at the west of the Main Pond gave negative pressure readings (consistent with unsaturated conditions), while VWP 2020-11B at the North Dyke gave a piezometric elevation of 197.5 m which is within the dyke fill zone, approximately 0.13 m above the foundation level. These measured conditions are consistent with previous trends and seasonal fluctuations. Fluctuations in the readings do not appear to follow the Main Pond level. Piezometer readings are shown as equivalent piezometric surface elevations versus time in Appendix IV.

The following piezometers recorded anomalous data, possibly due to malfunction or errors in recording data:

- **PP-VWP-2020-11A**: recorded an equivalent piezometric elevation of El. 433.7 m, which is unreasonably higher than the dyke crest elevation of El. 203.5 m (possible GeoExplorer software calculation error).
- **PP-VWP-2020-11C**: although multiple data points were recorded during the reporting period, only one data point recorded on September 29, 2020 is calculating an equivalent piezometric elevation (possible GeoExplorer software calculation error).
- **PP-VWP-2020-12**: although multiple data points were recorded during the reporting period, GeoExplorer is not calculating an equivalent piezometric elevation (possible GeoExplorer software calculation error).
- **PP-VWP-2018-02A**: the equivalent piezometric elevation increased by approximately 5.5 m to El. 211.5 m during a single day on September 11, 2020. The readings have not returned to normal since this date (possible malfunction).
- **PP-VWP-2018-02B**: the equivalent piezometric elevation decreased by approximately 4 m to El. 205 m during a single day on September 6, 2019. The readings have not returned to normal since this date (possible malfunction).
- **PP-VWP-2018-05**: recorded an equivalent piezometric elevation of approximately El. 198.8 m, which is above the ground surface level of El. 197.2 m at the instrument location, suggesting artesian conditions. The 2020 AFPR previously indicated this instrument requires a calibration check, and this is in progress.

- **PP-VWP-2018-06**: pressure readings stopped recording on September 30, 2020. Manual readings since then were consistent with earlier readings. There appears to be a defective interface, as the data is not being transmitted.

KCB notes that at the time of writing, review of piezometer functions was in progress by Golder.

Table 4.1 September 2020 to August 2021 Piezometer Readings

Piezometer ID	Location ID	Serial Number	Install Unit	Tip El. (masl)	Equivalent Piezometric Elevation (masl)	Measurement Date yyyy-mm-dd
PP-VWP-2020-11A	BH20-G-30	VW52436	Dyke Fill	198.9	433.7	2021-08-12
PP-VWP-2020-11B		VW69397	Lacustrine	194.3	198.5	2021-08-12
PP-VWP-2020-11C		VW69396	Till	182.2	**197.5**	2020-09-20
PP-VWP-2020-12	Main Pond[1]	VW52445	Pond	197.4	NO CALCULATIONS (calibration in progress)	N/A
PP-VWP-2020-13	Near BH20-G-30[2]	VW69514	Air Pressure	N/A	N/A	N/A
PP-VWP-2018-01A	BH18-B-01	VW52439	Lacustrine (Sand)	199.39	**204.4**	2021-08-12
PP-VWP-2018-01B		VW52429	Tailings	200.69	**205.4**	2021-08-12
PP-VWP-2018-02A	BH18-B-02	VW52433	Lacustrine (Sand)	203.04	**211.5**	2021-08-12
PP-VWP-2018-02B		VW52430	Tailings	204.54	**204.9**	2021-08-12
PP-VWP-2018-03A	BH18-B-03	VW53440	Till	192.86	**203.0**	2021-08-12
PP-VWP-2018-03B		VW53435	Lacustrine (Silt/Clay)	197.26	**203.2**	2021-08-12
PP-VWP-2018-03C		VW53441	Tailings	198.76	203.2	2021-08-12
PP-VWP-2018-04A	BH18-B-04	VW53434	Lacustrine (Sand)	199.43	**203.2**	2021-08-12
PP-VWP-2018-04B		VW53438	Tailings	200.43	**203.2**	2021-08-12
PP-VWP-2018-05	BH18-B-05	VW53432	Lacustrine (Sand)	191.55	198.8	2021-08-12
PP-VWP-2018-06	BH18-B-06	VW53431	Lacustrine (Sand)	196.44	**199.6**	2020-09-30
PP-VWP-2018-07	BH18-G-26	VW52444	Dyke Fill (Silt/Clay)	195.22	Negative Pressure Reading	2021-08-12
PP-VWP-2018-08	BH18-G-27	VW52442	Dyke Fill (Silt/Clay)	200.46	Negative Pressure Reading	2021-07-10
PP-VWP-2018-09	BH18-G-31	VW52443	Lacustrine (Silt/Clay)	198.35	Negative Pressure Reading	2021-07-10
PP-VWP-2018-10	Main Pond[3]	VW42437	Pond	N/A	200.7	2021-08-12

Notes:
[1] Monitors Main Pond water level at North Dyke, near the southeast corner of the Polishing Pond.
[2] Instrument measuring barometric pressure – installed with interface in steel mount across the crest of access road from borehole BH20-G-30.
[3] Monitors Main Pond water level near Polishing Pond Dyke.
[4] Piezometric elevations shown in Red indicate VWPs that have anomalous data during the reporting period.
[5] Piezometric elevations shown in **Bold** indicate VWPs that have significant periods of missing data during the reporting period. Periods with missing data are shown in Appendix IV.

An update of instruments reported as faulty in the previous AFPR is provided below:

- **PP-VWP-2018-01B**: previously reported as faulty due to unreasonable pressure readings; however, the pressure sensor is now recording consistent readings.
- **PP-VWP-2018-02A**: previously reported as faulty due to unreasonable pressure readings. Pressure readings have not returned to normal (possible malfunction).
- **PP-VWP-2018-02B**: previously reported as faulty due to unreasonable pressure readings. Pressure readings have not returned to normal (possible malfunction).
- **PP-VWP-2018-08**: previously reported as faulty due to unreasonable temperature readings. It is unknown whether the pressure sensor is damaged, since pressure readings have remained negative over time.
- **PP-VWP-2018-09**: previously reported as faulty due to unreasonable temperature readings. It is unknown whether the pressure sensor is damaged, since pressure readings have remained negative over time.

There was a recommendation from 2019 with a list of VWPs that require troubleshooting, but there are two instruments (PP-VWP-2018-05 and PP-VWP-2020-11A) that were not included on this list, and one instrument (PP-VWP-2018-01B) now appears to be giving reasonable data. The existing recommendation has been closed and replaced by the new recommendation below.

Recommendation/Action:

> *PP-VWP-2018-02A, PP-VWP-2018-02B, PP-VWP-2018-05, PP-VWP-2018-08, PP-VWP-2018-09 and PP-VWP-2020-11A have anomalous readings. Troubleshoot VWP calibration/data acquisition and data reduction. Assess the importance of these instruments for TIA surveillance and repair or replace faulty or damaged instruments where necessary.*

4.2.2 Flow and Water Level Measurements

The water level at the Main Pond and the Polishing Pond is measured at the culvert between the two ponds via a staff gauge. The pond level is also monitored remotely via a camera facing the staff gauge, both of which are installed along the Polishing Pond Dyke. As described in Section 4.1, part of the camera unit is located below the high water level of the Main Pond, and a recommendation has been made to relocate the camera. Treated water is released annually, during the summer months, through the Polishing Pond Spillway. Flow meters are installed on all siphon lines from the Polishing Pond.

5 DAM SAFETY ASSESSMENT

5.1 Design Basis Review

The North and West Dyke have a "Significant" potential consequence of failure and the South and East Dykes have a "Low" potential consequence (see Section 5.4), per the CDA Dam Safety Guidelines (CDA 2013). The relevant design criteria from CDA (2019) are compared in Table 5.1 for facilities with "Low" and "Significant" potential consequences.

Table 5.1 Design Criteria Based on CDA (2019)

Parameter	Construction, Operation, and Transition Phases	
	CDA (2019) "Low" Consequence	CDA (2019) "Significant" Consequence
Annual Exceedance Probability (AEP) – Floods	1/100	Between 1/100 and 1/1000
AEP – Earthquake Design Ground Motion (EDGM)	1/100	Between 1/100 and 1/1000
Factor of safety for slope stability: Static, Long Term Pseudostatic Post-Earthquake	 1.5 1.0 1.2	 1.5 1.0 1.2
Steepest Allowable Downstream Slope	Not specified	Not specified

5.2 Dam Safety Review

A Dam Safety Review (DSR) of the Pine Point Mine TIA was performed by SRK in 2014, with the site inspection conducted on July 8, 2014. There are no requirements to complete a DSR for the Pine Point Mine TIA based on the relevant permits and licenses for the site; however, the 2019 CDA Technical Bulletin on Application of Dam Safety Guidelines to Mining Dams suggests a frequency of DSRs ranging from 5 to 10 years, depending on the consequences of failure and changes in the dam or surroundings (CDA 2019). The previous DSR recommended assessing the need to conduct a DSR at not longer than 10-year intervals, with the next DSR to take place not later than 2024 (SRK 2016) based upon that recommendation. We understand that while there is no regulatory requirement for any DSR for the TIA, Teck does use these reviews as part of their internal governance program for all of their facilities that do retain fluids and can have a credible failure up to the point they are deemed a stable landform.

5.3 Failure Modes Review

KCB understands that Teck's long-term goal for all tailings facilities, where physically possible, 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.

A summary of the current conditions is provided below to describe the safeguards that are in place and the justification that these failure modes are well-managed for the Pine Point Mine TIA.

The potential failure modes included in the CDA Dam Safety Guidelines (2013) were reviewed based on the inspection and review of available documents:

- **Overtopping:** There is a permanent Main Pond in the TIA which drains into the Polishing Pond via a culvert. The pond level is actively managed by annual seasonal water treatment campaigns at the Polishing Pond, where treated water is discharged over the Polishing Pond Spillway via five siphon lines. The Main Pond Spillway and Polishing Pond Spillway are designed to discharge to the downstream environment to manage the risk of overtopping the TIA dykes. Site personnel also measure the pond level during routine inspections, and can remotely view the pond level and measuring staff gauge via a web camera near the staff gauge. The spillway capacity and freeboard limits were assessed for the 2021 freshet (Golder 2021a), and Golder is in the process of updating the freeboard limits for normal operations (as requested by Teck).
- **Internal Erosion and Piping:** The Main Pond is adjacent to the North Dyke, and does not pond against the South, East, or West Dykes. Limited records from the construction of the dykes are available, however historical cross sections from 1981 suggest the dykes were constructed in two zones; an upstream zone comprising stiff to very stiff clayey silt, and a downstream zone comprising dense sands with some gravel. Teck is planning to evaluate the filter compatibility of the dyke fill based on data from the 2018 and 2020 site investigations. There were no signs of internal erosion during the annual site inspection, and the Main Pond water elevation and VWP readings indicate seasonal fluctuations but no long-term trends.
- **Slope Instability:** A stability assessment of the TIA was completed as part of the 2014 DSR (SRK 2016), and indicated that the dykes achieved an acceptable factor of safety under static and pseudo-static loading conditions. An update of the stability analyses for the dykes is planned based on the data gained from the 2018 and 2020 site investigations. The site investigations were undertaken to address uncertainties in the configuration and fill placement within the dykes, and to better understand foundation conditions. The dykes have been observed over many years since construction and have performed well with no significant deformations observed.
- **Surface Erosion:** There are no significant erosion features on the crest or slopes of the dykes. Minor erosion rills were observed on some of the dykes – very common for this nature of facility. A few small areas of the surface cover within the TIA have eroded, exposing tailings. The erosion observed in these areas is not significant and is monitored during routine inspections. The upstream slope of the North Dyke is in contact with the Main Pond, and some areas of the slope are protected from erosion by riprap. The areas without riprap have experienced some minor slumping, and repairs and placement of additional riprap are planned to address this.
- **Earthquakes:** The mine is in an area of low seismic activity, and the estimated seismic ground motions are relatively small, with a peak ground acceleration (PGA) of 0.002 g for the 1/100 year event and 0.016 g for the 1/1000 year event, based on the National Building Code of Canada seismic hazard calculator (NRC 2015). The 2014 DSR conducted pseudo-static stability

analyses for the dykes which indicated an acceptable factor of safety, and KCB notes that the PGA used in this assessment was based on the 2010 NBCC seismic hazard calculator, which produced higher PGAs than the updated 2015 NBCC seismic hazard calculator. The PGA values used in the SRK assessment were 0.019 g for the 1/1000 year event and 0.036 g for the 1/2475 year event. Based on the above, failure modes triggered by earthquakes are effectively managed for the TIA.

Based on the observations above, Teck is managing the potential failure mechanisms for the TIA appropriately in light of the available information, and is taking appropriate steps to address relevant data gaps. The failure modes have not yet been evaluated to determine if they are credible.

Recommendation/Action:

Perform a credible failure modes assessment.

5.4 Potential Consequence of Failure

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

Golder (2020) reviewed the downstream potential consequence of the TIA based on CDA (2013), and the review is summarized as follows.

- There is no permanent population downstream of the dykes, and the loss of life associated with a potential failure of the dykes would be “low to none” based on the temporary population downstream (comprising mine exploration personnel).
- A potential failure of the dykes could impact the local environment, with the possibility of minimal short-term loss or deterioration of wildlife habitat. The South and East Dykes do not retain water, and therefore the impact to the environment is expected to be less than the North and West Dykes. Therefore, the impact to the environment from a failure of the South and East Dykes would likely be “low”, and the impact from a failure of the North and West Dykes could be “low” to “significant”.
- A potential failure of the dykes would not impact infrastructure and would have minimal economic losses.

Therefore, the potential consequence of the South and East Dykes is “low” and the potential consequence of the North and West Dykes is “significant”. There have been no material changes to the TIA or the upstream and downstream conditions since the previous review; therefore, there is no change in the TIA’s potential consequence.

5.5 Physical Performance

Geotechnical

The TIA has performed adequately for over 55 years, and there is no record of significant deformations since operations ceased in 1988. The most recent stability assessment of the TIA was conducted in 2014 as part of the DSR (SRK 2016). The stability assessment was undertaken to update the models based on more recent piezometric elevation data, changes to the earthquake design ground motions, and changes to the understanding of the stratigraphy. According to SRK, previous stability assessments were based on historical information presented in the 1981 and 2009 TIA stability assessments. Site investigations were undertaken in 2018 and 2020, and the reports were finalized on September 15, 2021. The data obtained during these investigations may be used to revise the stability assessments of the dykes. No signs of instability were observed during the annual inspection of the dykes.

Recommendation/Action:

> *Previous stability assessments were based on limited site characterization data. Update stability assessments and review filter compatibility for the dykes based on the 2018 and 2020 site investigation data.*

Hydrotechnical

The Main Pond Spillway and Polishing Pond Spillway both enable impounded water to discharge through the North Dyke into the downstream environment. The Main Pond Spillway is an 8 ft wide reinforced concrete channel, which passively releases water from the TIA when the pond level rises above El. 202.5 m, 1 m below the minimum crest elevation of the perimeter dykes. In 2012, the Main Pond Spillway was upgraded with concrete headwalls.

The Polishing Pond Spillway was also constructed as an 8 ft wide reinforced concrete structure. There are 5 siphon lines which enable the Polishing Pond to discharge over the Polishing Pond Spillway at pond elevations below the spillway invert elevation of El. 202.5 m during water treatment.

Both spillways are inspected during routine inspections, and Golder has previously observed some minor cracking and spalling at the Main Pond Spillway (Golder 2020). The flow capacity of the Main Pond Spillway and Polishing Pond Spillway was assessed by Golder as part of assessing interim freeboard limits for managing the pond during spring 2021 freshet (Golder 2021a). Work is in progress by Golder on updating the freeboard limits for normal operations.

Based on measurements from the Main Pond staff gauge, the maximum Main Pond level during the reporting period was approximately 202.1 m, measured in May 2021. This exceeded the NOWL Limit of 201.9 m (see Section 3.5 for description of Main Pond level limits). The Main Pond level exceeded the NOWL from May 9 to June 21, 2021 (Golder 2021b). Pine Point site personnel actively managed the pond during this time by treating and discharging water from the Polishing Pond in accordance with the revised 2021 freshet interim freeboard quantitative performance objectives (QPO) (Golder 2021a). Prior to the 2021 freshet, the Main Pond level was maintained below the original pond alert level of 201.6 m for the reporting period.

5.6 Operational Performance

The Pine Point Mine TIA has been closed for about 35 years and, as indicated in Section 2, the only operational requirement is for Teck to continue water treatment via the Polishing Pond. Water treatment volumes for the reporting period are discussed in Section 3.3.

5.7 OMS Manual and ERP Review

The OMS Manual was last revised in May 2020 (Teck 2020a) and the ERP for the Pine Point Mine was last revised March 31, 2020 (Teck 2020b). A 2021 revision of the OMS Manual was in progress at the time of writing.

6 CONCLUSIONS AND RECOMMENDATIONS

The deficiencies and recommendations from previous years and from the 2021 inspection are summarized in Table 6.1, used by Teck and consistent with the regulatory requirement for such inspections in British Columbia. The priorities assigned to each item in Table 6.1 are based on priority ratings developed by Teck as follows:

Priority 1 A high probability or actual TIA 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 TIA 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 TIA safety issues.

Priority 4 Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks.

The Pine Point Mine TIA appears to be in good condition and there are no major concerns related to the safety of the facility.

Table 6.1 Summary of Deficiencies and Recommendations

Structure	ID No.	Deficiency or Non Conformance	Applicable Regulation or OMS Reference	Recommended Action	Priority	Recommended Deadline/ Status
Previous Recommendations Ongoing						
North Dyke	2019-01	VWP faulty readings. PP-VWP-2018-01B PP-VWP-2018-02A PP-VWP-2018-02B PP-VWP-2018-08 PP-VWP-2018-09	None	Troubleshoot VWP calibration / data acquisition and data reduction. Faulty or damaged instruments should be repaired or replaced.	4	CLOSED – Replaced by 2021-01 (PP-VWP-2018-01B now showing consistent readings)
TIA Instrumentation	2019-02	Instrumentation installed in 2018 requires integration into OMS procedures.	Cl. 4.2 and 4.3 of OMS Manual	Establish procedures for frequency of data acquisition and review. Establish baseline readings and levels for alert and emergency response, with corresponding update of OMS Manual.	4	Deadline updated to Q4 2022 to allow time for completion of 2021-03
TIA	2020-03	Freeboard limits require update for 2019 storage curve, 2020 climate assessment, review of design criteria, and evaluation of spillway.	Cl. 2.7.3.2.3 of OMS Manual	c) Define interim freeboard limits (support 2020-02). d) Review flood storage capacity, water handling practices, determine capacity of spillway and update freeboard limits. Incorporate these changes in the OMS Manual.	3	c) Q1, 2021 / completed d) Draft report by Q4, 2021 / in progress

Structure	ID No.	Deficiency or Non Conformance	Applicable Regulation or OMS Reference	Recommended Action	Priority	Recommended Deadline/ Status
2021 Recommendations						
TIA Instrumentation	2021-01	VWP anomalous readings. PP-VWP-2018-02A PP-VWP-2018-02B PP-VWP-2018-05 PP-VWP-2018-08 PP-VWP-2018-09 PP-VWP-2020-11A	None	Troubleshoot VWP calibration / data acquisition and data reduction. Assess the importance of these instruments for TIA surveillance and repair or replace faulty or damaged instruments where necessary.	4	Q4 2022
North Dyke	2021-02	Absence of riprap on the upstream slope, resulting in erosion damage.	None	Adequately sized riprap should be placed in locations that do not have riprap protection.	2	Q4 2021 / in progress
TIA	2021-03	Previous stability assessments were based on limited site characterization data.	None	Update stability assessments and review filter compatibility for the dykes based on the 2018 and 2020 site investigation data.	4	Q4 2023
TIA	2021-04	Failure modes have not been evaluated to determine if they are credible.	None	Perform a credible failure modes assessment.	4	Q4 2022
Main Pond Spillway, Polishing Pond Spillway	2021-05	The spillways are vulnerable to blockage by woody debris.	None	Develop a plan to manage debris in the pond and add to the OMS Manual.	3	Q4 2022
TIA Instrumentation	2021-06	The remote camera system for monitoring the staff gauge is vulnerable to water damage during high pond levels.	None	Relocate the remote camera system to above the high-water level of the Main Pond.	4	Q4 2022

7 CLOSING

We thank you for the opportunity to work on this project. Should you have any questions, please do not hesitate to contact the undersigned.

KLOHN CRIPPEN BERGER LTD.

Daniel Klassen, P.Eng.
Geotechnical Engineer

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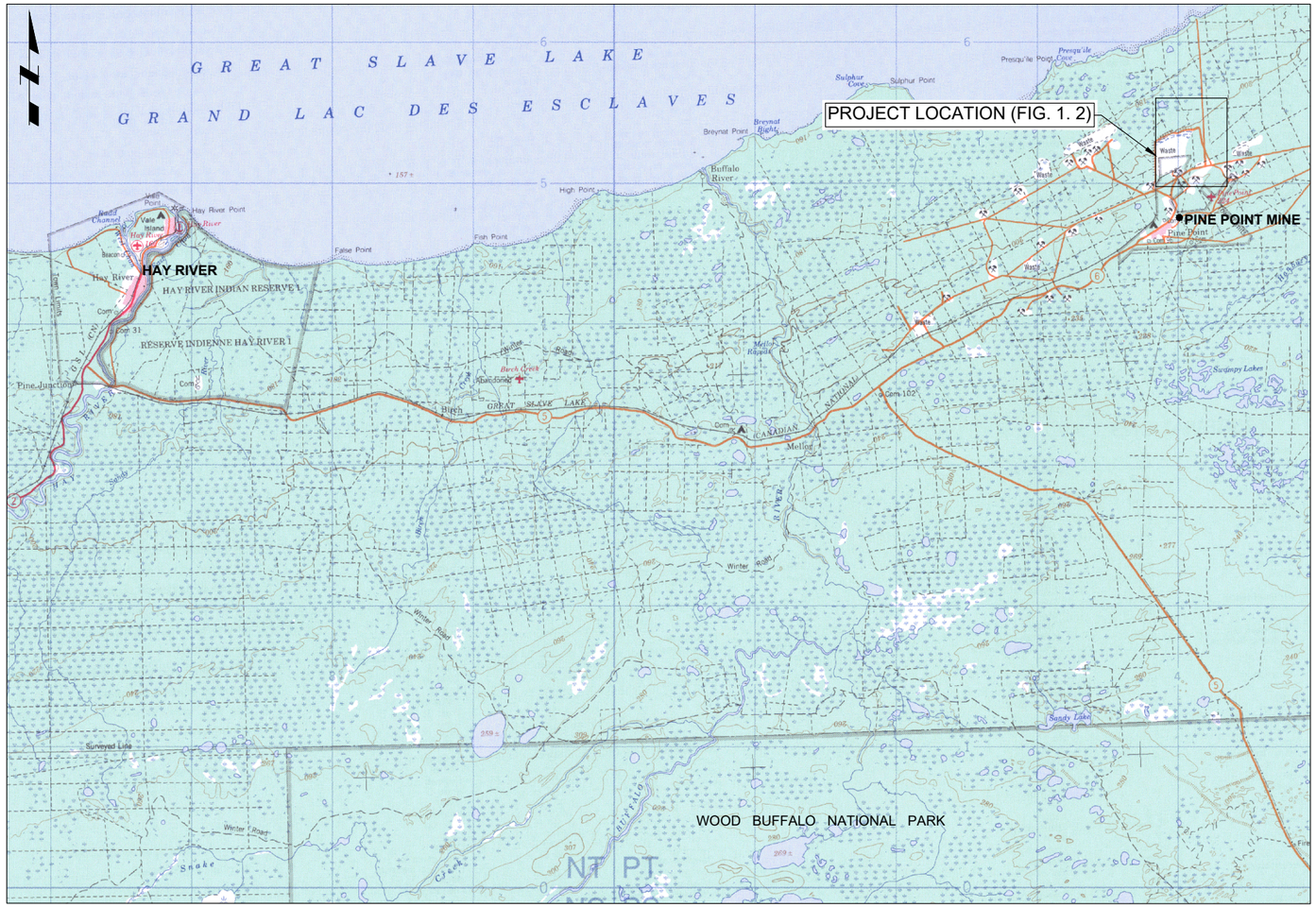
FIGURES

INSET MAP
NOT TO SCALE



SITE LOCATION PLAN
SCALE A

NOTE

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE REPORT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA, 2021 ANNUAL SUMMARY OF TAILINGS FACILITY PERFORMANCE

REFERENCES

1. TOPOGRAPHIC MAP OBTAINED FROM NATURAL RESOURCES CANADA
2. PROJECTION: TRANSVERSE MERCATOR. DATUM: NAD83 (CSRS), COORDINATE SYSTEM: UTM ZONE 11N

LEGEND

- ROAD
- RIVER
- WATER BODY
- NATIONAL PARK

SCALE A 0 10 km

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CLIENT: Teck

Klohn Crippen Berger

PROJECT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: SITE LOCATION PLAN

SCALE	PROJECT No.	FIG. No.
AS SHOWN	M10397A01	1. 1

KCB-FIG-D-L

SAVE DATE: 2021-09-14 (12:22 PM)
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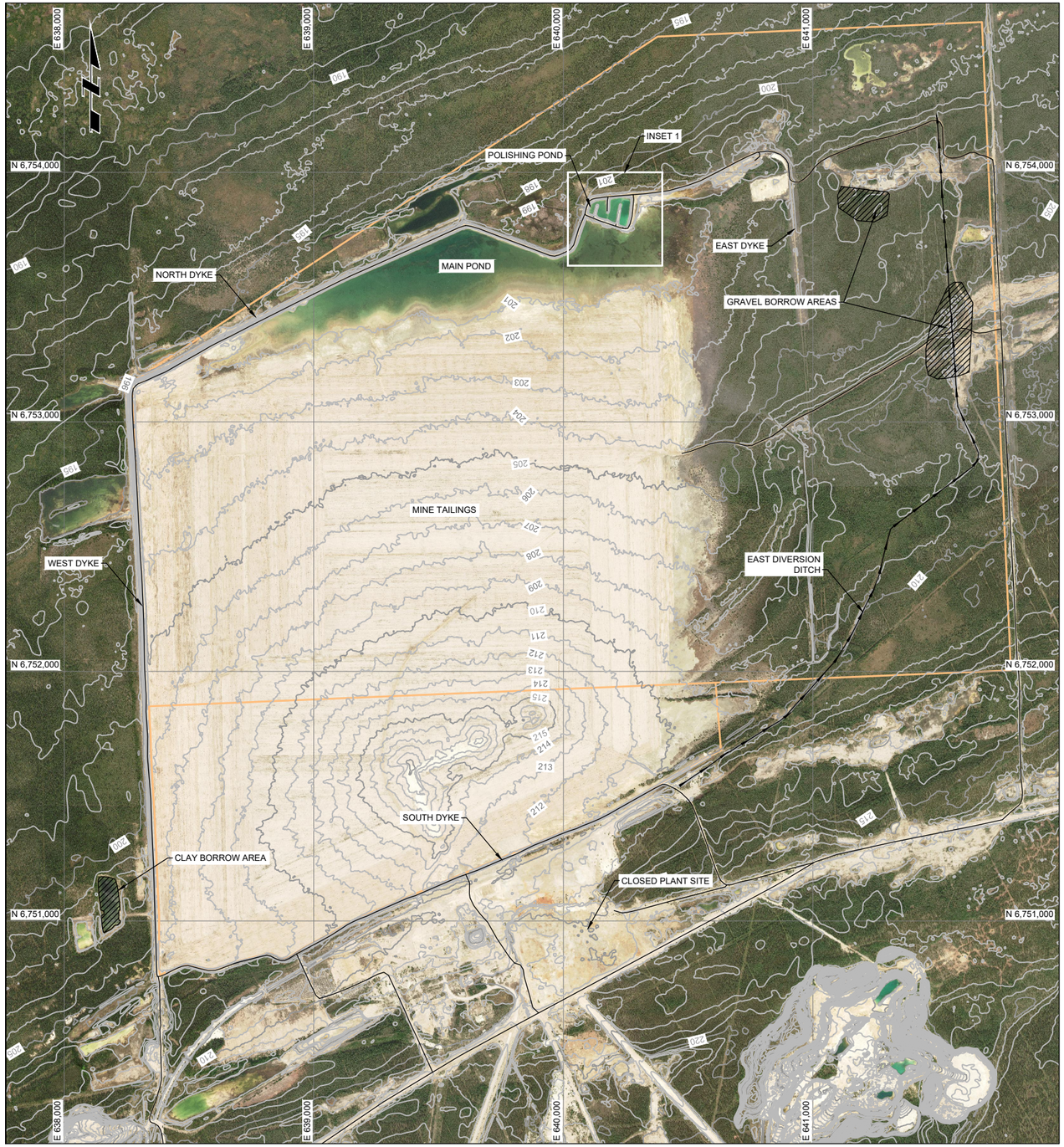

SITE PLAN
SCALE A

INSET 1 : POLISHING POND PLAN
SCALE B

NOTES
1. ALL UNITS ARE IN METRES UNLESS OTHERWISE SPECIFIED.
2. GRID IS DISPLAYED IN UTM NAD83, ZONE11. ELEVATIONS SHOWN IN METRES.
3. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE REPORT:
   PINE POINT MINE TAILINGS IMPOUNDMENT AREA,
   2021 ANNUAL SUMMARY OF TAILINGS FACILITY PERFORMANCE

REFERENCES
1. SURFACE LEASE BOUNDARY OBTAINED FROM TECK METALS LTD.
   FILE NAME: PinePoint_LeaseRoads_2021721.zip
2. IMPOUNDMENT AREA TOPOGRAPHIC AND ORTHOPHOTO DATA OBTAINED FROM TECK METALS LTD.
   FILE NAME: PinePoint_2019_1m_contours.dwg
   pine_point_wo4077_ortho_tile01-09.zip

LEGEND
- PINE POINT MINE SURFACE LEASE BOUNDARY
- TAILINGS IMPOUNDMENT AREA ACCESS ROAD
- MAJOR TOPOGRAPHIC CONTOUR (INTERVAL= 5m)
- MINOR TOPOGRAPHIC CONTOUR (INTERVAL = 1m)
- EAST DIVERSION DITCH
- EXISTING BORROW AREA

SCALE B 0 50 m

SCALE A 0 500 m

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CLIENT: Teck

Klohn Crippen Berger

PROJECT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: SITE LAYOUT
TAILINGS IMPOUNDMENT AREA

SCALE	PROJECT No.	FIG. No.
AS SHOWN	M10397A01	1. 2

KCB-FIG-D-L

SAVE DATE: 2021-10-20 (10:48 AM)
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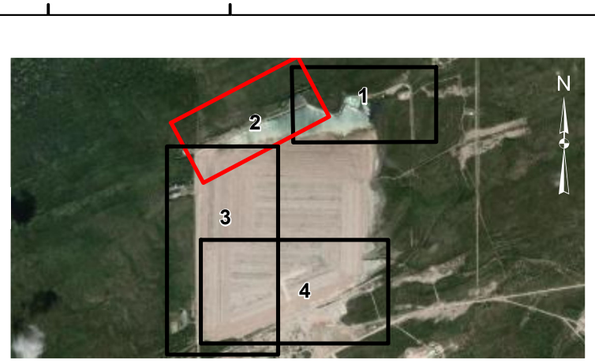

KEY PLAN

INSET FIGURE 2

LEGEND

SLOPE GRADIENT

- ≥ 2H:1V
- 2H:1V - 1.75H:1V
- 1.75H:1V - 1.5H:1V
- < 1.5H:1V

0 200 Meters

NOTES:
1. DATUM/PROJECTION: NAD83, ZONE 17N.
2. IMAGERY DATA SOURCE: ESRI.

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CLIENT: Teck

Klohn Crippen Berger

PROJECT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: NORTH DYKE DOWNSTREAM SLOPE GRADIENT

SCALE	PROJECT No.	FIG No.
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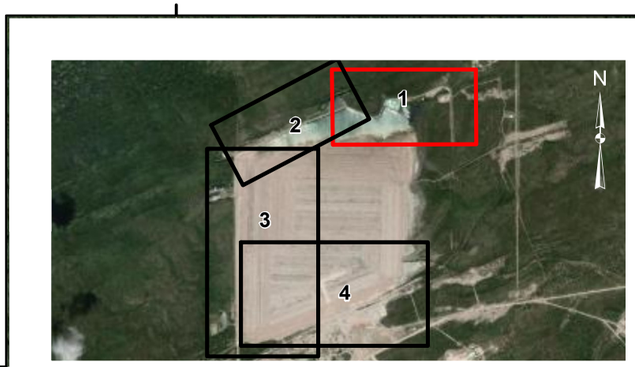

KEY PLAN

INSET FIGURE 1

LEGEND

SLOPE GRADIENT

- ≥ 2H:1V
- 2H:1V - 1.75H:1V
- 1.75H:1V - 1.5H:1V
- < 1.5H:1V

NOTES:
1. DATUM/PROJECTION: NAD83, ZONE 17N.
2. IMAGERY DATA SOURCE: ESRI.

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CLIENT: Teck

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PROJECT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: EAST AND NORTH DYKE DOWNSTREAM SLOPE GRADIENT

SCALE	PROJECT No.	FIG No.
1:4,500	M10397A01	1.4

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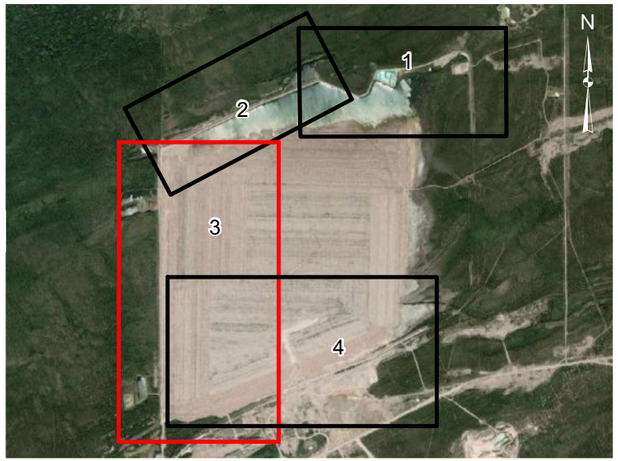

KEY PLAN

SOUTH DYKE

WEST DYKE

N 638,750

N 638,000

E 6,752,750

E 6,752,000

E 6,751,250

LEGEND

SLOPE GRADIENT

- ≥ 2H:1V
- 2H:1V - 1.75H:1V
- 1.75H:1V - 1.5H:1V
- < 1.5H:1V

INSET FIGURE 3

0 300 Meters

NOTES:
1. DATUM/PROJECTION: NAD83, ZONE 17N.
2. IMAGERY DATA SOURCE: ESRI.

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CLIENT: Teck

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PROJECT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: WEST DYKE DOWNSTREAM SLOPE GRADIENT

SCALE	PROJECT No.	FIG No.
1:6,500	M10397A01	1.5

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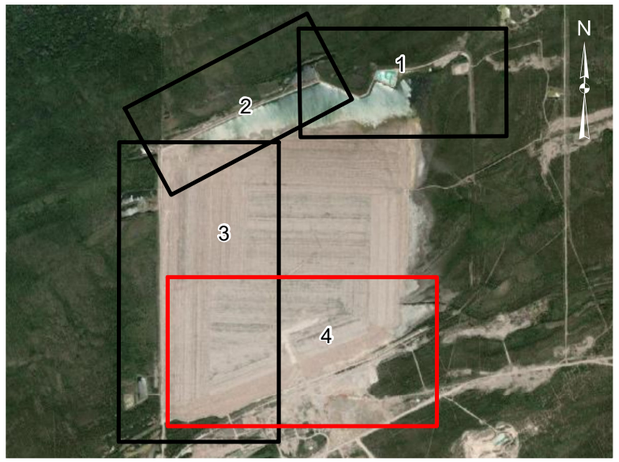

KEY PLAN

INSET FIGURE 4

LEGEND

SLOPE GRADIENT

- ≥ 2H:1V
- 2H:1V - 1.75H:1V
- 1.75H:1V - 1.5H:1V
- < 1.5H:1V

NOTES:
1. DATUM/PROJECTION: NAD83, ZONE 17N.
2. IMAGERY DATA SOURCE: ESRI.

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CLIENT: Teck

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PROJECT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: SOUTH DYKE DOWNSTREAM SLOPE GRADIENT

SCALE	PROJECT No.	FIG No.
1:6,000	M10397A01	1.6

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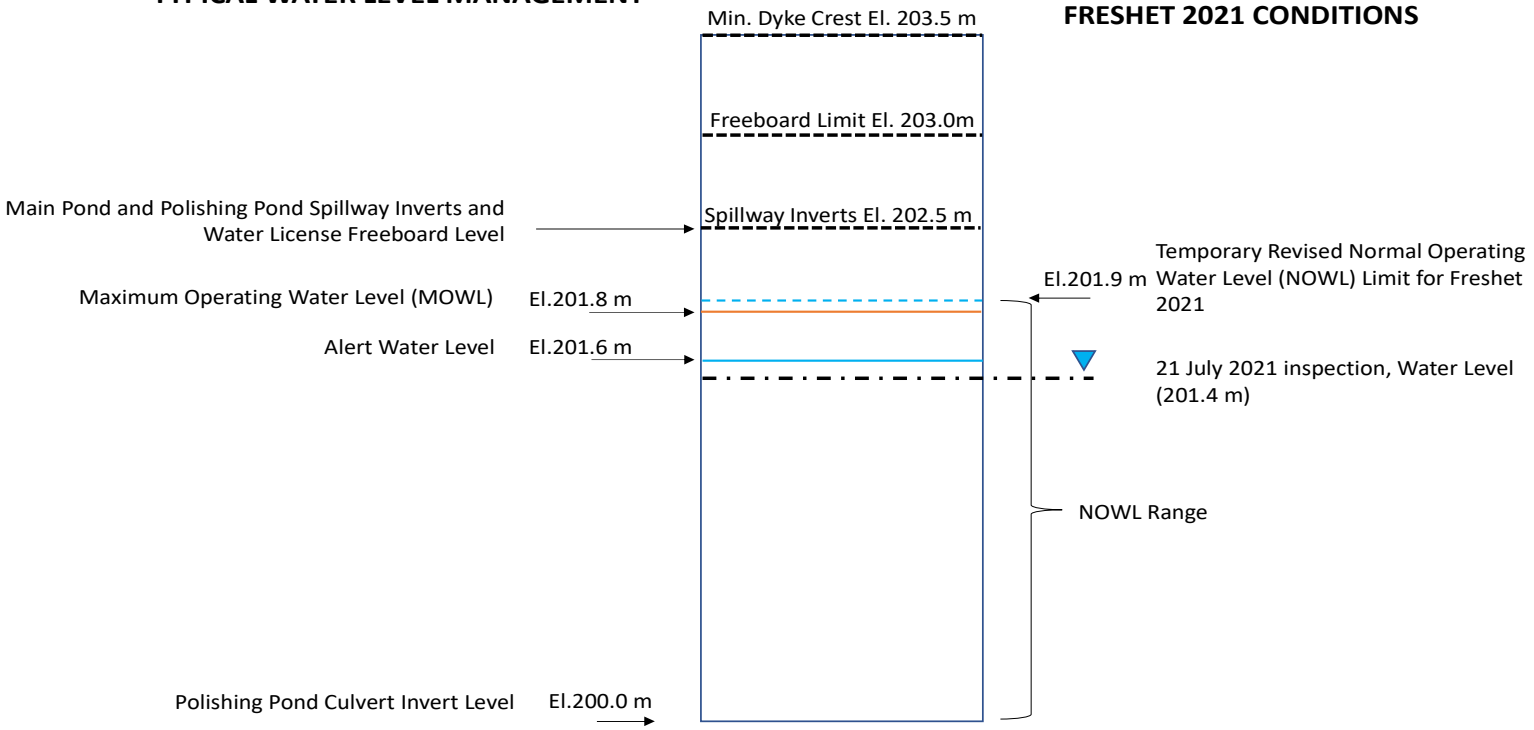
TYPICAL WATER LEVEL MANAGEMENT

WATER LEVEL MANAGEMENT FRESHET 2021 CONDITIONS



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CLIENT: Teck

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PROJECT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: MAIN POND - WATER LEVEL MANAGEMENT

PROJECT No.: M10397A01

FIG No.: 3.1

NOTES

IMAGERY DATA SOURCE: ESRI
DATA PROJECTION: NAD83, ZONE 17N
ALL LOCATIONS SHOWN ARE APPROXIMATE
FIGURE NOT TO SCALE

LEGEND

(1) OBSERVATION NUMBER (SEE REPORT SECTION 4.1)

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CLIENT: Teck

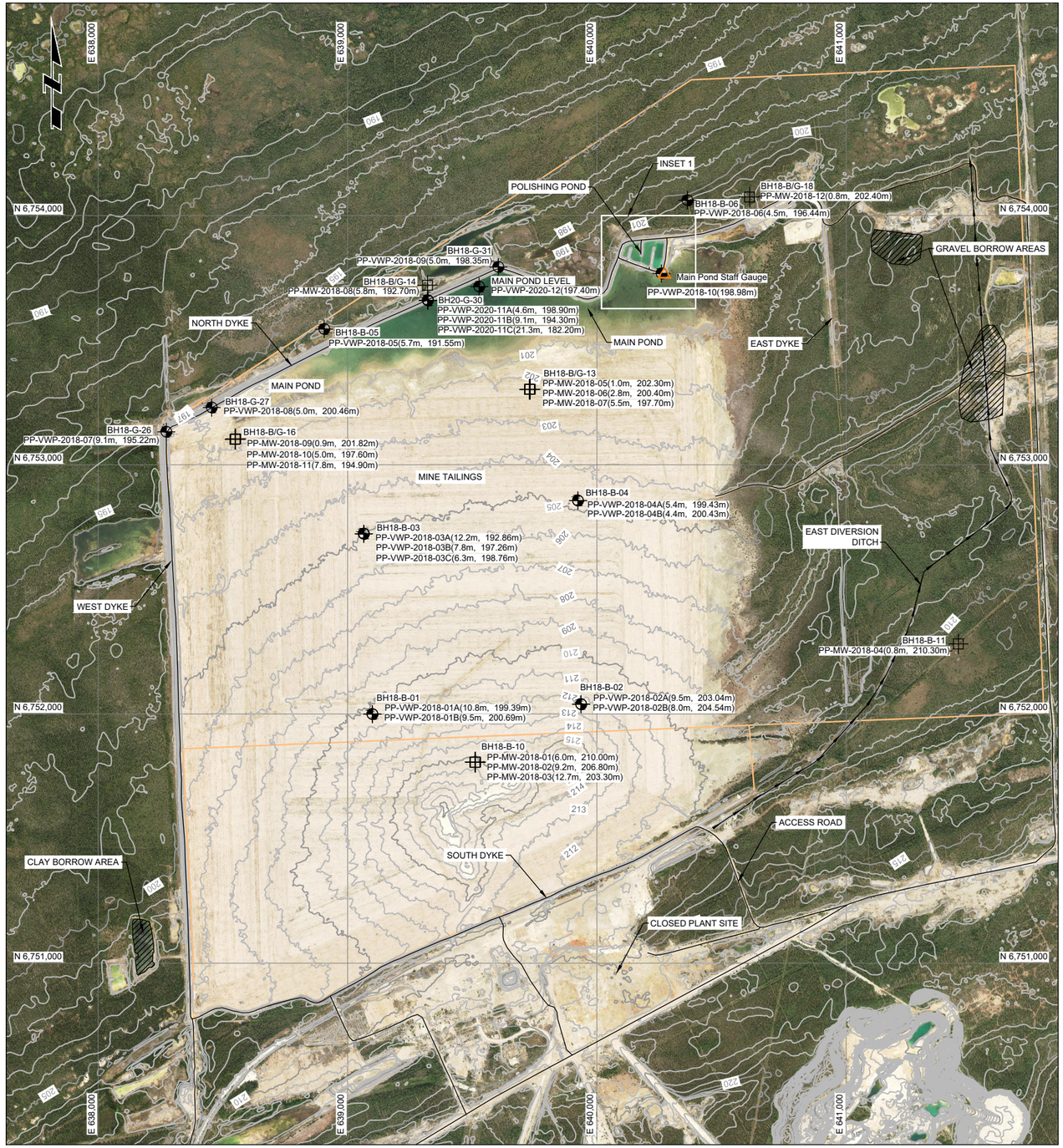
Klohn Crippen Berger

PROJECT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: JULY 2021 OBSERVATION LOCATIONS

PROJECT No.: M10397A01

FIG No.: 4.1



SITE PLAN
SCALE A

INSET 1 : POLISHING POND PLAN
SCALE B

PIEZOMETER INSTALL
PP-VWP-2018-02A(8.0m, 202.12m)
PINE POINT
VIBRATING WIRE PIEZOMETER
YEAR
NUMBER
(DEPTH OF TIP m, ELEVATION OF TIP m)

MONITORING WELL INSTALL
PP-MW-2018-02(6.0m, 198.12m)
PINE POINT
MONITORING WELL
YEAR
NUMBER
(DEPTH TO TOP OF SCREEN m, ELEVATION OF TOP OF SCREEN m)

SCALE B 0 50 m
SCALE A 0 500 m

NOTES

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE SPECIFIED.
2. GRID IS DISPLAYED IN UTM NAD83, ZONE11. ELEVATIONS SHOWN IN METRES.
3. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE REPORT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA, 2021 ANNUAL SUMMARY OF TAILINGS FACILITY PERFORMANCE

REFERENCES

1. SURFACE LEASE BOUNDARY OBTAINED FROM TECK METALS LTD. FILE NAME: PinePoint_LeaseRoad_2021721.shp
2. IMPOUNDMENT AREA TOPOGRAPHIC AND ORTHOPHOTO DATA OBTAINED FROM TECK METALS LTD. FILE NAME: PinePoint_2019_1m_coutours.dwg pine_point_wo4077_ortho_tile01-09.zip

LEGEND

- PINE POINT MINE SURFACE LEASE BOUNDARY
- TAILINGS IMPOUNDMENT AREA ACCESS ROAD
- MAJOR TOPOGRAPHIC CONTOUR (INTERVAL= 5m)
- MINOR TOPOGRAPHIC CONTOUR (INTERVAL = 1m)
- EAST DIVERSION DITCH
- EXISTING BORROW AREA
- EXISTING VIBRATING WIRE PIEZOMETER
- EXISTING MONITORING WELL
- STAFF GAUGE

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CLIENT: Teck

Klohn Crippen Berger

PROJECT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: INSTRUMENTATION AND MONITORING WELL PLAN

SCALE	PROJECT No.	FIG. No.
AS SHOWN	M10397A01	4. 2

KCB-FIG-0-L

SAVE DATE: 2021-10-20 (10:57 AM)
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APPENDIX I

Facility Data Sheet

Appendix I
Facility Data Sheet

PINE POINT MINE TAILINGS IMPOUNDMENT AREA

PHYSICAL DESCRIPTION

Tailings Impoundment Area (including dykes)	Approximately 7,000,000 m^2
Tailings quantity impounded	Approximately 50,000,000 to 60,000,000 tonnes
Reservoir Capacity (to maximum operating water level of 201.8 m)	930,000 m^3
Consequence Classification	Significant (refer to descriptions for classification of individual dykes)
Inflow Design Flood (IDF)	Between 1/100 and 1/1000 annual exceedance frequency (based on consequence classification of Significant)
Design Earthquake	Between 1/100 and 1/1000 annual exceedance frequency (based on consequence classification of Significant)
Main Pond Spillway Capacity	Unknown
Polishing Pond Spillway Capacity	Unknown
Catchment Area	690 ha

PINE POINT MINE TAILINGS IMPOUNDMENT AREA
NORTH DYKE

PHYSICAL DESCRIPTION

Embankment Type	Earthfill
Maximum Embankment Height	9 m
Embankment Length	2.9 km
Embankment Crest Width	8 m (typical)
Embankment Downstream Slope Gradient	2H : 1V (typical)
Consequence Classification	Significant

PINE POINT MINE TAILINGS IMPOUNDMENT AREA
WEST DYKE

PHYSICAL DESCRIPTION

Embankment Type	Earthfill
Maximum Embankment Height	9 m
Embankment Length	2.4 km
Embankment Crest Width	6 m (typical)
Embankment Downstream Slope Gradient	2H : 1V (typical)
Consequence Classification	Significant

PINE POINT MINE TAILINGS IMPOUNDMENT AREA
EAST DYKE

PHYSICAL DESCRIPTION

Embankment Type	Earthfill
Maximum Embankment Height	2 m
Embankment Length	0.8 km
Embankment Crest Width	6.5 m (typical)
Embankment Downstream Slope Gradient	2H : 1V (typical)
Consequence Classification	Low

PINE POINT MINE TAILINGS IMPOUNDMENT AREA
SOUTH DYKE

PHYSICAL DESCRIPTION

Embankment Type	Earthfill
Maximum Embankment Height	6 m
Embankment Length	2.5 km
Embankment Crest Width	5 m (typical)
Embankment Downstream Slope Gradient	2H : 1V (typical)
Consequence Classification	Low

APPENDIX II

July 2021 Photographs

Appendix II
July 2021 Photographs

Photo II-1 South Dyke – looking southwest, minor rutting

Photo II-2 South Dyke – looking northeast, minor rills on upstream slope, exposed tailings

Photo II-3 South Dyke – looking northwest, minor rills on upstream slope

Photo II-4 South Dyke – looking southwest, minor rills on upstream slope

Photo II-5 South Dyke – looking northeast, minor rills on upstream slope

Photo II-6 South Dyke – looking northeast, minor rills on downstream slope

Photo II-7 South Dyke – looking southwest (note steep downstream slope)

Photo II-8 South Dyke – looking northeast, standing water at downstream toe

Photo II-9 South Dyke – looking northeast, exposed tailings at upstream toe

Photo II-10 South Dyke – looking southeast, standing water at downstream toe

Photo II-11 South Dyke – looking west, vegetation on downstream slope

Photo II-12 West Dyke – looking north, minor vegetation on downstream slope

Photo II-13 West Dyke – looking south, red staining at former seepage point

Photo II-14 West Dyke – looking east, erosion of tailings cover

Photo II-15 West Dyke – looking north, water ponding at downstream toe

Photo II-16 West Dyke – looking west, seepage and pond downstream of dyke

Photo II-17 West Dyke – northwest corner, looking southeast, new erosion rill with sediment fan on downstream slope

Photo II-18 North Dyke – looking south, minor slope repair on downstream slope

Photo II-19 North Dyke – looking northeast, edge of pond

Photo II-20 North Dyke – looking west, slumping and erosion along toe of upstream slope

Photo II-21 North Dyke – head scarp of slump along upstream toe

Photo II-22 North Dyke – looking east, minor erosion on upstream slope

Photo II-23 North Dyke – looking east, riprap placed on upstream slope

Photo II-24 North Dyke – looking northeast, pond near downstream toe

Photo II-25 North Dyke – looking east, slumping and erosion on upstream slope

Photo II-26 North Dyke – looking north, slumping and erosion on upstream slope

Photo II-27 North Dyke – looking east, slumping and erosion on upstream slope

Photo II-28 North Dyke – looking north, slumping and erosion on upstream slope

Photo II-29 East Dyke – looking south, ponding near upstream slope, vegetation present on both sides of dyke

Photo II-30 East Dyke – looking southeast, rill observed on downstream slope

Photo II-31 East Dyke – looking north, vegetation on downstream slope and ponding at toe

Photo II-32 Main Pond Spillway – looking southwest, erosion and slumping of upstream slope on either side of spillway wing walls

Photo II-33 Polishing Pond – looking northeast, water observed bubbling above culvert outlet(p87)

Photo II-34 Polishing Pond – looking southwest, staff gauge flagged for multiple levels

Photo II-35 Polishing Pond Spillway – looking northwest, pond outlet pipes (est. 20,000m^3/day outflow)

Photo II-36 Polishing Pond Spillway Inlet – looking northwest

APPENDIX III

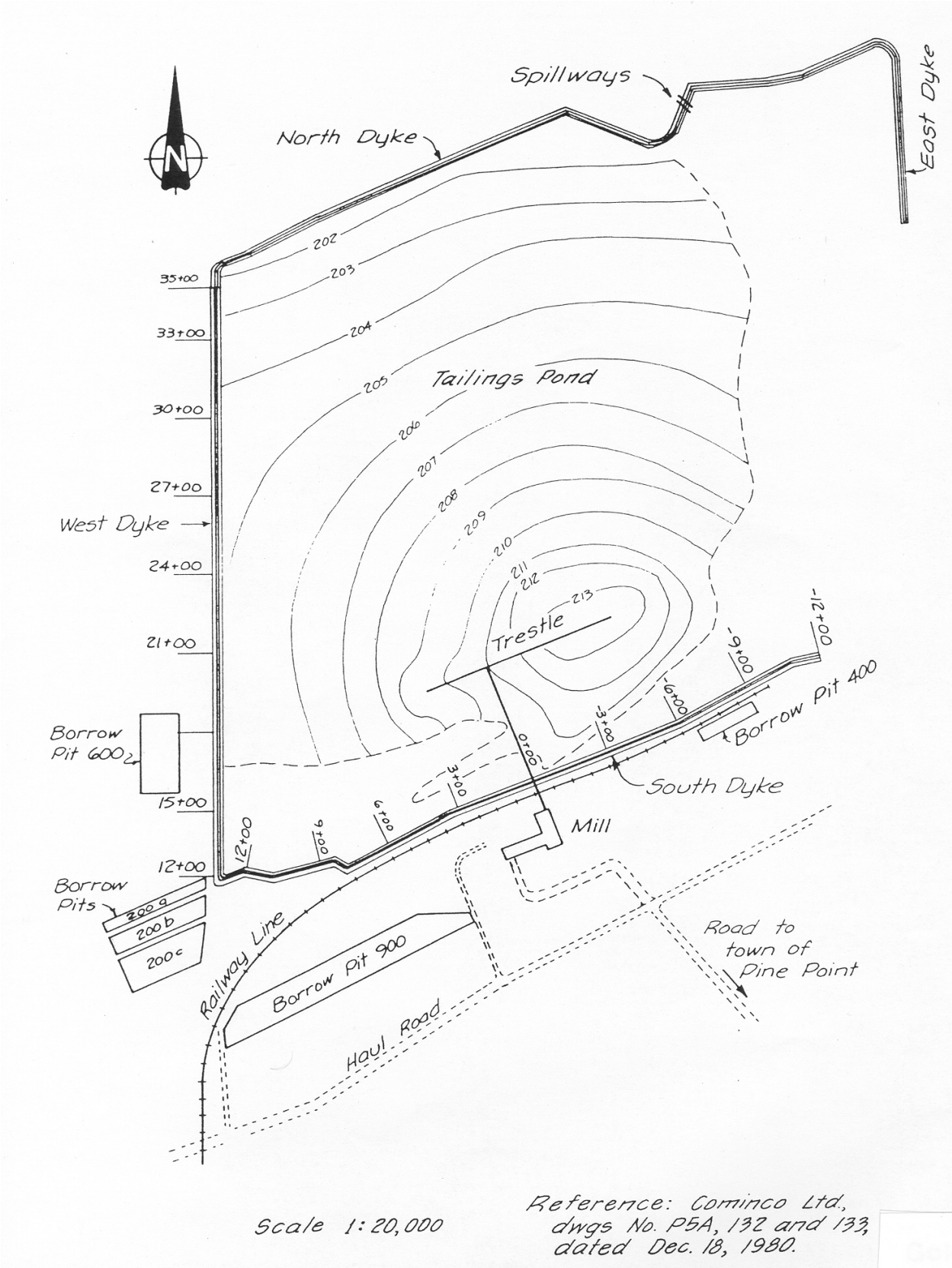
July 2021 Inspection Form

Teck Metals Ltd
Tailings Impoundment Inspection Form
Pine Point Tailings Impoundment

Date: July 21, 2021		Inspected By: Daniel Klassen, P.Eng., and Bob Chambers, P.Eng.
Weather: Cloudy, with sunny periods. 22 °C		
Tailings Pond Information:		
Pond Elevation: 201.40 m		Operating Limits: Alert 201.6 m, Max Op. 201.8m, NOWL of 201.9 m for 2021 freshet.
Crest Elevation: 203.50 m		Freeboard: 2.1 m
Dyke Inspection Check List (✓ = checked and no problems; x = not checked)		
Check: Upstream Slope of Dyke, Crest and Downstream Slope of Dyke		
South Dyke	**Checked**	**Comment**
Ponded Water	✓	Ponds downstream at southeast of TIA, and 600 m east of southwest corner. U/S dry.
Erosion	✓	Upstream slope has minor rills on east side of dyke. Some areas with minor rills on downstream slope (west side).
Settlement/Depressions	✓	No settlement observed but minor rutting at east end on the crest.
Cracks/Movement	✓	None.
Debris: on upstream side.	✓	None.
Vegetation	✓	Minor vegetation on downstream and upstream slopes.
Other – (photos)		
Notes:		
West Dyke		
Ponded Water	✓	Two large ponds downstream of toe on north side. Upstream dry.
Erosion	✓	Erosion of cover exposes tailings near upstream slope at some locations. Minor rills on downstream slope at a few locations.
Settlement/Depressions (on dam crest)	✓	None.
Sinkholes	✓	None.
Cracks/Movement	✓	None.
Debris	✓	None.
Vegetation	✓	Sparse, minor vegetation on upstream and downstream slopes
Other – (photos)	✓	

Notes:		One larger rill near NW corner is up to 1 m wide and 0.4 m deep.

North Dyke	**Checked**	**Comment**
Ponded Water	✓	Main Pond begins approx. 300 m east of NW corner, continues across most of north dyke. Ponds downstream of toe.
Erosion	✓	Erosion along upstream toe, head scarp of slump 30 to 50 cm high.
Settlement/Depressions	✓	None.
Sinkholes	✓	None.
Cracks/Movement	✓	None.
Debris	✓	Woody debris along upstream slope at pond high water level.
Vegetation	✓	Minor vegetation on upstream and downstream slopes.
Main Pond Spillway	✓	Small ponds at d/s end.
Treatment Spillway	✓	5 siphons discharging.
Other – (photos)		
Notes:		
East Dyke		
Ponded Water	✓	Pond upstream at north end. Ponds downstream 150 m south of corner.
Erosion	✓	Minor rills on downstream slope.
Settlement/Depressions	✓	None.
Sinkholes	✓	None.
Cracks/Movement	✓	None.
Debris	✓	None.
Vegetation	✓	More vegetation than other dykes, both U/S and D/S. Some trunks > 20 mm in diameter.
Other – (photos)		
Notes:		


Spillways
East Dyke
North Dyke
N
202
203
204
205
Tailings Pond
206
207
208
209
210
211
212
213
Trestle
35+00
33+00
30+00
27+00
West Dyke
24+00
21+00
15+00
12+00
-12+00
-9+00
-6+00
-3+00
0+00
3+00
6+00
9+00
12+00
Borrow Pit 600
Borrow Pit 400
South Dyke
Mill
Borrow Pits
200a
200b
200c
Railway Line
Borrow Pit 900
Haul Road
Road to town of Pine Point
Scale 1:20,000
Reference: Cominco Ltd., dwgs No. P5A, 132 and 133, dated Dec. 18, 1980.

Tailings Impoundment Inspection
Explanation of Details

Ponded Water:

Look for pools of water against the inside or outside slopes of the Dyke structure. The pooled water is a potential source of water to erode the dyke and therefore the presence of any water must be recorded. Ideally the GPS location should be noted in the comments area.

Another aspect of pooled water is that it may be a source of seepage water at the outside toe of the dyke therefore where pooled water is observed look for increased seepage at the toe. The presence of water at the dyke face can be an indication of increased water levels within the dyke which can decrease Dyke stability.

Erosion:

The presence of small rills, up to 0.3m deep, on the downstream face of the dyke are normal and of no concern. If the rills start eroding into channels greater than 0.3 m and are cutting into the crest more than 0.5 m then the rills must be filled to prevent further progress.

Erosion can also be caused by wave action on the pooled water. Erosion has been occurring on the inside slope of the North Dyke and will soon require placement of material to armor the dyke face. Erosion into the till core must be prevented therefore any excessive erosion must be reported. Ideally record the GPS location so the area can be found on future inspections.

Settlement/Depressions:

Settlement or depressions in the crest or slopes indicate groundwater erosion of the interior of the dyke. Look for any visible seepage at the toe of the dyke. This is a very serious problem and it must be investigated by a professional.

Ideally record the GPS location so the depression can be easily found.

Sinkholes:

Sinkholes are localized deep depressions and are another indication of interior erosion of the dyke. This is a very serious problem and it must be investigated by a professional.

Ideally record the GPS location so the depression can be easily found.

Cracks/Movement:

Cracks accompanied by movement are an indication of a dyke failure and material would probably be seen flowing from the toe of the dyke. This is a very serious situation which must be reported immediately and be investigated by a professional. Ideally record the GPS location so the area can be easily found.

Debris:

Accumulation of debris on the dyke can prevent inspection of the dyke and should be removed.

Vegetation:

Small vegetation on the slopes of the dykes is good to minimize surface erosion. Larger vegetation hinders inspections of the dyke and can damage the dyke if root systems penetrate the till core or large root systems are ripped out by the wind. Therefore any trees on the dyke slopes over 1" diameter should be removed.

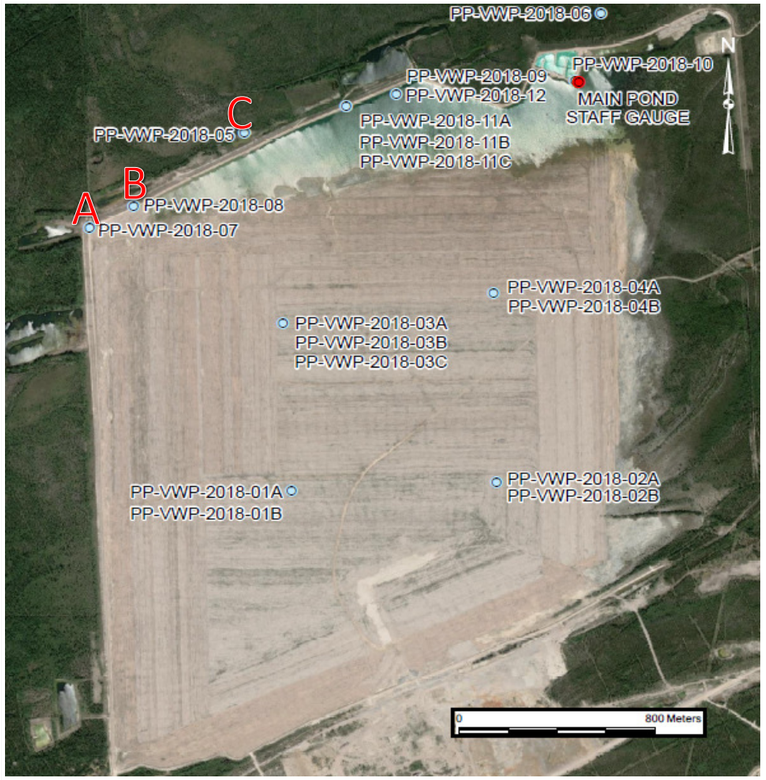
Photos:

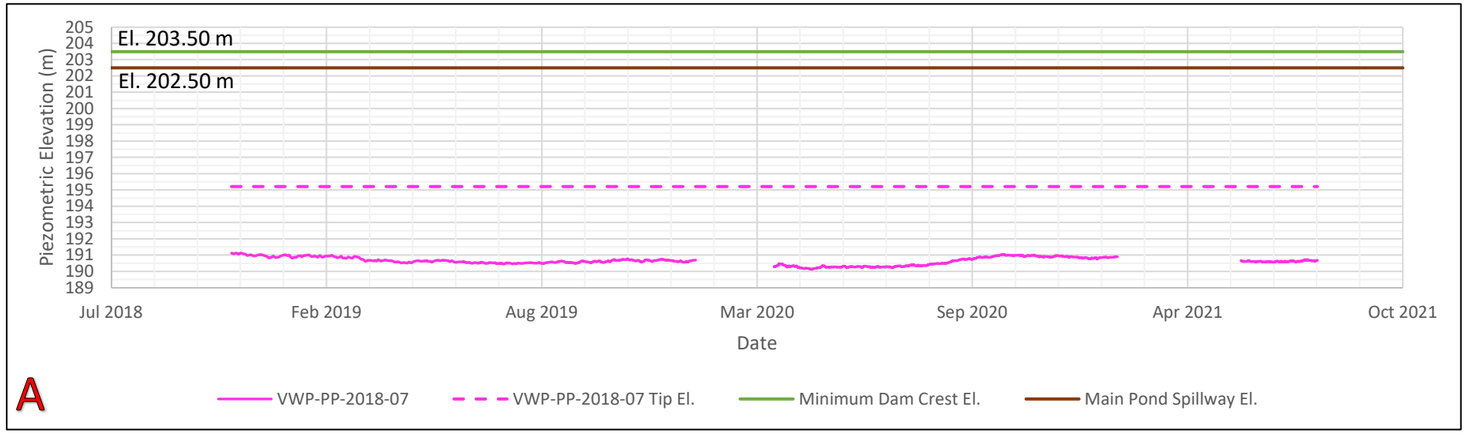
A log of photos should be maintained.

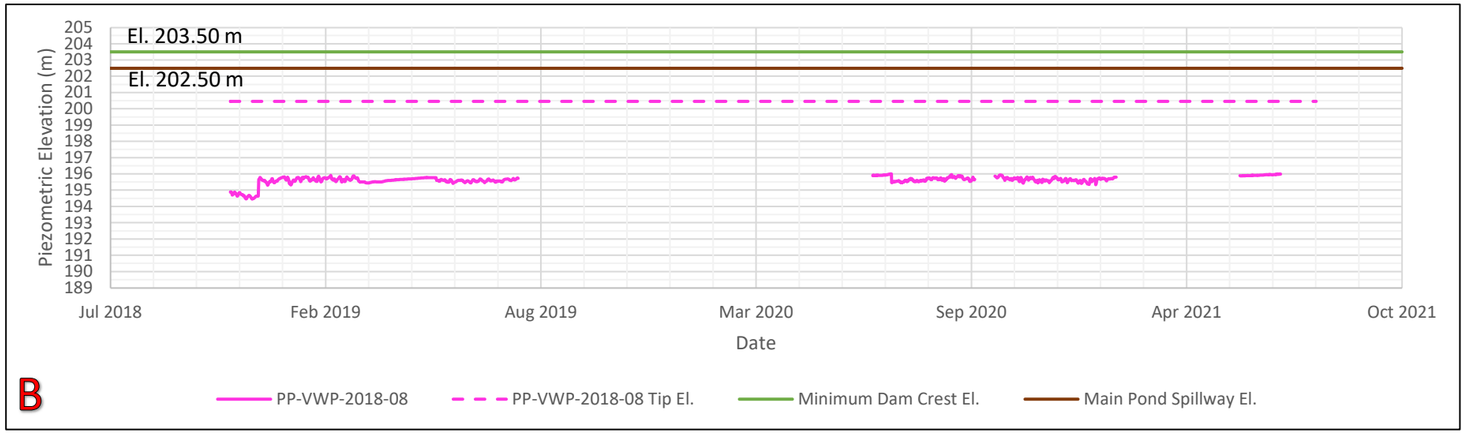
Locations of key photos should be noted so future photos are taken from the same spot of area looking at the same feature.

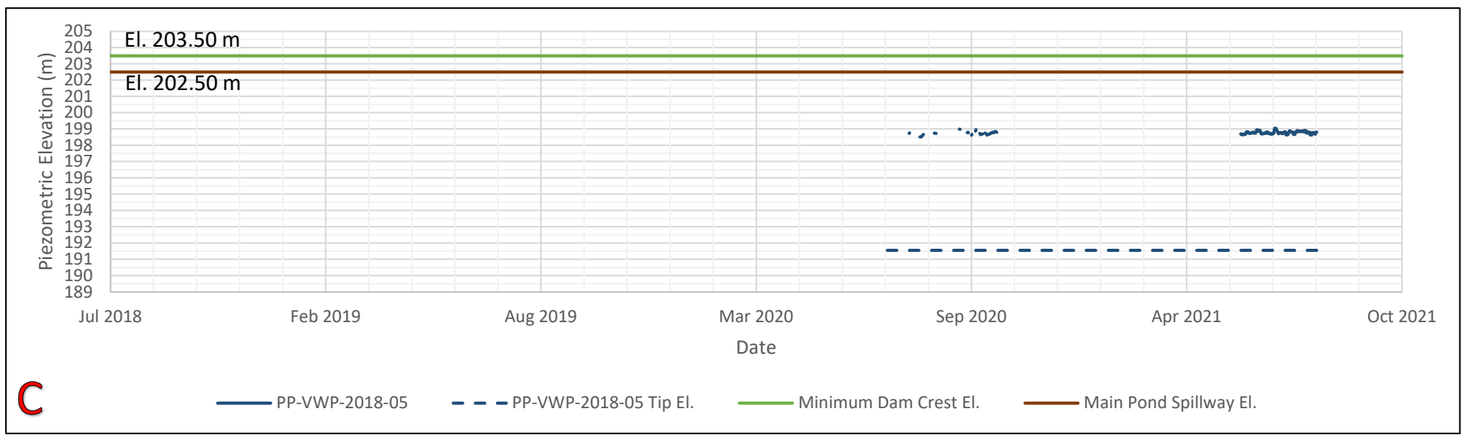
APPENDIX IV

Vibrating Wire Piezometer and Main Pond Level Plots









INSTRUMENTATION NOTES

A -Instrument PP-VWP-2018-07: Pressure head readings are negative. Piezometric levels cannot be determined from negative pressure readings.

B -Instrument PP-VWP-2018-08: Pressure head readings are negative. Piezometric levels cannot be determined from negative pressure readings.

C -Instrument PP-VWP-2018-05: Trigger action response plans (TARPS) are scheduled to be developed for this instrument. As such any malfunctioning instrument should be repaired or replaced (Golder, 2020)

FIGURE NOTES

IMAGERY DATA SOURCE: ESRI
DATA PROJECTION: NAD83, ZONE 17N
GOLDER 2020. 2020 ANNUAL INSPECTION PINE POINT TAILINGS IMPOUNDMENT AREA. DECEMBER 16, 2020.

LEGEND - VWP TIP INSTALL STRATA

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CLIENT: Teck

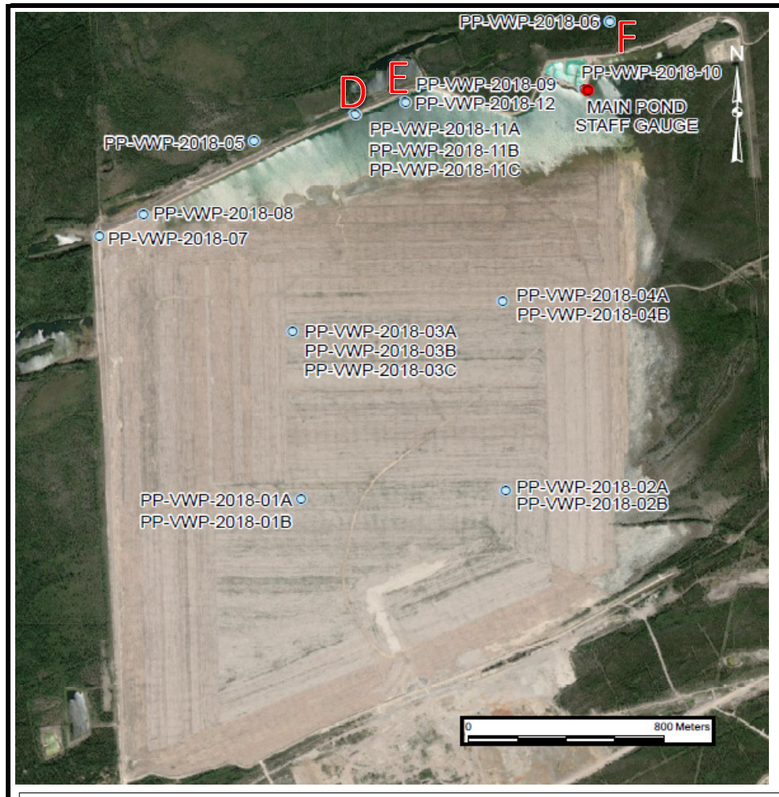
Klohn Crippen Berger

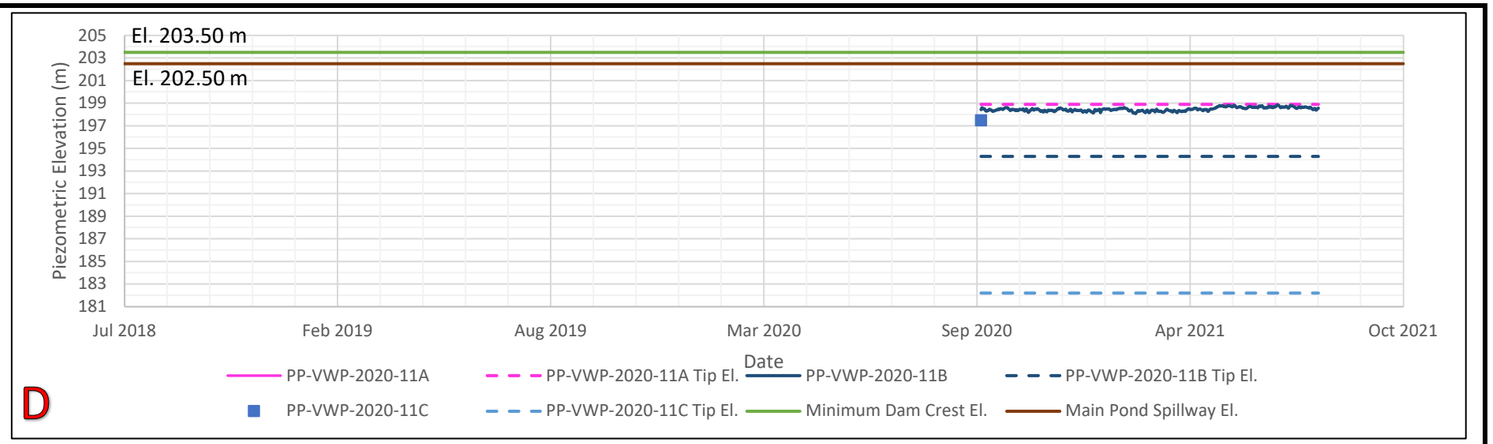
PROJECT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA
2021 ANNUAL FACILITY PERFORMANCE REVIEW

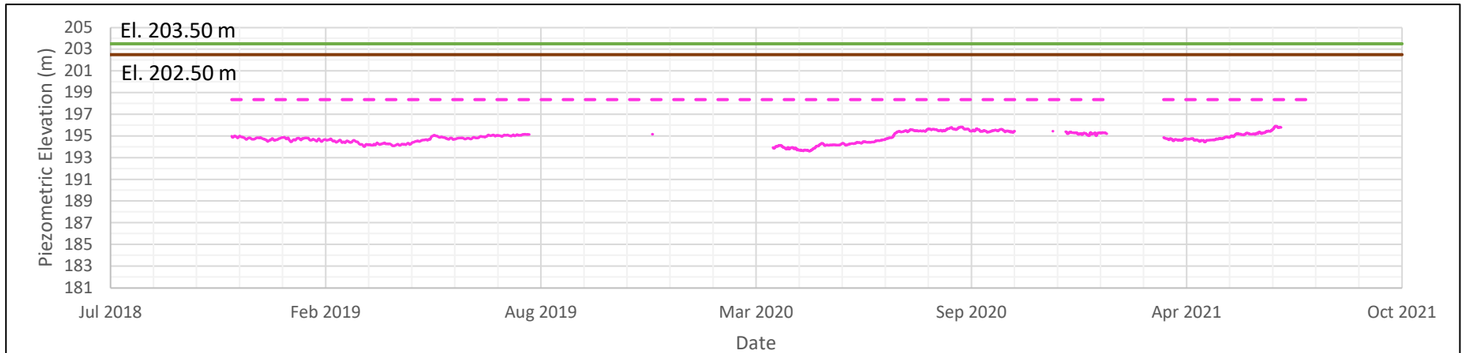
TITLE: NORTH DYKE PIEZOMETERS
SHEET 1 OF 2

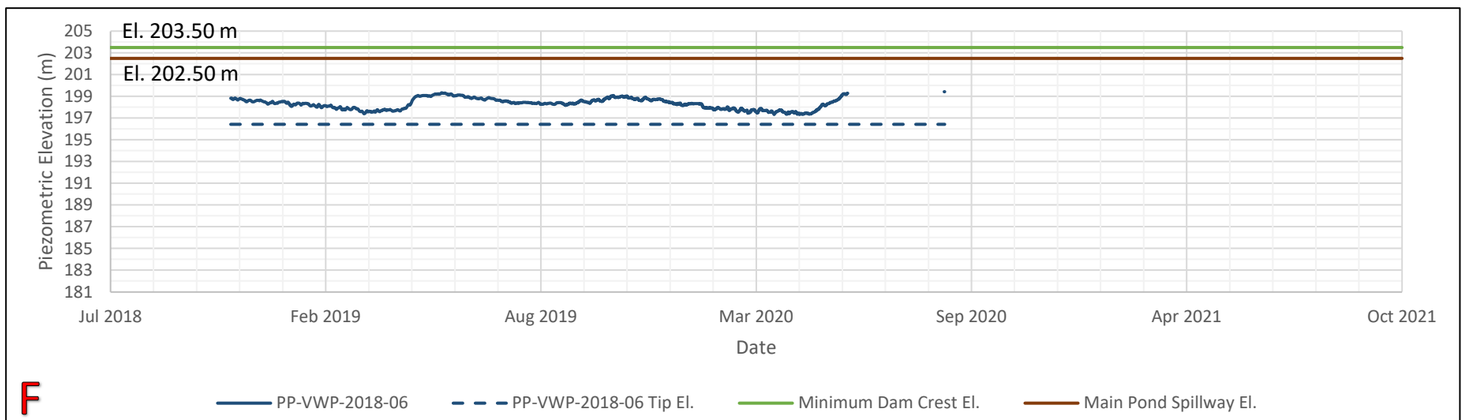
PROJECT No. M10397A01

FIG No. IV-1









INSTRUMENTATION NOTES

D -Instrument PP-VWP-2020-11A: Pressure head readings equivalent to a piezometric surface on the order of 400 m elevation (omitted).
-Instrument PP-VWP-2020-11C: Single reading available for instrument.

E -Instrument PP-VWP-2018-09: Pressure head readings are negative. Piezometric levels cannot be determined from negative pressure readings.

F -Instrument PP-VWP-2018-06: Pressure readings stopped recording 2020-09-30.

FIGURE NOTES

IMAGERY DATA SOURCE: ESRI
DATA PROJECTION: NAD83, ZONE 17N

LEGEND - VWP TIP INSTALL STRATA
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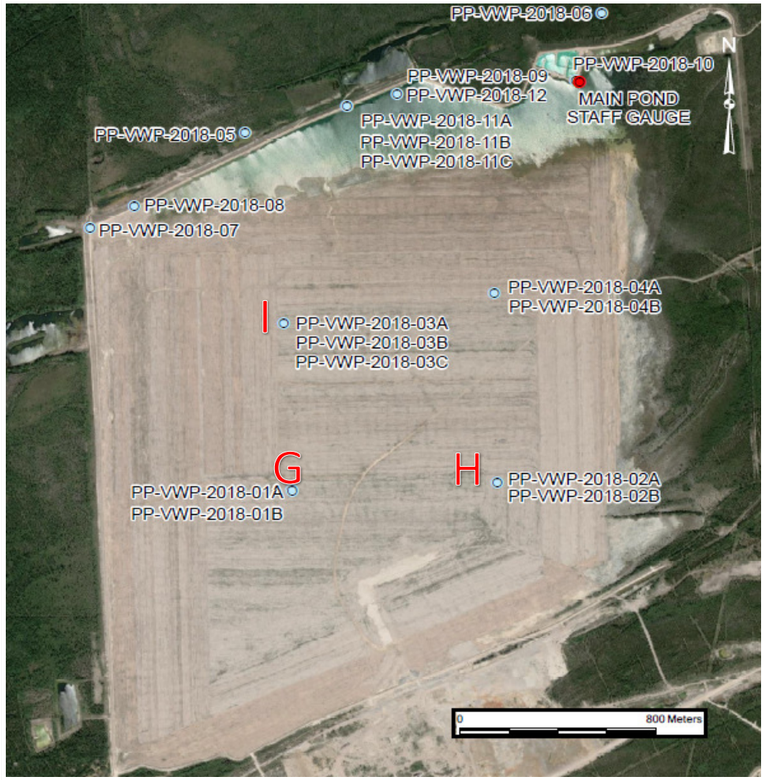
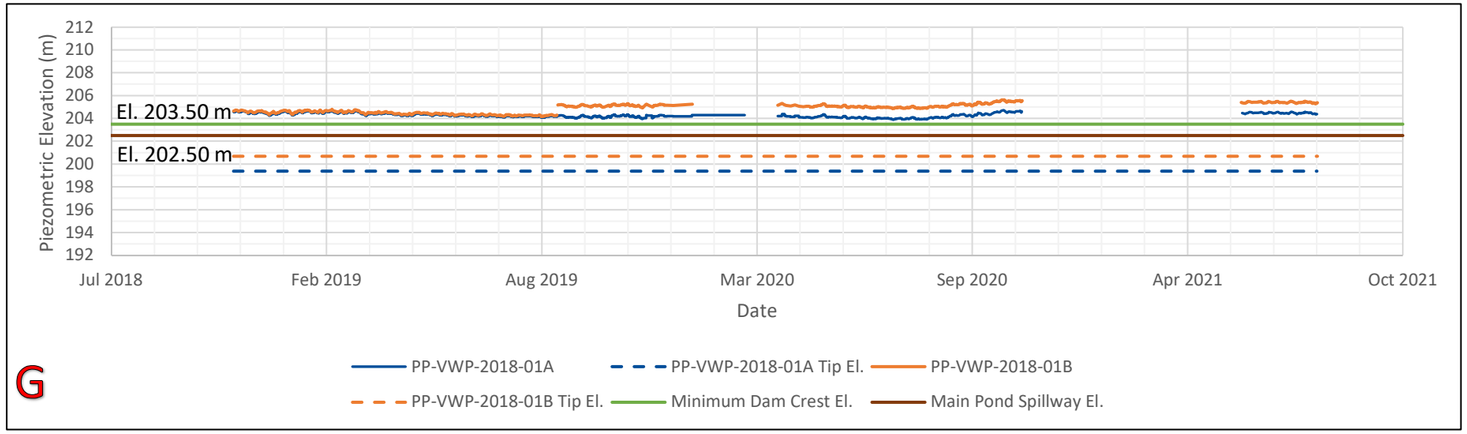
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: NORTH DYKE PIEZOMETERS
SHEET 2 OF 2

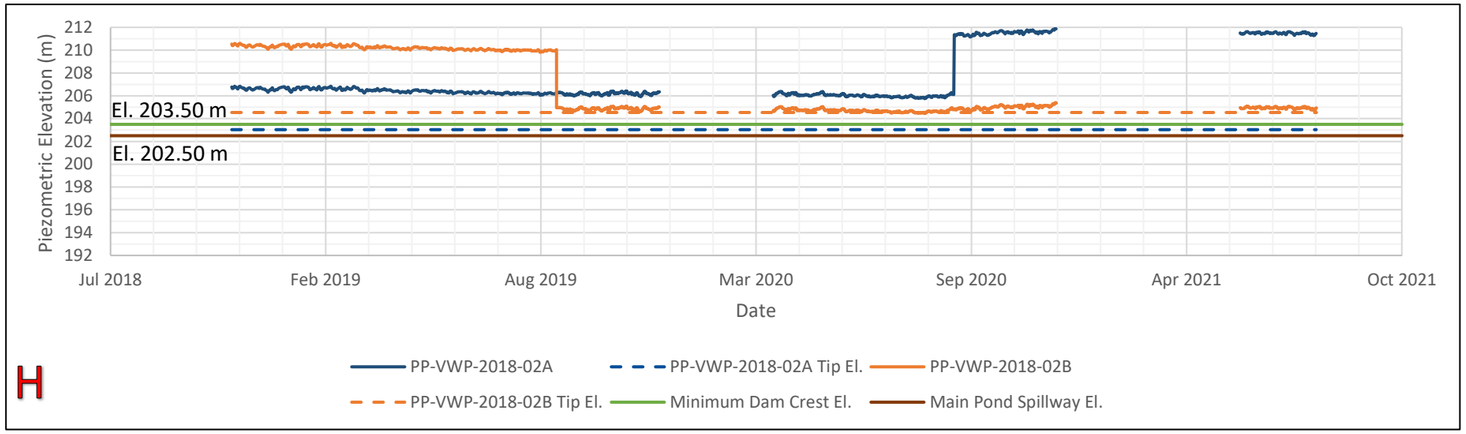
PROJECT No. M10397A01

FIG No. IV-2

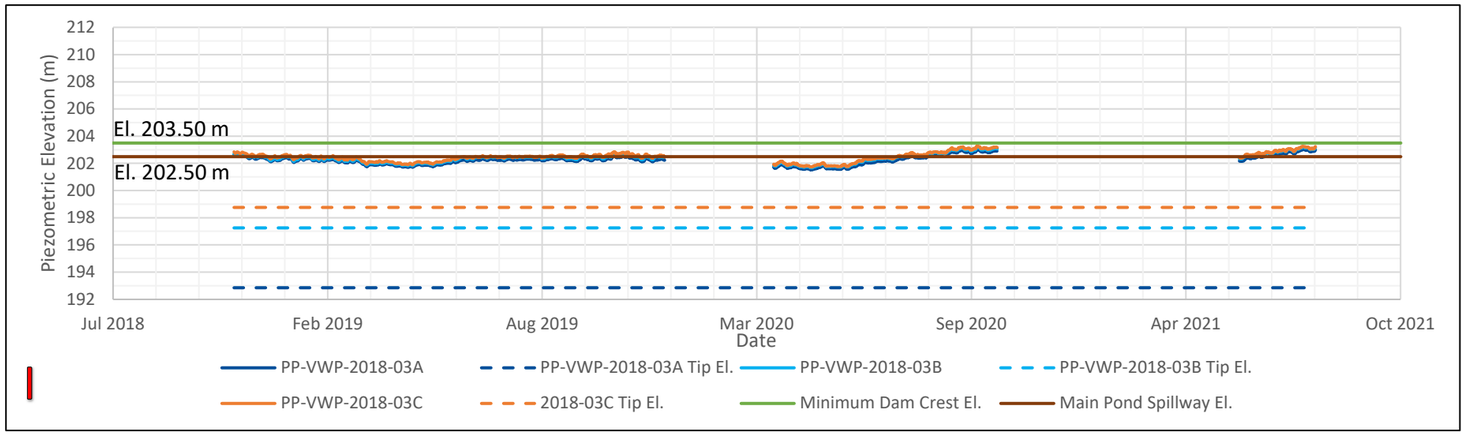




G



H



I

INSTRUMENTATION NOTES

G -Instrument PP-VWP-2018-01B: Considered not functioning as of 2020 DSI (Golder, 2020). Significant and instantaneous increase in pressure recorded is anomalous and unexplained.

H -Instrument PP-VWP-2018-02A and 02B: Considered not functioning as of 2020 DSI (Golder, 2020). Significant and instantaneous increase/decrease in pressure recorded is anomalous and unexplained.

FIGURE NOTES

IMAGERY DATA SOURCE: ESRI
DATA PROJECTION: NAD83, ZONE 17N

LEGEND - VWP TIP INSTALL STRATA

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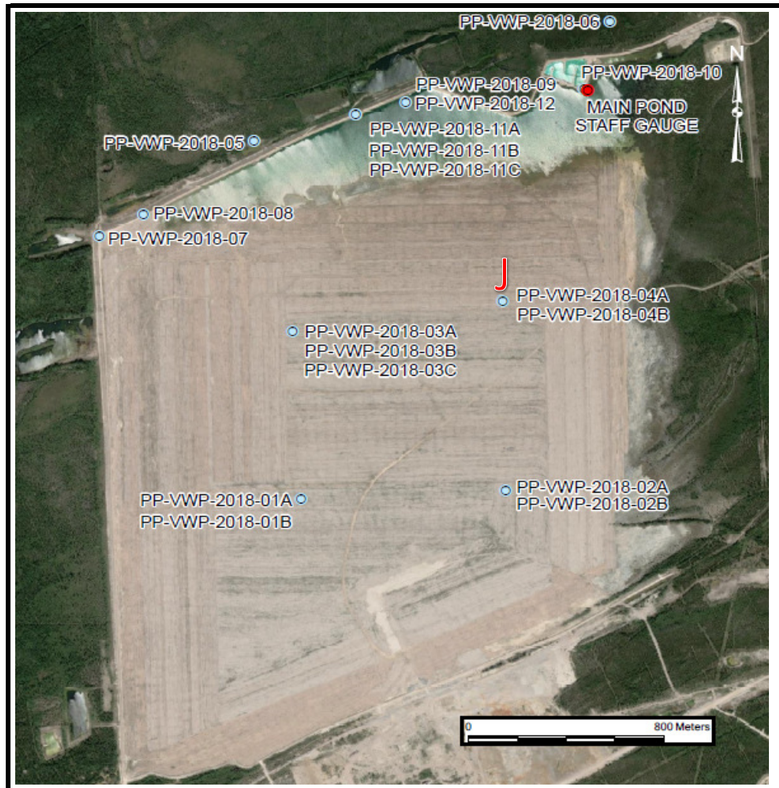
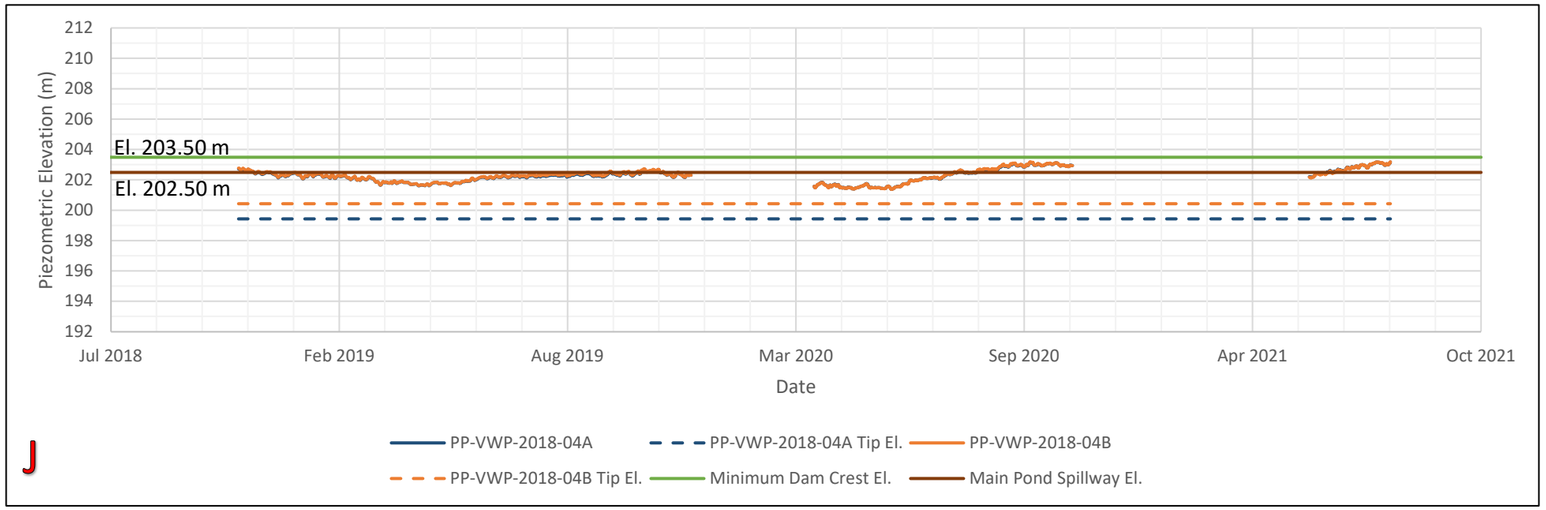
PROJECT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: TAILINGS FACILITY PIEZOMETERS
SHEET 1 OF 2

PROJECT No. M10397A01

FIG No. IV-3





INSTRUMENTATION NOTES

J -No current notes.

FIGURE NOTES

IMAGERY DATA SOURCE: ESRI
DATA PROJECTION: NAD83, ZONE 17N

LEGEND - VWP TIP INSTALL STRATA

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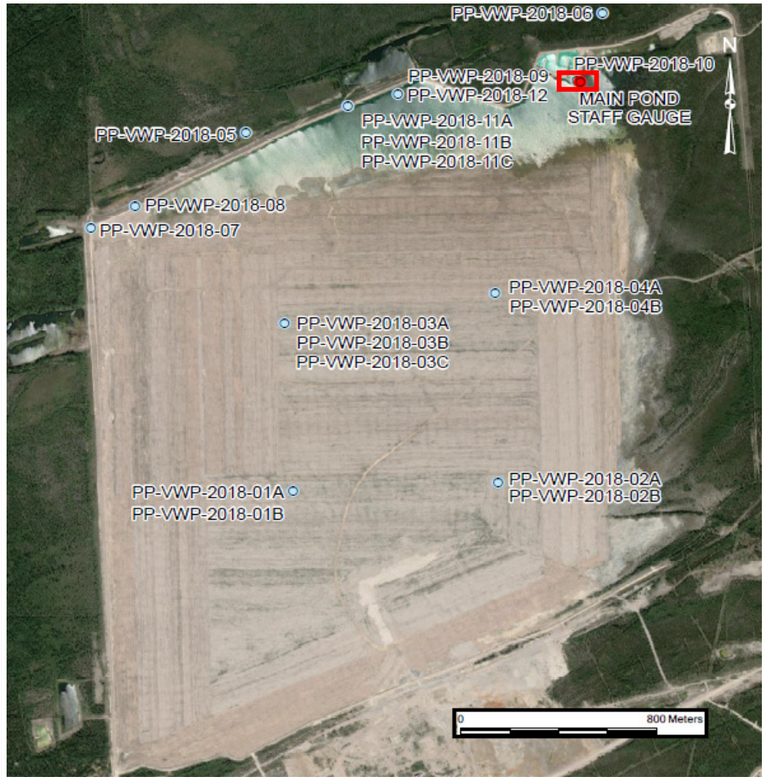
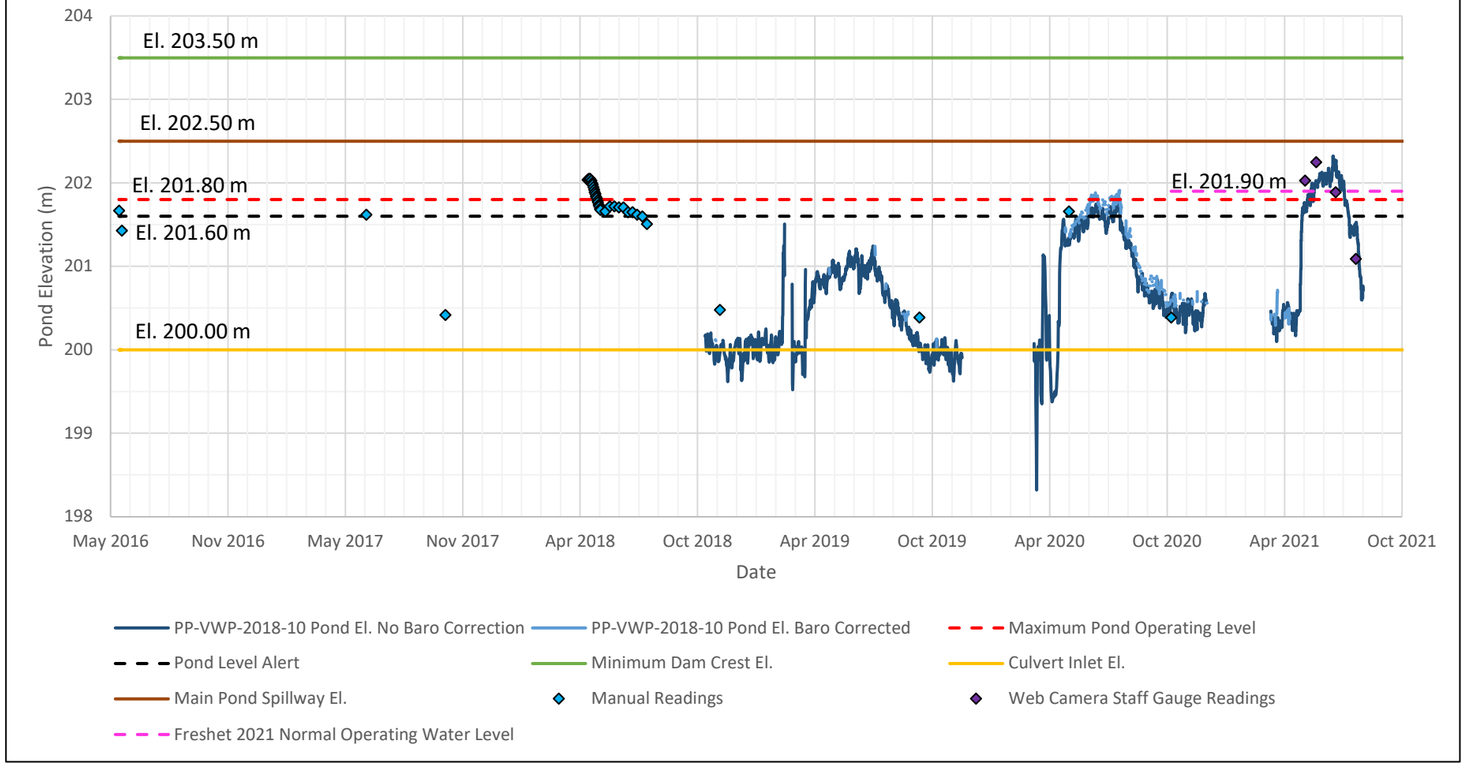
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: TAILINGS FACILITY PIEZOMETERS
SHEET 2 OF 2

PROJECT No. M10397A01

FIG No. IV-4





INSTRUMENTATION NOTES

-PP-VWP-2018-10 pond level readings differ from manual readings (Golder 2021b)

FIGURE NOTES

IMAGERY DATA SOURCE: ESRI
DATA PROJECTION: NAD83, ZONE 17N

LEGEND - VWP TIP INSTALL STRATA

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CLIENT: Teck

Klohn Crippen Berger

PROJECT: PINE POINT MINE TAILINGS IMPOUNDMENT AREA
2021 ANNUAL FACILITY PERFORMANCE REVIEW

TITLE: POND LEVEL MONITORING

PROJECT No.: M10397A01

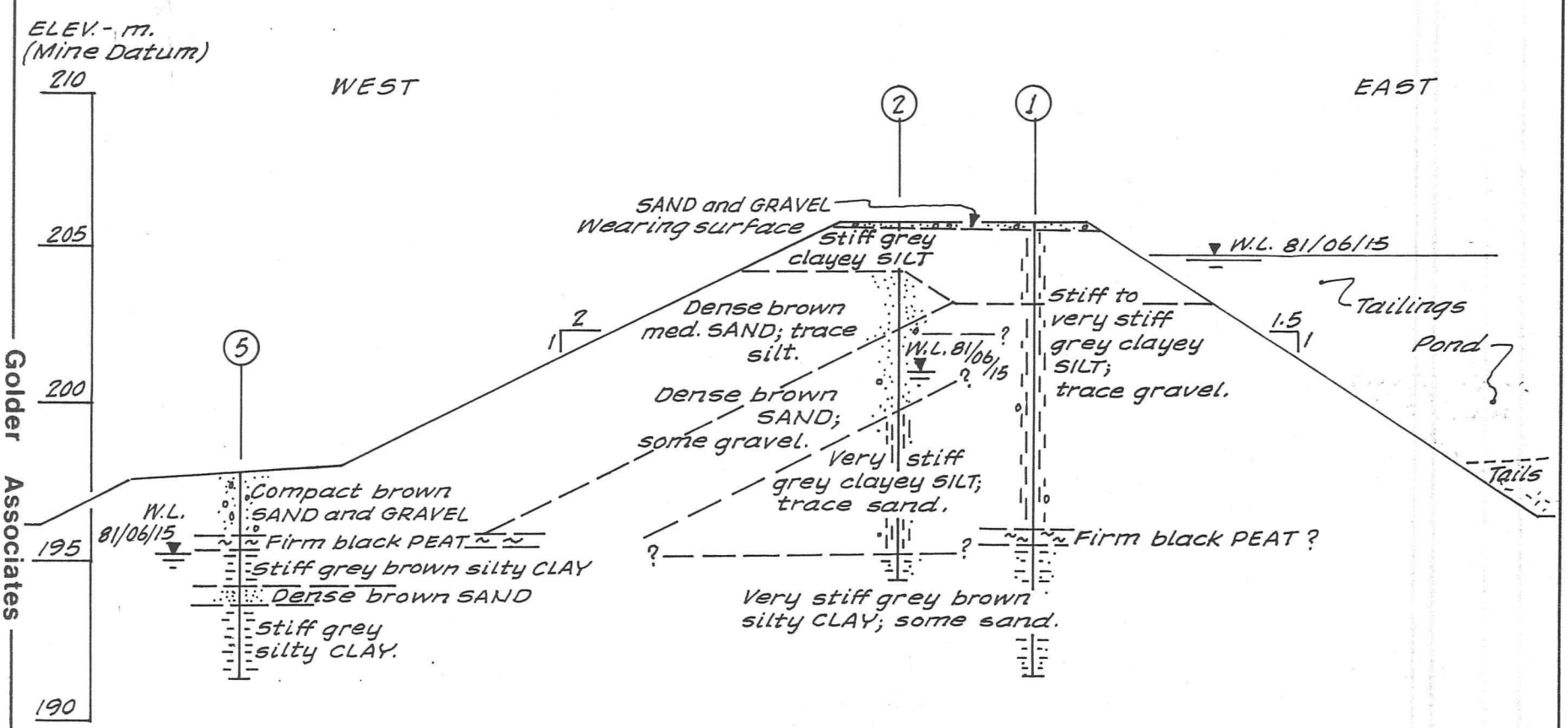
FIG No.: IV-5

APPENDIX V

TIA Dyke Historical Cross-Sections

PROJECT NO. 812-1116 DRAWN Mg. REVIEWED JH DATE July '81

INFERRED STRATIGRAPHY Sta. 35+40 - WEST DYKE.



SECTION A-A
Station 35+40 - West Dyke

Scale: 1:200

LEGEND:

(5) Location of Borehole.

NOTES:

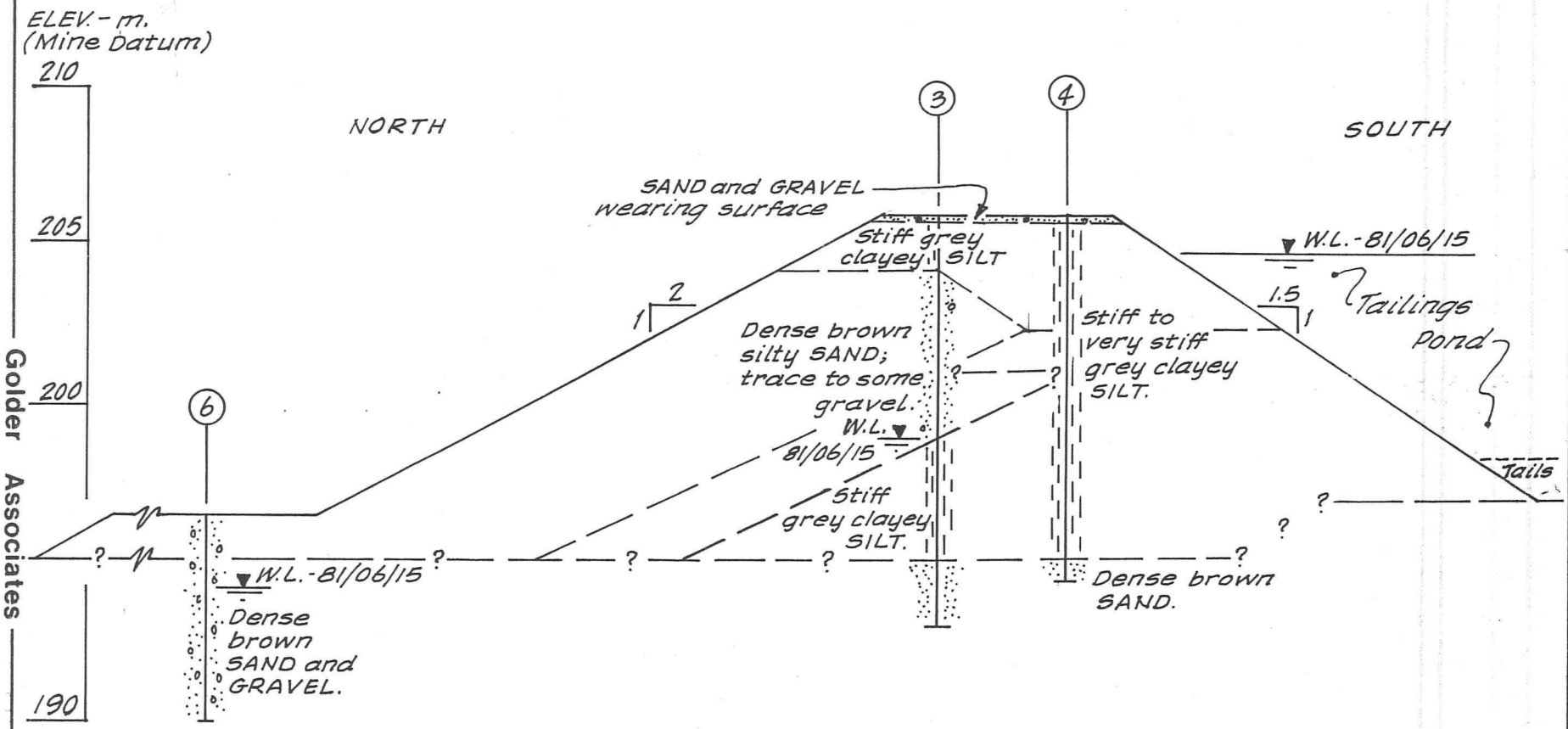
1. For location of Section, see Fig. 2.
2. Section partially inferred from construction records.
3. Black peat removed from under toe berm of west dyke south of Sta. 35+00.

Golder Associates

Figure 3

PROJECT NO. 812-1116 DRAWN hg REVIEWED ..... DATE July 181

INFERRED STRATIGRAPHY
Sta. 36+50 - NORTH DYKE



SECTION B-B
Station 36+50 - North Dyke

Scale: 1:200

LEGEND:
(6) Location of Borehole.

NOTES:
1) For location of Section, see Fig. 2.
2) Section partially inferred from construction records.

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Figure 4