REPORT

2019 Dam Safety Inspection for South Tailings Pond and North Tailings Pond

Teck Coal Limited, Fording River Operations

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Executive Summary

This report presents the 2019 annual dam safety inspection (DSI) for the South Tailings Pond (STP) and North Tailings Pond (NTP) facilities at the Teck Coal Limited, Fording River Operations (FRO) site, located near Elkford, British Columbia. This report was prepared based on a site visit carried out by Golder Associates Ltd. (Golder) from 10 to 11 September 2019, discussions with FRO staff, and a review of data provided by FRO. The reporting period for the data review is from 1 September 2018 to 31 August 2019, unless otherwise noted. The dam inspection reports and photographs from the site visit are presented with this report. The DSI report was prepared in accordance with Part 10 of the Health, Safety and Reclamation Code (HSRC) for Mines in British Columbia (Ministry of Energy and Mines 2017), which sets out the frequency for inspection of dams and tailings storage facilities.

Summary of Facility Description

The FRO site is an active open pit coal mine located near Elkford, BC. FRO's tailings storage infrastructure includes two tailings pond facilities, the STP and NTP, and two permitted destinations for in-pit tailings disposal, the 2 Pit and 3 Pit Tailings Storage Area and the Turnbull Tailings Storage Facility (TSF). Tailings discharge from the wash plant, within the processing plant, is currently directed to the STP. The NTP has been essentially filled to its design capacity and is currently inactive.

The STP facility is located south of the processing plant, on the east side of a realigned reach of the Fording River; it occupies a total area of approximately 67 ha and has a minimum crest elevation of 1,637.85 m. The STP is a downstream-constructed, zoned earth fill dam and was developed on the flood plain of the Fording River. Construction of the STP was initiated in 1977 and the dam was raised in six stages between 1983 and 2013.

The NTP is a downstream-constructed, zoned earth fill dam located on the west side of a realigned reach of the Fording River across from the processing plant. The NTP was developed on a segment of the Fording River flood plain and has a surface area of approximately 32 ha. The NTP has a minimum crest elevation of 1,652.6 m. Construction of the NTP was initiated in 1971 and the dam was raised four times between 1973 and 1979.

Summary of Key Hazards

Credible failure modes for the STP and NTP facilities include:

- Internal Erosion (suffusion and piping):
  - Filter compatibility is generally met between the dam fill materials and the foundation flood plain sand and gravel; however, this is not met for the tailings and the flood plain sand and gravel. Migration of the tailings through the sand and gravel is considered low risk.
- Overtopping:
  - Pond elevation is managed to be maintained below the maximum allowable pond elevation. A trigger action response plan provides direction if a water elevation approaches a triggers level. For the STP facility, the detailed design of a permanent spillway is underway and it is scheduled for construction in 2020 and 2021.

- Instability:
  - Static and seismic stability assessments (Golder 2018b) results indicate that the factor of safety of the dams meet design criteria.
  - Instability from erosion of toe from the Fording River, riprap protection is in place along the NTP dam toe and most of the STP dam toe to a 200-year return period flood level. FRO are undertaking a flood widening project to reduce the risk of this this hazard.
- Release of tailings or tailings-affected water through a pipeline failure:
  - Managed through inspection of active pipelines.

Dam Classification

Both the STP and NTP dams meet the definition of a “dam” as defined in the HSRC (Ministry of Energy and Mines 2017).

Both of the dams are classified as “Very High” consequence, following the dam consequence classification guidelines from HSRC Guidance Document Section 3.4 (Ministry of Energy and Mines 2016), which references the Canadian Dam Association (CDA) *Dam Safety Guidelines* (CDA 2013). The classifications are governed by the consequences of a potential fair-weather failure scenario.

An incremental inundation assessment was completed in 2017 to assess the consequence of failure of the STP and NTP during a major flood event of the Fording River (Golder 2017d). The assessment concluded that the consequence of a failure occurring coincident with a major river flood event was “High.” A risk-informed assessment, which would be supported by a design level flood-induced dam break and inundation assessment, is recommended to determine the appropriate criteria for the flood protection requirements along the downstream toes of the STP and NTP dams. The dam classification should be reviewed after the Main Dam breach and inundation study (Golder 2019e, draft under FRO review) is completed (recommended action 2018-06).

Summary of Significant Changes, and Changes to Instrumentation, Stability, and Surface Water Control

South Tailings Pond

Following the reclassification of the STP dam from a High to a Very High consequence structure, Golder (2018b) updated the liquefaction assessment, seismic stability analysis, inflow design flood (IDF), and freeboard assessments. The hydrologic assessment of the STP found that the updated IDF volume of water that needs to be contained within the facility (due to the lack of a spillway) would exceed the existing storage capacity in the facility, assuming that the facility already contained the maximum operating pond volume. Work to address IDF management in the STP was conducted throughout 2019 and is currently focused on the detailed design of a permanent spillway. The spillway is planned to be constructed in two phases, with the first phase in 2020 and the second in 2021.

FRO and the Teck Tailings Working Group selected an environmental design flood event for the STP facility based on a workshop in May 2019 with this process summarized in Golder (2019d).

A site investigation of the STP tailings was conducted in December 2018 (Golder 2019f, factual report in draft and in the process of being finalized by Golder) to assess the bearing capacity and liquefaction potential of the tailings and the potential of the STP dams overtopping as a result of tailings liquefaction during an earthquake. The bearing capacity of the tailings at the north end of the STP was summarized in a letter (Golder 2019h). Two vibrating wire piezometers were installed in saturated tailings below the phreatic surface to monitor water levels in the tailings.

Stockpiled excavated tailings from near the north single point discharge area were regraded in September 2019.

Ground squirrel burrows were observed on the upstream slope and bench of the Main Dam, and a badger burrow was observed at the toe of the Main Dam near the seepage collection wells. FRO prepared a plan in 2019 to remove the ground squirrel burrows, and it was approved by the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. FRO plans to implement the animal burrow removal plan in 2020.

Signage was installed at the dam toe, crest, and vicinity of the STP in June 2019 to notify passersby that the structure is a tailings dam and to provide direction and contact information to report any issues observed or any proposed work in the vicinity.

The 2019 dredging operations at the STP were carried out between 6 April 2019 and 28 October 2019, and transferred a total of 1.66 million dry metric tonnes from the STP to the Turnbull TSF.

Bathymetric surveys were conducted by FRO in April and June 2019 to monitor the available capacity in the STP.

Site drainage was temporarily redirected to the STP in January and February 2019 to facilitate sediment removal from the North Loop Settling Pond. Site drainage was routed back to the North Loop Settling Pond for the rest of the reporting period.

There were no significant changes in visual monitoring records for the STP since the 2018 DSI.

North Tailings Pond

FRO conducted a drilling program in September 2018 and installed monitoring wells to support the NTP transition scope of the NTP Flood Mitigation Project. Two monitoring wells were installed at the toe of the NTP dam at the southeast and northeast corners of the dam.

A piezometer and staff gauge were installed in the NTP during the reporting period to monitor water level. A data logger was installed for the piezometer and is connected to GeoExplorer.

Signage was placed at the dam toe, crest, and vicinity of the NTP in June 2019 to notify passersby that the structure is a tailings dam and to provide direction and contact information to report any issues observed or any proposed work in the vicinity.

There were no significant changes in visual monitoring records, instrumentation, dam stability, or surface water control for the NTP since the 2018 DSI.

Review of Operation, Maintenance, and Surveillance Manual

The operation, maintenance, and surveillance (OMS) manual for the STP and NTP is Version 2019.03 issued on 27 February 2020 (FRO 2020).

Review of Emergency Preparedness Plan and Emergency Response Plan Manuals

An emergency response plan (ERP) was developed for the STP and NTP in conjunction with all tailings storage facilities on site at FRO in 2018 and updated in 2019 (SP&P EP.009; FRO 2019). This document is under final review by senior staff at FRO at the time of writing this report. This document was developed to meet the regulations and related guidelines of the HSRC (Ministry of Energy and Mines 2016, 2017), the CDA (2013), the Mining Association of Canada (MAC 2011), and Teck Resources Limited (Teck Resources 2019).

FRO has also developed a *Tailings Impoundment Flood Response Protocol for the Fording River*. This document was issued on 26 September 2017 (FRO 2017) and should be reviewed prior to the 2020 freshet and updated as required to ensure functionality.

The emergency preparedness plan (EPP; EP.008) was last updated on 15 December 2015 (FRO 2015). FRO plans to update the EPP once the ERP is finalized. The EPP will outline the warnings FRO will issue, the expected actions of local authorities and other responders for dam breach flood emergencies.

The emergency planning documents should continue to be reviewed at least annually, with updates incorporated when required. The ERP should be tested annually. FRO carried out an internal tabletop exercise to test the ERP on 26 November 2019.

Dam Safety Review

The most recent dam safety review of the STP and NTP was completed in 2014 (KCB 2014). A dam safety review is required at a minimum of every five years for all water and tailings storage facilities regardless of dam consequence classification according to HSRC Section 10.5.4 (Ministry of Energy and Mines 2017). The next dam safety review, required in 2019, is currently underway, with a site inspection of the facilities conducted by a third-party consultant in September 2019.

Annual Dam Inspection

The STP and NTP facilities were observed to be in good condition at the time of the 2019 annual inspection.

Status of 2018 Dam Safety Inspection Recommended Actions

A number of recommended actions were prepared as part of the 2018 annual DSI (Golder 2019a). A summary of the status of the 2018 annual DSI recommended actions is presented in Table E-1. Recommendations that are noted as complete can be closed out. Items from the 2018 DSI that are incomplete have been brought forward into the 2019 DSI recommendations and shown in Table E-2.

A number of recommendations are in progress and some are incomplete, but Golder considers the work to be appropriately prioritized based on good communication between the Engineer of Record team and the FRO Tailings Engineer.

Table E-1: Current Status of 2018 Dam Safety Inspection Recommend Actions for the South Tailings Pond and North Tailings Pond Facilities

Facility	ID Number	Deficiency or Non-conformance	Recommended Action	Current Status as of March2020
STP	2015-12a,b,c	Riprap erosion protection along downstream toe north of STP Sta. 0+680, no riprap south of STP Sta. 0+680; risk-informed protection requirements not yet defined	Perform risk-informed assessment to determine appropriate flood protection requirements for downstream toe of dam along Fording River and timeline to implement.	**Incomplete** – see Table E-2 for updated recommendation and timeline.
			Implement required protection measures for the operational phase according to the as-defined schedule.	**In progress** – see Table E-2 for updated recommendation and timeline.
			Execute flood risk mitigation plan until flood protection requirements defined by the risk-informed assessment are in place.	**Complete** – Monitoring and management requirements for the Fording River are documented in *Tailings Impoundment Flood Response Protocol for the Fording River,* FRO (2017).
	2017-01	North abutment construction deficiencies	Address construction deficiency, finish dam construction.	**In progress, pending decommission of FortisBC gas pipeline** – see Table E-2 for updated recommendation and timeline.
	2017-05	Potential overtopping hazard due to tailings liquefaction and redistribution during seismic event needs to be assessed	Complete liquefaction and overtopping assessment for tailings within facility.	**In progress** – drilling completed in 2018, draft assessment issued, final in progress.
	2018-02	Planned dredging of tailings to Turnbull TSF is behind schedule and the result is a very high level of tailings in STP, which is causing operational issues (e.g., high levels of solids in STP causing operational difficulties)	Dredging to Turnbull TSF should be started as soon as possible in April 2019 with a minimum annual dredging target of 1.3 million tonnes.	**Complete –** 2019 dredging season started on 6 April and ended on 28 October 2019, and dredged 1.66 million dry metric tonnes**.**
	2018-03	The current spillway design does not meet the Very High dam consequence classification IDF	Update design of permanent spillway as per the new inflow design flood and requirements from HSRC Guidance Document (Ministry of Energy and Mines 2016). Develop a construction schedule accordingly.	**In progress** – permanent spillway design is underway.
	2018-04a,b,c	Current operation of the facility for water management does not meet the Very High dam consequence classification IDF	Design upstream diversion to divert runoff from upstream catchment (Blackmore Creek). The diversion should be sized to allow the STP to manage the IDF, if possible.	**Superseded by** recommended action 2018-04c**.**
			Construct the upstream diversion of Blackmore Creek.	**Superseded by** recommended action 2018-04c.
			Design a permanent emergency spillway to pass the peak outflow from the 24-hour IDF.	**Superseded by** recommended action 2018-03.
	2018-05	No closure plan for STP	Develop a closure plan for STP.	**Incomplete** – see Table E-2 for updated recommendation and timeline.
	2018-06	Construction of the Active Water Treatment Facility-South (AWTF-S) is underway downstream of the STP Main Dam, potentially increasing the number of workers in the dam breach inundation zone.	Review potential inundation for failure of the Main Dam relative to the downstream facility and develop an emergency response plan for the downstream workers if required.	**In progress** – preliminary results of inundation study have been provided and interim mitigation plans are being advanced.

Table E-1: Current Status of 2018 Dam Safety Inspection Recommend Actions for the South Tailings Pond and North Tailings Pond Facilities

Facility	ID Number	Deficiency or Non-conformance	Recommended Action	Current Status as of March2020
NTP	2015-05a,b	No passive emergency system against overtopping; emergency system requires active response	Assess the need for spillway after finalizing the NTP closure plan.	**Ongoing** – closure planning ongoing as part of the NTP Flood Mitigation Project, which should document when a spillway is required as part of facility closure. Real-time monitoring from GeoExplorer alerts tailings group of water level changes.
			If required, determine a construction schedule.	
	2015-06a,b,c	Risk-informed criteria for flood erosion protection along toe of dams not defined	Perform risk-informed assessment to determine appropriate flood protection requirements for downstream toe of dam along the Fording River and the timeline to implement.	**Incomplete** – see Table E-2 for updated recommendation and timeline.
			Implement required protection measures for the operational phase according to the as-defined schedule.	**Incomplete** – see Table E-2 for updated recommendation and timeline.
			Execute the flood risk mitigation plan until the flood protection requirements defined by the risk-informed assessment are in place.	**Complete** – Monitoring and management requirements for the Fording River are documented in *Tailings Impoundment Flood Response Protocol for the Fording River* FRO (2017).
	2015-07a,b	Buried pipes passing through crest locations	Inspect steel pipes as part of regular dam inspections until NTP closure plans are finalized. Include inspections in OMS manual update.	**Complete** – inspection requirements have been added to the OMS manual and routine NTP inspection forms.
			Execute abandonment plan for PVC pipes.	**Incomplete** – the pipes will be removed as part of the NTP Flood Mitigation Project construction. See Table E-2 for updated recommendation and timeline.
	2016-06	No closure plan for NTP	Develop closure plan for NTP based on results of feasibility investigation into NTP decommissioning.	**In progress** – as part of the NTP Flood Mitigation Project. See Table E-2 for updated recommendation and timeline.
	2018-01	Real-time water level readings are not available, and water level readings are limited during winter months when there is ice cover on the pond.	Install a real-time water level instrument in the NTP pond and connect this to the site GeoExplorer system	**Complete** – real-time water level monitoring instrument was installed in May 2019.
STP and NTP	2016-04	EPP & ERP require updating	Reference to the TARPs needs to be included for actions required based on instrumentation warnings and alarms.	**In progress** – draft ERP is being finalized. EPP will be updated after ERP is finalized. See Table E-2 for updated recommendation and timeline.
	2018-07	GPS, inclinometer, and NTP freeboard QPOs in the OMS manual do not reflect the most recent recommendations in Golder (2018b)	Update OMS manual with recommended GPS, inclinometer, and NTP freeboard QPOs from Golder (2018b).	**Complete.**

IDF = inflow design flood; FRO = Fording River Operations; STP = South Tailings Pond; NTP = North Tailings Pond; HSRC = Health, Safety and Reclamation Code; DSI = dam safety inspection; TSF = tailings storage facility; OMS = operation, maintenance and surveillance; EPP = Emergency Preparedness Plan; ERP = Emergency Response Plan; QPO = Quantifiable performance objectives; PVC = poly vinyl chloride; TARP = trigger-action-response plan.

2019 Dam Safety Inspection Findings and Recommended Actions

Table E-2 summarizes the 2019 findings and recommended actions for the STP and NTP, along with incomplete and in-progress items from previous DSIs. Previous recommendations have been reviewed and updated according to the information included in the 2019 DSI.

Table E-2: 2019 Dam Safety Inspection Recommended Actions for the South Tailings Pond and North Tailings Pond Facilities

Facility	ID Number	Deficiency or Non-conformance	Applicable Guideline or OMS Manual Reference	Recommended Action	Priority Level	Recommended Timing for the Action
STP	2015-12a, b	Riprap erosion protection along downstream toe north of STP Sta. 0+680, no riprap south of STP Sta. 0+680; risk-informed protection requirements not yet defined	HSRC §10.1.8	Perform risk-informed assessment to determine appropriate flood protection requirements for downstream toe of dam along Fording River and timeline to implement.	2	2020
				Implement required protection measures for the operational phase according to the as-defined schedule.	2	2020 and 2021
	2017-01	North and south abutment construction deficiencies	HSRC §10.5.1(3)	Address construction deficiency by commencing office engineering then finishing dam construction at north abutment following gas line decommissioning and grout decommissioned gas line in south abutment. TARPs and controls are in place in the interim if excess seepage is observed at the abutments.	3	Q3 2020
	2017-05	Potential overtopping hazard due to tailings liquefaction and redistribution during seismic event needs to be assessed	n/a	Complete liquefaction and overtopping assessment for tailings within facility.	2	2020
	2018-03	The current spillway design does not meet the Very High dam consequence classification IDF	HSRC §10.6.10	Update design of permanent spillway as per the new inflow design flood and requirements from HSRC Guidance Document (Ministry of Energy and Mines 2016). Develop a construction schedule accordingly.	2	Q2 2020
	2018-05	No closure plan for STP	HSRC §10.6.7 MAC TSM	Develop a closure plan for STP.	4	Q3 2020
	2018-06	Construction of the Active Water Treatment Facility-South (AWTF-S) is underway downstream of the STP Main Dam, potentially increasing the number of workers in the dam breach inundation zone.	HSRC §10.1.7 CDA 2013	Review credible failure modes and potential for inundation from a failure of the Main Dam relative to the downstream facility and develop an emergency response plan for the downstream workers if required.	2	Q1 2020
	2019-01	Portions of the Main Dam were eroded as a result of discharge of effluent on undesignated areas of the dam	CDA 2013 §3.5.3	Repair by placing breaker rock over geotextile on the eroded areas.	2	2020
	2019-02	The existing water level sensor is located near the upstream slope of the dam, where the sensor would detect dam/ground surface if the water level is lower	HSRC §4.4.1 CDA 2013 §3.6.3	Dredge the tailings under the relocated existing water level sensor to re-establish free water or add a new sensor.	3	Q2 2020

Table E-2: 2019 Dam Safety Inspection Recommended Actions for the South Tailings Pond and North Tailings Pond Facilities

Facility	ID Number	Deficiency or Non-conformance	Applicable Guideline or OMS Manual Reference	Recommended Action	Priority Level	Recommended Timing for the Action
NTP	2015-05a,b	No passive emergency system against overtopping; emergency system requires active response	n/a	Assess the need for spillway after establishing an NTP closure plan.	4	Q2 2020
				If required, determine a construction schedule.	4	2020
	2015-06a,b	Risk-informed criteria for flood erosion protection along toe of dams not defined	CDA 2013 §6.2	Perform risk-informed assessment to determine appropriate flood protection requirements for downstream toe of dam along the Fording River and the timeline to implement.	2	2020
				Implement required protection measures for the operational phase according to the as-defined schedule.	2	2020
	2015-07b	Buried pipes passing through crest locations	n/a	Execute abandonment plan for identified pipes.	3	2020
	2016-06	No closure plan for NTP	HSRC §10.6.7 MAC TSM	Develop a closure plan for NTP.	4	2020
	2019-03	A part of the downstream toe area below the NTP dam was excavated for access for a monitoring well installation program in 2019	HSRC §10.5.8	Backfill and grade excavated area.	3	Q3 2020
	2019-04	A loose CR layer was identified in the NTP dam investigation, which is currently unsaturated. This loose CR layer may liquefy if it becomes saturated during the design earthquake event.	HSRC §10.1.8	Currently, FRO does not plan to put NTP back into operation. The next update to the OMS manual shall document that if the NTP facility is put back into operation or for any proposed dam modifications, liquefaction and stability assessments considering the loose CR layer must be carried out.	3	2020
STP and NTP	2016-04	EPP & ERP require updating	HSRC §10.4.2(1)	Update the ERP and EPP with emergency response actions from the STP Main Dam breach and inundation study results and EoR designate/backup contacts	4	Q2 2020
	2019-05	The document *Tailings Impoundment Flood Response Protocol for the Fording River* (FRO 2017) requires an update	n/a	Review the *Tailings Impoundment Flood Response Protocol for the Fording River* and update as required prior to the 2020 freshet.	3	Q1 2020
	2019-06	The facilities' risk assessments were not reviewed in 2019	HSRC §10.4.2(1d)	Review and update (if required) the risk assessments of NTP and STP to reflect current conditions	3	Q4 2020

STP = South Tailings Pond; NTP = North Tailings Pond; IDF = inflow design flood; FRO = Fording River Operations; OMS = operation, maintenance and surveillance; CDA = Canadian Dam Association; HSRC = Health, Safety and Reclamation Code; TARP = trigger-action-response plan; MAC = The Mining Association of Canada; TSM = Towards Sustainable Mining; QPO = Quantifiable performance objectives; EPP = Emergency Preparedness Plan; ERP = Emergency Response Plan; Sta. = Station; n/a = not applicable; DSI = dam safety inspection.

Priority Level	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant risk of regulatory enforcement.
2	If not corrected could likely result in dam safety issues leading to injury, environmental impact or significant regulatory enforcement; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice – Further improvements are necessary to meet industry best practices or reduce potential risks.

Source: HSRC Guidance Document, Section 4.2 (Ministry of Energy and Mines 2016).

Table of Contents

TABLES

CHARTS

FIGURES

APPENDICES

APPENDIX F
FRO Water Quality Data

APPENDIX G
Tailings Storage Facility Registry

APPENDIX H
GPS Plots

APPENDIX I
Slope Inclinometer Data

1.0 INTRODUCTION

1.1 Purpose, Scope of Work, Method

Golder Associates Ltd. (Golder) has completed this annual dam safety inspection (DSI) for the South Tailings Pond (STP) and North Tailings Pond (NTP) at the Teck Coal Limited, Fording River Operations (FRO) site, located near Elkford, BC. The reporting period for the data review is from 1 September 2018 to 31 August 2019, unless otherwise noted.

The report is based on a site visit carried out by Golder from 10 to 11 September 2019, discussions with FRO staff, and review of data provided by FRO. This report was prepared in accordance with the Teck Resources Limited *Guideline for Tailings and Water Retaining Structures* (Teck Resources 2019) and consists of the following:

- a summary of the site conditions and background information for the facilities
- a summary of the operation, construction, and maintenance activities for the reporting period
- dam consequence classification and review of required operational documents
- site photographs and records of dam inspection
- review of dredging data
- review of assessment of dam safety relative to potential failure modes
- recommended actions

Photographs of STP and NTP from the site inspection are presented in Appendix A, and a summary of the observations is included in the inspection reports in Appendix B and C for the STP and NTP, respectively.

FRO switched coordinate systems on 25 October 2016 from FRO Mine Grid to Universal Transverse Mercator (UTM) with elevations referenced to the Elk Valley Elevation Datum. All coordinates presented in this report are in UTM with elevations referenced to the Elk Valley Elevation Datum unless otherwise noted.

The previous annual DSI for this facility was carried out in September 2018 and is reported in the 2018 DSI report (Golder 2019a).

This revision only includes data provided to Golder up to and including 4 December 2019 unless stated otherwise.

This report is to be read in conjunction with the Study Limitations provided at the end of the report.

1.2 Regulatory Requirements

1.2.1 BC Health, Safety and Reclamation Code

The DSI report was prepared in accordance with Part 10 of the Health, Safety and Reclamation Code (HSRC) for Mines in British Columbia (Ministry of Energy and Mines 2017), which sets out the frequency for inspection of dams and tailings storage facilities. It is understood that this report will be submitted by FRO to the Chief Inspector of Mines.

The guidelines for annual DSI reports provided in the HSRC Guidance Document (Ministry of Energy and Mines 2016, Section 4.2) were followed where applicable during the preparation of this report.

1.2.2 Permits and Licences

Specific amendments to the permits concerning STP and NTP are as follows:

- Permit C-3 Amendment to permit approving work system – South Tailings Pond tailings dredging project. Issued by the Ministry of Energy, Mines and Petroleum Resources. 27 April 1995.
- Permit C-3 Amendment to permit approving work system and reclamation program – Raising the South Tails Pond Dyke. Issued by the Ministry of Energy, Mines and Petroleum Resources. 30 June 2008.
- Permit C-3 Amendment to permit approving work system and reclamation program – Turnbull South Pit Tailings Storage Facility. Issued by the Ministry of Energy and Mines. 14 November 2013.
- Permit C-3 Amendment to permit approving work system and reclamation program – Turnbull South Pit Tailings Storage Facility East Pipeline Route. Issued by the Ministry of Energy and Mines. 6 May 2015.
- Permit C-3 Amendment to permit approving work system and reclamation program – Fording River Swift Mine Plan and Reclamation Program. Issued by the Ministry of Energy and Mines. 15 December 2015.
- Permit 424 Amendment to authorized discharges. Issued by the Ministry of Environment. 6 December 2016.
- Permit 424 Amendment to authorized discharges – Request for additional site water pumping to maintain freeboard at the South Tailings Pond. Issued by the Ministry of Environment. 22 March 2018.
- Permit 424 Amendment to authorized discharges – Request for additional site water pumping to maintain freeboard at the North Tailings Pond. Issued by the Ministry of Environment. 2 January 2019.

2.0 BACKGROUND

2.1 Site History

The FRO site is an active open pit coal mine located near Elkford, BC, which currently has two tailings pond facilities, the STP and NTP, and two permitted destinations for in-pit tailings disposal, the 2 Pit and 3 Pit Tailings Storage Area and the Turnbull Tailings Storage Facility (TSF). This DSI report is for the STP and the NTP.

The STP facility is located south of the processing plant, on the east side of the Fording River. The STP is composed of two dams, the Main and West dams. Tailings discharge from the wash plant, within the processing plant, is currently directed to the STP.

The NTP is located on the west side of the Fording River across from the processing plant. The NTP has been essentially filled to its design capacity and is currently inactive.

A location and plan view of the STP and NTP facilities is shown in Figure 1.

2.2 System Description

At the STP, the earth fill dams provide the following:

- impoundment of the tailings slurry
- storage of settled tailings
- temporary storage of runoff, excess slurry water, and water from pit dewatering or sediment ponds (when viable based on freeboard)
- reservoir of water as the reclaim source of the coal processing plant

At the NTP, the earth fill dam provides storage for settled tailings and only retains a small pond, which receives runoff from the local tailings surface area and small surrounding catchment area. This facility is not in active use.

2.2.1 Tailings Description

The raw coal delivered to the breaker at FRO contains high-ash material in the form of carbonaceous mineral rock. To meet product specifications, this high-ash rock is separated from the raw coal at the wash plant within the processing plant. The high-ash waste consists of a coarse fraction and a fine fraction. The coarse fraction, referred to as coarse rejects (CR), consists of sand and gravel-sized fragments of washed, crushed rock ranging in size from approximately 1 to 100 mm. The fine fraction of the waste, comprising rock fragments smaller than approximately 1.0 mm, includes “coarse-fine” rejects (0.75 to 1.0 mm) and the flotation tailings (less than 0.75 mm). Since 2005, the coarse-fine rejects and the majority of the flotation tailings have been separated at the wash plant. The coarse-fine rejects are mixed with the CR to produce combined coarse and fine rejects (CCFR), which are hauled by trucks to a designated CCFR spoil. The flotation tailings from the wash plant are a slurry and are sent via pipeline to the STP where they are hydraulically deposited from the north single point discharge.

2.2.2 Tailings Impoundments

In the past, tailings were discharged to the STP and NTP alternately. The tailings stream has never discharged to the both ponds concurrently. The NTP is essentially full, and tailings have not been deposited there since 2006.

Tailings are seasonally dredged from the STP to increase available tailings storage capacity. Previously, the dredged tailings were pumped to the NTP, 2 Pit, or 3 Pit South (Golder 2016a). Dredging operations to the NTP ended in 2006. Dredging to 2 Pit was discontinued in 2004. No dredged tailings have been sent to 3 Pit South since 6 October 2015.

Seasonal dredging from the STP to the Turnbull TSF started in 2016 and is planned to continue for approximately the next 15 years until 2034 for the base case and 6 years until 2025 for the Turnbull West project case (Golder 2018a), which is the range of estimated life of the facility when the Turnbull TSF reaches capacity.

2.3 Overview of Design, Construction, and Previous Operation

A summary of the STP and NTP design, dam construction, and past operations is presented in the following subsections. Additional details of construction history are presented in the operation, maintenance, and surveillance (OMS) manual (FRO 2020).

2.3.1 South Tailings Pond

A plan view of the STP facility is shown in Figures 2 and 3. The STP occupies a total area of approximately 67 ha and is located to the south of the processing plant, on the east side of a realigned reach of the Fording River. The STP was developed on the flood plain of the Fording River. The Fording River was diverted to a new alignment outside the footprint of the STP by excavating a new channel through a topographic bench on the west side of the Fording River flood plain. This topographic bench consists of native glacial till soils overlying Fernie Shale. Confinement at the STP is provided by the Main Dam, which extends across the width of the Fording River flood plain, and by the West Dam, which extends parallel to the east side of the Fording River Diversion Channel. The West Dam is primarily founded on the glacial till bench.

Initial construction of the STP dams was performed between 1977 and 1979. From 1983 to 2013, the STP dams have been raised in six stages using the downstream construction method:

1) 1983 to 1984 (FCL 1984)

2) 1985 to 1990 (FCL 1988, 1989, 1990)

3) 1993

4) 2008 (Golder 2009)

5) 2010 (FRO 2010)

6) 2012 to 2013 (Golder 2013, 2014d)

The design crest elevation of 1,637.85 m was specified in the original design report (reported as elev. 1,638.3 m FRO Mine Grid in Golder 1976), and this elevation was reached with construction carried out in 2013. Designs of the north and south abutment sections of the dam are presented in the design update report and design drawings (Golder 2011, 2012a), and the construction summary of the STP raise is reported in the construction record report (Golder 2014d). The design crest elevation of the north end of the West Dam is 1,639.5 m.

The current minimum crest of the STP dam is elev. 1,637.85 m (confirmed with 2019 LiDAR survey data from FRO).

The dam's construction prior to the 2008 raise was wider than design, which created a bench along the length of the facility when the 2008 and later lifts were constructed, as shown in the sections in Figures 4 and 5.

The June 2013 flooding of the Fording River caused high flows along the downstream toe of the STP dam, which eroded the foundation soils and a minor portion of the CR shell. Repairs to the STP downstream toe area were completed in 2013.

Riprap upgrades were completed for the STP in 2016, and construction was carried out under the direction of Kerr Wood Leidal Associates Ltd. (KWL) as Designer of Record. KWL oversaw the placement of approximately 2.5 m thickness of riprap by FRO and FRO contractors along the existing STP riprap alignment for scour protection and to accommodate the revised 200-year return period (Q200) design flow (KWL 2017b). During construction, KWL provided oversight to the gradation and quality of the riprap, which was sourced on site. A construction completion report and record drawings for these riprap upgrades are included in KWL (2017b). Golder provided on-site services to oversee resloping of the till bench and cutting into weathered bedrock for key-in of the riprap material, and monitored seepage conditions and signs of instability (Golder 2017a).

One recommendation remains outstanding from the reconstruction and riprap upgrades (Golder 2014c): river flood protection south of STP Sta. 0+680 needs to be completed to improve long-term stability of the STP structure (recommendation 2015-12 in Table 25). The riprap upgrades south of Sta. 0+680 have not been completed due to not having equipment access south of the Fording River bridge footing and the elevation of the bedrock in the Fording River channel in this area.

2.3.1.1 Main Dam

The STP Main Dam, which extends across the Fording River flood plain, has a maximum height of approximately 35 m. A typical section of the STP Main Dam is presented in Figure 4. The Main Dam was constructed and raised using a downstream construction method. It consists of a low permeability starter dam of compacted glacial till soil with a cut-off through the sand and gravel into the underlying in situ till. Raises above the starter dam included an inclined low permeability zone of compacted glacial till soil on the upstream side of the dam, supported by a zone of compacted CR or CCFR. The compacted CR or CCFR zone that forms the downstream shell of the Main Dam provides the structural strength of the dam.

As indicated in Figure 4, discontinuous flood plain sands and gravels extend beneath the whole downstream shell of the Main Dam. These sands and gravels extend through the Fording River flood plain gravels and are joined to in situ glacial till soils that underlie the flood plain gravels. These flood plain sediments are pervious and serve as an underdrain for the dam.

The Main Dam abuts high ground at the location of the reclaim barge. The south abutment till blanket and dam tie into both the high ground and in situ soil in the railway embankment. The till blanket was constructed to reduce potential seepage losses from the STP south abutment and to mitigate against a preferential flow path at the dam's tie-in to the south abutment.

2.3.1.2 West Dam

The STP West Dam is founded on the till bench that borders the western edge of the Fording River flood plain. It was constructed and raised using downstream construction method. A typical section through the West Dam, presented in Figure 5, consists of a low permeability zone of compacted glacial till soil on the upstream side of the STP West Dam, supported by a zone of compacted CR or CCFR. The West Dam abuts into the railway embankment at the north abutment. The West Dam ranges from a height of 16 m near Sta. 0+400 to 24 m near the transition to the Main Dam.

A key-in excavation was constructed for a portion of the north abutment, and the excavation was filled with compacted till. The construction of the north abutment section between Sta. -0+160 to -0+223 is on hold due to proximity to the high pressure gas pipeline. An interim berm was constructed approximately parallel to the gas pipeline.

2.3.1.3 Railway Embankment

A segment of the railway embankment south of the loading loop traverses an area that impounds tailings in the STP facility. A stability assessment of the embankment was previously carried out by Golder in 1984 (Golder 1984) and updated in 2010 (Golder 2010). The 1984 assessment recommended a buttress on both sides of the railway embankment to maintain stability of the embankment with respect to the increase in the pond elevation. FRO constructed this buttress in stages as the tailings and STP pond level increased between 1985 and 2014.

In 2010, Golder recommended that FRO grout the existing culverts that conveyed surface runoff through the railway embankment, install new culverts at a higher elevation, and backfill the area east of the railway embankment to provide further buttressing for the railway embankment to improve stability (Golder 2010). The corrugated steel culverts passing through the railway embankment were filled with concrete during 2009 and 2010 to prevent the flow of tailings from the STP to the east as the tailings level rose above the elevation of the existing culverts. The unused culverts were properly closed and abandoned, and in 2010 the area of the railway embankment was backfilled and graded. Surface runoff from the area upslope of the railway embankment, including Blackmore Creek, is now diverted around the backfilled area into the STP through twin 0.8 m diameter culverts installed in 2010.

A till cut-off was constructed through the rejects buttress fill that runs parallel to the railway embankment (Golder 2013).

Three culverts were installed in 2015 under the railway track to pass pipelines (two at 0.6 m diameter and one at 0.3 m diameter) as part of the STP to Turnbull TSF tailings transfer project. These culverts are located just north of the twin Blackmore Creek culverts

2.3.2 North Tailings Pond

A plan view of the NTP facility is shown in Figures 6 and 7. The NTP was developed on a segment of the Fording River flood plain and has a surface area of approximately 32 ha. In the 1970s, the Fording River was diverted into a new constructed channel (McElhanney 1969) to allow construction of the NTP on the west side of the Fording River flood plain (Golder Brawner 1969). Along the eastern and southeastern sides of the NTP facility, confinement for water and the stored tailings is provided by a zoned earth fill dam that has a maximum height of approximately 24 m. The NTP dam was designed and constructed using a downstream construction method. A confining dam is not required along the west side of the facility because the natural ground to the west of the NTP is higher than the stored tailings or pond level.

A typical section through the zoned earth fill NTP dam is presented in Figure 8. The crest of the dam was raised in stages, as the tailings storage requirements increased progressively during the early years of operation at FRO. Stage 1 of the dam was constructed entirely of compacted glacial till soil, complete with a compacted glacial till cut-off that extends through the Fording River flood plain gravels and is joined to in situ glacial till soils that underlie the flood plain gravels.

During subsequent stages of construction, the compacted glacial till was extended upward in the form of an inclined zone on the upstream side of the NTP dam. Structural support for this inclined till zone is provided by compacted CR. As shown in Figure 4, the in situ fluvial sands and gravels of the Fording River flood plain extend beneath the cross-section of the dam. These fluvial sediments have a high hydraulic conductivity and serve as an underdrain that promotes downward seepage from the facility.

The original design for the NTP was completed by Golder (Golder Brawner 1969, 1970). Construction of the NTP was initiated in 1971 (Golder Brawner 1971), and the facility was put into service in March 1972. The NTP dam was raised four times between 1973 and 1979 (Golder Brawner 1973, 1974a,b, 1975a,b; Golder 1979) using a downstream construction method and reached its current elevation in 1979. The NTP facility was at its tailings storage capacity by 1980 (Golder 1981). Between 1980 and 1991, the NTP was inactive, and the facility was dewatered and excavated using scrapers to recover additional tailings storage capacity (FCL 1981; Golder 1981). The NTP was put back into active use and refilled with tailings between 1993 and 1997, after which the facility was again inactive. From 2001 to 2002, the NTP was dredged and the tailings were sent to 2 Pit and 3 Pit South. Dredged tailings from the STP were used to fill the excavated areas of the NTP seasonally between 2004 and 2006. No tailings have been sent to the NTP since 2006, and the tailings pipeline has been partially removed.

The design crest of the NTP dam is elev. 1,653 m with minimum elevation of the NTP dam crest at elev. 1,652.6 m (confirmed with 2019 LiDAR survey data from FRO).

Following the flood of June 1995, riprap was placed along the downstream/eastern toe of the dam, as well as along the opposite (left) side of the Fording River channel. The condition of the riprap placed in 1995 had degraded by the time of the 2006 dam safety review, and review of the riprap sizing and placement was recommended by Golder. Assessment of the riprap was performed by KWL (2007, 2009).

Between 19 and 20 June 2013, a significant 48-hour rainfall event occurred which resulted in flooding of the Fording River. High flows along the toes of the NTP dam triggered major erosion of the CR shell. Golder was retained by FRO to provide geotechnical input for flood repairs of the NTP dam. KWL was retained to provide recommendations for sizing and placement of the river bank protection along the downstream dam toe (KWL 2014). The dam shell was rebuilt using compacted CCFR material. A total CCFR fill of approximately 22,350 m^3 was placed and compacted between 3 July and 8 August 2013 (Golder 2014b). Riprap revetment construction was carried out along the toe of NTP dam under the direction of KWL in 2013 and 2014.

In 2016, FRO constructed a sediment pond north of the NTP facility (the Liverpool Sediment Pond); the outlet channel from this pond is routed through the north end of the NTP tailings deposit and includes a fish barrier weir constructed through the north abutment of NTP dam (AMEC-FW 2017).

Additional riprap upgrade works were designed and construction carried out under the direction of KWL as Designer of Record in 2016 and 2017 (KWL 2017a). The 2016 work included placing riprap of approximately 2.5 m thickness along the existing NTP riprap alignment for scour protection and to accommodate the revised 200-year return period (Q200) design flow plus freeboard. During 2017, riprap construction was completed under the direction of KWL which included the excavation and placement of approximately 150 m of riprap at the upstream end of the NTP, and the placement of approximately 745 m of riprap over the existing bank protection. During construction, KWL provided oversight to the gradation and quality of the riprap, which was sourced on site. A construction completion report and record drawings for these riprap upgrades are included in KWL (2017b).

Golder completed a screening-level flowability assessment of the tailings within NTP in 2016 (Golder 2017c) to assess the possibility of revising the NTP from a tailings dam to a mine waste facility or “landform” per Section 10.6.12 of the HSRC (Ministry of Energy and Mines 2017).

2.3.3 Water Management of the South Tailing Pond and North Tailings Pond

2.3.3.1 Freeboard Management

The STP and NTP dams were reclassified in 2018 from High to Very High consequence structures following the dam consequence classification guidelines from the HSRC Guidance Document Section 3.4 (Ministry of Energy and Mines 2016), which references the Canadian Dam Association guidelines (CDA 2013). As a result of the reclassification, Golder updated the inflow design flood (IDF) and freeboard assessment for both facilities (Golder 2018b). The resulting minimum required freeboard during the IDF event and maximum operating water level for the STP and NTP are summarized in Table 1.

For the STP, a maximum operating water level at 1.2 m below the minimum dam crest elevation would provide the required minimum freeboard only if the external catchment area (from Blackmore Creek) of the STP is diverted during the IDF event. For the NTP, the maximum operating water level must be 1.9 m below the minimum dam crest elevation to store the IDF while maintaining the required minimum freeboard.

Table 1: Maximum Pond Elevations and Freeboard Levels

Parameter	STP (m)	NTP (m)
Minimum dam crest elevation	1,637.85[(a)]	1,652.60[(b)]
Minimum required freeboard (during IDF)	0.40	0.35
IDF water level (dam crest elevation minus the minimum freeboard)	1,637.45	1,652.25
Maximum operating water level	1,636.65[(c)]	1,650.70

(a) Minimum Main Dam crest elevation following 2013 dam raise construction reported in Golder (2014d), confirmed with 2019 LiDAR survey data from FRO.

(b) Dam crest elevation from 2018 LiDAR, confirmed with 2019 LiDAR survey data from FRO.

(c) The maximum operating water level is calculated assuming all the STP external watershed areas are diverted during the IDF event.

Source: Golder 2018b.

STP = South Tailings Pond; NTP = North Tailings Pond; IDF = inflow design flood; FRO = Fording River Operations.

2.3.3.2 Control of Inflows and Outflows

Floating reclaim pumps are used to recirculate water from the STP to the processing plant. Water demand at the plant is greater than the volume of water that is available from recirculation of tailings slurry transport water alone, creating a water deficit in the STP facility water balance. Makeup water is added to the STP from various locations on site to satisfy the reclaim water demand. In the event of high water levels, the STP water level trigger-action-response plan (TARP) from Appendix B or the NTP water level TARP from Appendix C of the OMS manual would be followed (FRO 2020).

There are no permanent working pumps at the NTP. A pump can be installed to pump water from the NTP to the STP when required.

2.3.4 Design Parameters for the South Tailings Pond and North Tailings Pond

The following design parameters apply to the STP and NTP. Typical sections of the dams are shown in Figures 4 and 5 for the STP and in Figure 8 for the NTP.

2.3.4.1 Foundation Materials

The retention dams at the STP and the NTP are founded on Fording River flood plain sands and gravels, dense glacial till soils, or shale bedrock.

A subsurface investigation was completed by FRO to compile in situ density data and subsurface stratigraphy under the STP and NTP dams (FRO 2016).

2.3.4.2 Embankment Fill Materials

The following materials were used in the construction of the dams: till fill, and CR and CCFR.

2.3.4.2.1 Till Fill

A zone of compacted glacial till fill forms the upstream face of the retaining dams. This till fill zone serves as a low permeability zone to minimize seepage through the dam rather than as structural support. The glacial till material was sourced locally on site.

2.3.4.2.2 Coarse Rejects and Combined Coarse and Fine Rejects

At both the STP and the NTP, support for the low permeability zone of the dams is provided by compacted CR or CCFR. The CR is a waste product generated at the wash plant and consists of sand and gravel-sized, well-graded, washed crushed rock material.

For the 2010 and 2012 raises of the STP dams, CCFR was used in place of the CR following modifications to the wash plant waste streams. The CCFR is formed by combining the CR with finer material previously sent to the tailings ponds as tailings. The CCFR contains approximately 2% to 10% material finer than 0.075 mm. The engineering properties of the CCFR are similar to those of the CR and used in slope stability analysis (Golder 2018b).

Golder personnel were on site throughout the 2012 and 2013 dam raise construction period to provide quality control services following the Quality Control Specifications from Golder (2011). Results of the quality control program related to the dam raise, including construction observations and deficiencies noted by the Golder personnel, and recommendations to address the deficiencies, are included in the construction record reports (Golder 2013, 2014d).

2.3.4.3 Seismicity

The site is located in an area of relatively low seismicity in BC. Golder developed a site-specific seismic hazard model for the FRO site based on historical seismicity and a review of geological and paleoseismological features (Golder 2016b). Golder's model includes four area sources from the 5th Generation Seismic Hazard Model and nine faults and fault segments mapped in northwest Montana. The 5th Generation Seismic Hazard Model was developed by Natural Resources Canada for use in the 2015 National Building Code of Canada.

Probabilistic analysis results from site-specific hazard model are listed in Table 2. All site-specific peak ground acceleration values were evaluated for a soil Site Class C as described in the 2010 National Building Code of Canada (NRCC 2010) as this represents Golder's understanding of the general foundation conditions at the dam locations.

Table 2: Fording River Operations Site Seismic Hazard Values

Exceedance Probability	Return Period (years)	Peak Ground Acceleration (g)
40% in 50 years	100	0.020
10% in 50 years	475	0.063
5% in 50 years	1,000	0.097
2% in 50 years	2,475	0.158
1% in 50 years	5,000	0.222
½% in 50 years	10,000	0.300

Notes: For firm ground site class "C," very dense soil and soft rock foundation, as defined by 2010 National Building Code of Canada (NRCC 2010).

Return periods are not exact representations of annual exceedance probabilities; rounding per Canadian Dam Association (CDA 2013, 2014) is shown.

FRO (Fording River Operations) site coordinates: 50.202°N, -114.876°W.

The HSRC Guidance Document, Section 3.3.1 (Ministry of Energy and Mines 2016) recommends a return period of ½ between the 2,475-year and 10,000-year seismic event or the maximum credible earthquake for tailings dams with Very High consequence classification.

2.4 Key Personnel

The Engineer of Record (EoR) for the STP and NTP dams is John Cunning, P.Eng., an employee of Golder Associates Ltd. A succession plan for the EoR is in development between Golder and FRO, where the EoR designate is Ms. Julia Steele, P.Eng., another employee of Golder. In an event where neither Ms. Steele nor Mr. Cunning could be reached (e.g., they are travelling to site), Golder has provided FRO with backup EoRs emergency contacts and their contact details should be added to the FRO tailings emergency contact list, which is references in the emergency plan documents (EP.008 and EP.009) (recommended action 2016-04).

KWL has historically been responsible for hydraulics-related works and has completed a Fording River hydraulics assessment (KWL 2017c) and prepared design and construction record reports for erosion protection along the STP and NTP dam toes following the 2013 flood event (KWL 2017a,b). Jason Miller of KWL is the Designer of Record for the erosion protection works for both the STP and NTP facilities. The annual riprap inspection was conducted on 18 October 2019 by KWL, and its associated inspection report is included in Appendix D.

The tailings engineer at FRO is Robyn Gaebel, P.Eng. The TSF Qualified Person for the STP and NTP is Adam Langer, P.Eng., Superintendent Engineering who is an employee of Teck Coal Limited and is responsible for tailings and water-retaining structures.

2.5 Quantifiable Performance Objectives

Quantifiable performance objectives (QPOs) have been established for the STP and NTP with consideration of the credible failure modes for the facilities. Golder has updated the QPOs for piezometers and GPS units at the STP and NTP based on the stability update completed in 2018 (Golder 2018b).

2.5.1 Piezometers

Slope stability analysis of the STP and NTP dams (Golder 2018b) informed the initial development of warning and alarm QPOs. The warning and alarm QPOs were updated with the stability assessment for the Very High dam classification Golder (2018b) and presented in the Elk Valley Elevation Datum system, rounded to the nearest 0.1 m, and should be included in the 2019 update of the OMS manual.

Three new vibrating wire piezometers were installed in two locations (BH-CPT18-05A and -07A) within the STP tailings deposit in December 2018. The piezometers were installed as part of a site investigation to gather data for bearing capacity and liquefaction assessments of the tailings deposit. No QPOs are required for these instruments as they were not installed for dam safety reasons.

Seven piezometers were installed in three locations (CP17-NTP-01, -02, and -04) within the NTP tailings deposit in November and December 2017. These are being monitored to support NTP facility closure studies and no QPOs are required for these instruments.

The piezometer QPOs are presented in Table 3.

Table 3: Piezometer Instrumentation Trigger Levels for the South Tailings Pond and North Tailings Pond

Dam	Monitoring Instrument	Warning Water Elevation (m)
NTP	TH15-05	>1,646.5
	TH15-06	>1,643.5
	TH15-07	>1,640.5
STP – Main Dam	SP-3	>1,604.0
	SP-5	>1,603.5
	TH15-04	>1,603.5
	TH15-01 / VW-5	>1,617.5
	TH15-02 / VW-4	>1,624.0
STP – West Dam	TH15-03 / VW-1 / VW-2	>1,627.5
	SP-W1	>1,623.1
	SP-W3	>1,623.0
	VW-3	>1,627.0

NTP = North Tailings Pond; STP = South Tailings Pond; > = greater than.

2.5.2 Dam Crest Displacement Monitoring

The STP has 10 GPS units to monitor displacements. FRO ceased the use of prisms on the NTP dam in May 2018 due to difficulties with surveying in winter (i.e., snow cover on the prisms) and with backsight readings. The prisms were replaced with GPS units, with three units installed at the NTP in June 2018. Dam crest displacement monitoring is considered a best practice and warning levels for displacement data from the GPS units has been established.

Data from the GPS units should be reviewed by FRO as part of the tailings dam inspections for the STP and NTP (on a weekly to monthly basis for STP and monthly basis for NTP) to check for movements or trends of concern. The data and results of the routine FRO review should be provided to the EoR on a monthly basis for review.

Table 4 provides the updated trigger levels for GPS units on the STP and NTP dams from Golder (2018b). The trigger levels for 3D velocity with 12-point averaging are set above the noise level of the instruments.

Table 4: GPS Monitoring Instrumentation Trigger Levels for Both South and North Tailings Ponds

Dam	Monitoring Instrument	Survey Data	Warning	Alarm
STP & NTP	GPS	3D displacement (or cumulative relative displacement)	>100 mm	>150 mm
		3D point velocity with 12-point averaging	>100 mm/day	>150 mm/day

Note: Discuss with Engineer of Record prior to zeroing displacement data.

STP = South Tailings Pond; NTP = North Tailings Pond; > = greater than.

2.5.3 Inclinometers

In total, there are seven inclinometers (Table 5): four inclinometers are installed in the STP dam (TH15-01 to TH15-04) and three are installed in the NTP (TH15-05 to TH15-07). These were installed during 2015 drilling as a best practice, and not in response to any dam displacement concerns. Slope inclinometer data were collected quarterly up until September 2018. During the 2018 DSI site visit, the EoR and TSF Qualified Person agreed that the inclinometers should be read three times per year and the readings timed with the following events:

- shortly before freshet
- latter part of freshet
- late summer

In 2019, data from the slope inclinometers were collected in April, June, and December.

Table 5: Inclinometer Summary

Location	Test Hole	Approximate A-A Axis Azimuth (°)	Hole Depth (m)	Casing Stickup (m)	Start Depth (m)	Reading Intervals (m)
STP	TH15-01	310	41.00	0.8	40.0	1.0
	TH15-02	10	40.00	1.0	40.0	1.0
	TH15-03	30	30.05	1.1	30.0	1.0
	TH15-04	15	6.00	1.0	6.0	1.0
NTP	TH15-05	235	20.90	0.9	21.0	1.0
	TH15-06	290	29.20	1.0	29.0	1.0
	TH15-07	305	40.80	0.9	41.0	1.0

Summary table provided by email (Roseingrave 2017, pers. comm.).

STP = South Tailings Pond; NTP = North Tailings Pond.

FRO and the EoR discussed challenges with setting QPOs for inclinometers as they are not a critical dam safety control and it is not practical to set QPOs for inclinometers. Monitoring inclinometers is considered a best practice and Table 6 has been updated to provide suggested screening trigger levels for review of the inclinometer data.

Table 6: Trigger Levels for Inclinometers

Monitoring Instrument	Trigger Level	Severity	
		Acceptable	Warning
Inclinometer	Downstream displacement	<5 mm	>5 mm and <15 mm

Trigger levels provided are for readings measured at depths greater than 1 m below ground surface. > = greater than; < = less than.

2.5.4 Freeboard QPO

The warning and alarm triggers shown in Table 7 are currently used by FRO for the STP and NTP facilities' water level elevations. The warning and alarm triggers shown for NTP in Table 7 are being included in the 2019 update of the OMS manual. STP and NTP water level TARPs are provided in Appendices B and C, respectively, of the OMS manual (FRO 2020).

Table 7: Freeboard QPO Trigger Levels for the South Tailings Pond and the North Tailings Pond

Dam	Survey Data	High Level Warning	High Level Alarm (i.e., freeboard exceedance)
NTP	Water level	>1,650.4 m	>1,650.7
STP	Water level	>1,636.55 m	>1,636.65 m

NTP = North Tailings Pond; STP = South Tailings Pond; > = greater than.

2.5.5 Swift Area Blasting

The Swift mining area has active open pit mining operations located near the STP and NTP dams. A blast monitoring TARP has been prepared to monitor potential effects from this nearby blasting. The response framework for the monitoring data is described in Golder (2018c), and the TARP is included in Appendix D of the OMS manual (FRO 2020).

3.0 OPERATION, MAINTENANCE, AND CONSTRUCTION DURING 2018/2019 REPORTING PERIOD

A summary of the operations, maintenance, and any construction activities for the 2018/2019 DSI reporting period is discussed in the following sections for each of the STP and NTP.

3.1 South Tailings Pond

3.1.1 Inflow Design Flood Accommodation

Following the reclassification of the STP dam from a High to a Very High consequence structure, Golder (2018b) updated the liquefaction assessment, seismic stability analysis, inflow design flood (IDF), and freeboard assessments. The hydrologic assessment of the STP found that the updated IDF volume of water that needs to be contained within the facility (due to the lack of a spillway) would exceed the existing storage capacity in the facility, assuming that the facility already contained the maximum operating pond volume. Work to address IDF management in the STP was conducted throughout 2019 and is currently focused on the detailed design of a permanent spillway. The spillway is planned to be constructed in two phases, with the first phase in 2020 and the second in 2021.

3.1.2 Determination of Environmental Design Flood

An environmental design flood (EDF) is defined as the most severe flood that is to be managed without release of untreated water to the environment (CDA 2014). The EDF is one of the considerations required for the design of the STP permanent spillway.

A workshop was held on the FRO mine site on 16 May 2019 to achieve a common understanding of the EDF assessment process among FRO's stakeholders in the context of the STP, and to establish the next steps in the EDF assessment process. FRO and the Teck Tailings Working Group selected an EDF event for the STP facility based on the workshop with this process summarized in Golder (2019d).

3.1.3 Main Dam Breach and Inundation Assessment of the Active Water Treatment Facility-South

A dam breach and inundation study was conducted by Golder (2019e, draft under FRO review) to assess the potential for inundation in the immediate downstream area of the Main Dam, which now includes the Active Water Treatment Facility-South. The study was carried out as a result of recommendation 2018-06 from the 2018 DSI (Golder 2019a).

FRO, in collaboration with the STP EoR, is in the process of determining emergency planning actions in response to the initial results of the study.

3.1.4 Backup at North Single Point Discharge

In June 2017, and in June through August 2019, tailings were observed to periodically back up at the north single point discharge channel area and the tailings pipeline to become partially submerged. During each occurrence, FRO contracted an earthworks company to excavate, with a long-arm excavator, tailings from the main discharge channel to direct tailings flow away from the discharge point and towards the main reclaim pond. The STP tailings discharge area TARP and associated Interim South Tailings Pond Discharge Inspection Form were invoked during all incidents, with the TARP being updated in 2019.

The excavated tailings were stockpiled to the west of the channel and spread locally in the area using a dozer. As part of the work in 2018, FRO prepared a presentation (Appendix A in STP Tailings Beach Management Plan [FRO 2018]) to the earthworks contractor that provided details around the excavation work on the north end beach of the STP facility. Work progressed through to spring 2018 without any incident related to bearing capacity for the selected equipment. A site investigation was conducted by Golder in December 2018 (Golder 2019f, factual report in draft and in the process of being finalized by Golder) to define the southern limit of the tailings excavation work area and to assess the bearing capacity and liquefaction potential of the tailings at the north end of the STP. The bearing capacity assessment was summarized in a letter (Golder 2019h). Details of the site investigation are provided in Section 3.1.5.

3.1.5 2018 Site Investigation of Tailings

Golder carried out a site investigation in December 2018 on the tailings, which included six cone penetration tests (CPTs), two seismic CPTs, sonic drilling, electronic field vane shear testing, piezometer installation, and laboratory testing, with results presented in a draft report by Golder (2019f). Locations of the boreholes and CPT holes are shown in Figure 3.

Some of the conclusions from the site investigation are as follows:

- The tailings below the phreatic surface are susceptible to liquefaction in all CPT locations.
- The phreatic surface was found to be 6.6 to 8.8 m below the tailings surface at the time of the geotechnical investigation.
- The allowable bearing capacity of tailings surface reduces with distance away from the discharge point due to the reduction in the undrained shear strength of tailing materials. The undrained allowable bearing capacity, when measured as radial distances from the end of the pipe discharge point, for a 1 m square footing was:
  - 160 kPa in areas within 200 m of the discharge point
  - 120 kPa between 200 and 350 m from the discharge point
  - 70 kPa between 350 and 500 m from the discharge point

Two vibrating wire (VW) piezometers (one in each of boreholes BH-CPT18-05A and -07A) were installed in saturated tailings below the phreatic surface to monitor water levels in the tailings. One VW piezometer was installed in the in situ till in BH-CPT18-07A to monitor the phreatic surface in the dam foundation.

Data loggers were installed for these piezometers on 23 August 2019, and their readings are live on GeoExplorer. The water level in the tailings is between elev. 1,630.5 and 1,631 m as of 2 October 2019, which is 6.5 to 7 m below surface of the tailings beach.

The results from the site investigation are being used to assess the liquefaction potential of the tailings and the potential of the STP dams overtopping as a result of tailings liquefaction. The bearing capacity assessment of the tailings is summarized in a letter by Golder (2019h).

3.1.6 Tailings Regrade

The excavated tailings that were temporarily stockpiled west of the channel were regraded in 2019. A portion of the excavated tailings were placed at elevations above the dam crest in this area. FRO prepared a plan to regrade these tailings.

FRO contracted the same earthworks company that cleared the backed-up north single point discharge area to regrade the tailings across a larger area and to slope the tailings to the topography of the STP facility and dam, where elevation is the highest at the north end and slopes down towards the south. FRO provided a safe work plan to the EoR for review, and the EoR provided recommendations on the maximum elevation of the graded surface tailings, setback between the graded tailings and STP dam upstream slope, and geotechnical considerations for safe working conditions in this area (Golder 2019g).

The tailings regrade work commenced during the week of 9 September 2019 and was completed on 23 September 2019.

3.1.7 Pond Capacity, Dredging, and Other Operation Updates

The STP was active and tailings were deposited into the STP throughout the reporting period.

Bathymetric surveys were completed by FRO on 3 April (before dredging commenced) and 25 June (during dredging operations) 2019 to confirm the capacity in the STP. FRO plans to conduct the next bathymetric survey prior to dredging in Spring 2020.

Dredging from the STP to the Turnbull TSF began in 2016. The 2019 dredging season started on 6 April and ended on 28 October 2019, and achieved a dredging total of 1.66 million dry metric tonnes.

Site drainage was sent to the STP in January and February 2019 when sediments were removed from the North Loop Settling Pond; site drainage was diverted to the North Loop Settling Pond for the rest of the reporting period. Site drainage includes wash water from the dryer building, clean coal building, water used in the plant site area, and surface water runoff from the plant site area and nearby waste rock piles.

On 21 February 2019, erosion on the upstream slope of the Main Dam to the west and east of the Kilmarnock discharge was observed. Vacuum trucks with effluents from the Maxam sump were authorized to discharge in the area of the Kilmarnock discharge pipelines, where there is riprap protection on the dam slope. The trucks discharged in areas 80 m northeast and 20 m southwest of the Kilmarnock discharge instead, causing the erosion.

Signage was placed at the dam toe, crest, and vicinity of the STP in June 2019 to notify passersby that the structure is a tailings dam and to provide direction and contact information to report any issues observed or any proposed work in the vicinity.

An animal burrow removal plan to remove the ground squirrel burrows was developed by FRO Environment and was approved by the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. FRO plans to implement the animal burrow removal plan in 2020.

3.1.8 Construction and Maintenance

The existing high-pressure gas pipeline that crosses the north and south abutments of the STP is scheduled to be decommissioned by 2020, and this allows the current pipeline to be decommissioned. Golder provided a scope of work for engineering, on-site laboratory testing and construction quality assurance and quality control services, and as-built reporting for the north abutment tie-in work. At the south abutment, the decommissioned gas pipeline would be exposed and cut off downstream of the STP dam and backfilled. Golder provided a scope of work for the south abutment work in August 2019.

An emergency riprap stockpile is maintained at the south end of the STP with an approximate volume of 4,500 m^3.

3.1.9 Inspections

The STP dams were inspected by FRO geotechnical personnel throughout the year per the inspection schedule outlined in Section 1.3.3 of the OMS manual (FRO 2020). The STP dams were inspected weekly between May and October, and twice per month between November and April. A summary of the dam inspection action items are included in Appendix E, and the EoR team has reviewed them as part of the annual review.

Water quality testing is completed by FRO environmental personnel. Water quality testing results are provided in Appendix F.

3.2 North Tailings Pond

3.2.1 Operation and Capacity

The NTP was not operational and there was no tailings deposition during the reporting period.

The NTP water level reached its maximum allowable pond elevation of 1,650.7 m on 21 July 2019 following two days of heavy rainfall. A pump was set up the next day to pump water from NTP via an existing pipeline to the STP and continued pumping until 26 July when the pond level dropped below elev. 1,650.5 m. FRO conducted an internal review in September 2019 to identify the factors that contributed to freeboard exceedance and to improve future monitoring. The results of the review indicated a management of change exercise was not completed when the NTP's freeboard was increased from 1.2 to 1.9 m in 2018 and that geotechnical hazard management (e.g., establishing clear roles and responsibilities, management of change practices, and personnel training) was inadequate. FRO identified key learnings from this internal review and is in the process of implementing them.

For planning purposes, the NTP is to be considered as having no available tailings capacity.

Signage was placed at the dam toe, crest, and vicinity of the NTP in June 2019 to notify passersby that the structure is a tailings dam and to provide direction and contact information to report any issues observed or any proposed work in the vicinity.

An animal burrow removal plan to remove the ground squirrel burrows was developed by FRO Environment and was approved by the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. FRO plans to implement the animal burrow removal plan in 2020.

3.2.2 New Instrumentation

In September 2018, FRO conducted a drilling program to install groundwater monitoring wells to support the NTP transition scope of the Flood Mitigation Project. Two monitoring wells were installed at the toe of the NTP dam, with one of them (FR-MW- NTPSE) installed at the southeast corner of the dam near Sta. 1+350. The location of these monitoring wells is shown in Figure 7. A part of the drill pad for FR-MW- NTPSE was excavated into the toe of the NTP dam and should be backfilled.

A piezometer and staff gauge were installed in the pond to monitor water level. A data logger was installed for the piezometer and it is connected to GeoExplorer. Readings from the piezometers are live on GeoExplorer and are collected every six hours.

3.2.3 Liverpool Sediment Pond System

The Liverpool Sediment Pond system outlet channel and fish barrier at the north abutment area of the NTP facility were completed in late 2016, and are not considered part of the NTP facility. The Liverpool Sediment Pond outlet channel was constructed over the NTP tailings beach at the north end of the facility, and the fish barrier structure was constructed through the NTP dam's north abutment. The outlet works for the Liverpool system should continue to be inspected during both the monthly NTP and Liverpool Sediment Pond inspections.

3.2.4 Inspections

The NTP dam was inspected monthly by FRO geotechnical personnel. A summary of the dam inspection action items are included in Appendix E, and the NTP dam inspection reports have been reviewed by the EoR.

4.0 REVIEW OF CLIMATE DATA, WATER BALANCE, AND DAM REGISTRY

4.1 Climatic Review

Three local climate monitoring stations exist at FRO: waste water treatment plant, A Spoil, and Brownie Spoil.

There were records available from each of the local weather stations during the reporting period of 1 September 2018 to 31 August 2019. The A Spoil station is not equipped to measure snowfall, and its precipitation data between freeze-up to spring thaw were not used as part of the review.

The Fording River Cominco station is the closest regional Environment and Climate Change Canada station to the FRO site; however, the station did not publish precipitation data over the reporting period. Data from the waste water treatment plant were used as main precipitation station for the Fording River Cominco infilling gap process since December 2013, which means the waste water treatment plant station precipitation data were used over the reporting period.

The total precipitation recorded at the waste water treatment plant, and Brownie Spoil stations over the reporting period is shown in Table 8, with their monthly total precipitation presented in Chart 1. For comparison purposes, the long-term (1970 to 2018) average monthly precipitation at FRO is also presented in Chart 1, while the long-term (1970 to 2018) average annual precipitation at the mine site is estimated to be 636 mm.

Note that all data presented in Table 8 and Chart 1 are raw data; no adjustments for station elevation or undercatch were made.

Table 8: Total Precipitation from 1 September 2018 to 31 August 2019

Weather Station	Total Precipitation (mm)
Waste water treatment plant weather station	496
Brownie Spoil weather station	576

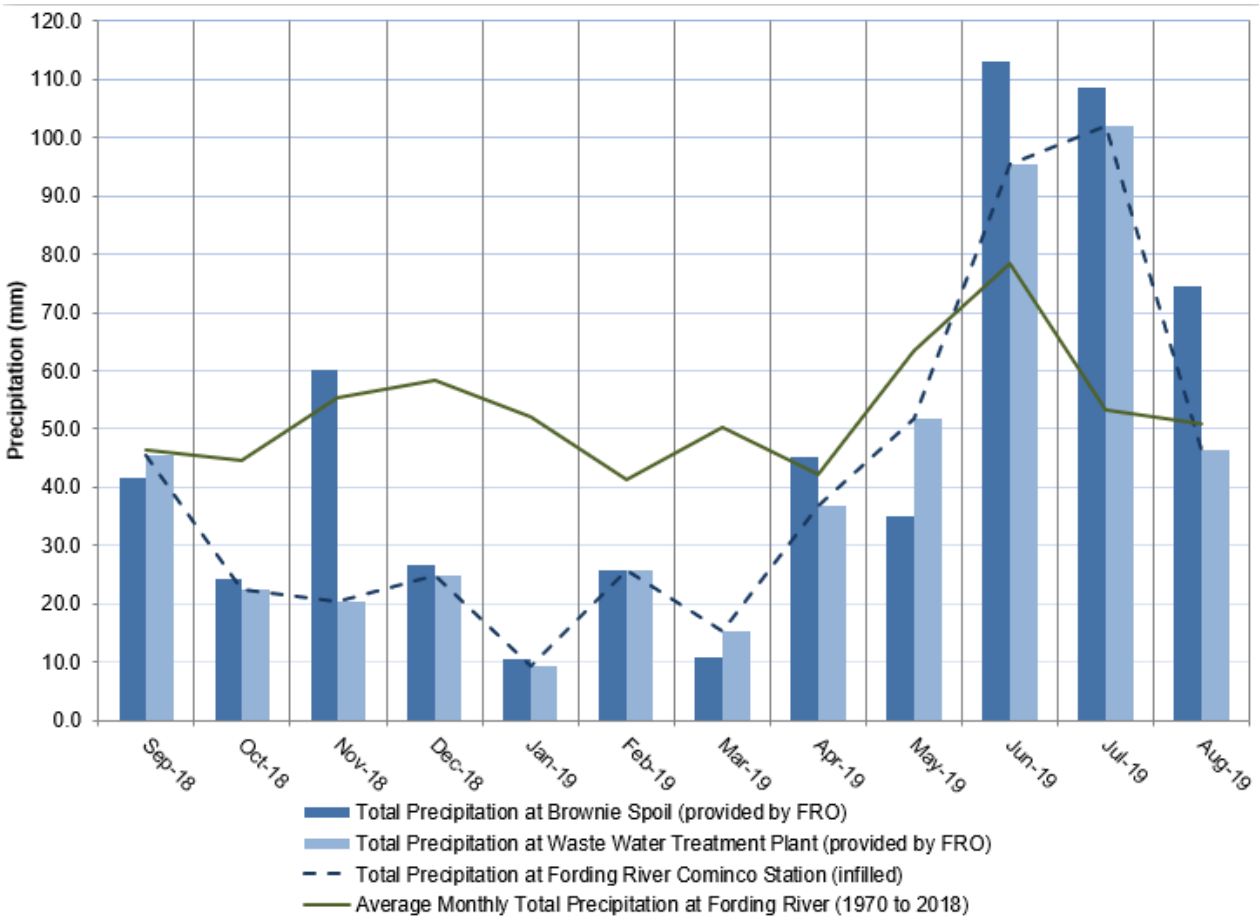


Chart 1: Monthly Precipitation Data from 1 September 2018 to 31 August 2019

The climate data in Table 8 indicate the annual precipitation received at FRO from 1 September 2018 to 31 August 2019 was lower than the long-term annual average of 636 mm at the local weather stations. A similar observation could be made from Chart 1, where the total monthly precipitation data recorded at each of the local weather stations were generally at or lower than the long-term average except for the months of June, July, and August 2019 at the Brownie Spoil station.

Winter snowfall accumulation typically melts and runs off starting in April to May at FRO, with higher flow events expected during those months as a result of combined rainfall and snowmelt events. Spring flooding levels in the Elk Valley were well below historical levels in 2019, which is attributed in part to the lower than average precipitation observed in April (for two out of three local stations) and May 2019.

4.2 Water Balance

4.2.1 South Tailings Pond

The water balance for STP from 1 September 2018 to 31 August 2019 is summarized in Table 9 using climate inputs from the waste water treatment plant station.

Table 9: 1 September 2018 to 31 August 2019 – South Tailings Pond Water Balance

IN	Annual Volume (m^3)	OUT	Annual Volume (m^3)	Total Inventory Change (m^3)
Surface water runoff	175,200	Evaporation	104,700	-79,100
Make up water	4,284,700	Seepage loss	2,462,400	
Precipitation	80,100	Water retained in tailings	106,600	
Tailings slurry	23,445,900	Dredged slurry to Turnbull TSF	2,219,900	
Miscellaneous	30,200	Clarified water return	23,201,600	
Sum	28,016,100	**Sum**	28,095,200	

TSF = tailings storage facility.

For the reporting period, the water balance model estimates a decrease in volume in the STP pond. This is consistent with the observed decrease in pond elevation and increased dredging volume in 2019. The estimated seepage loss from the STP pond is similar to previous years.

4.2.2 North Tailings Pond

The water balance for NTP from 1 September 2018 to 31 August 2019 is summarized in Table 10 using climate inputs from the waste water treatment plant station.

Table 10: 1 September 2018 to 31 August 2019 – North Tailings Pond Water Balance

IN	Annual Volume (m^3)	OUT	Annual Volume (m^3)	Total Inventory Change (m^3)
Surface water runoff	240,900	Evaporation	40,500	**7,700**
Precipitation	29,700	Seepage loss	222,400	
Sum	**270,600**	**Sum**	**262,900**	

For the reporting period, the water balance model estimates an increase in volume in the NTP pond, which is consistent with the observed small increase in pond elevation. Estimated seepage loss is similar to previous years.

4.3 Water Quality Monitoring

FRO Environment carries out water quality monitoring in and around the STP facility at the following locations:

- STP north seep (at culverts)
- STP southwest corner (pond at toe of dam)
- STP west seep (embankment below West Dam)

It is understood that FRO Environment submits water quality monitoring results to the BC Ministry of Environment as part of compliance reporting. Water quality testing results at the above locations were provided by FRO and are included in Appendix F of this report; the assessment of the water quality results is beyond the scope of this DSI.

4.4 Tailings Storage Facility Registry

The TSF registry for the STP and NTP is included in Appendix G.

5.0 TAILINGS FACILITY DAM SAFETY ASSESSMENT

This section presents the dam safety assessment of the STP and NTP facilities based on the observations and data review for each of the failure modes that are most relevant to this type of dam.

5.1 Method

5.1.1 Site Visit

The site inspections at the STP and NTP were carried out on 10 and 11 September 2019, respectively, by Mr. John Cunning, P.Eng., and Ms. Clara Lee, P.Eng., of Golder. They were accompanied by Ms. Natasha Carrière, E.I.T., the seconded tailings engineer, and Mr. Patrick Lea, E.I.T., of FRO.

The temperature during the visit was between approximately 4°C and 8°C and the weather was rainy and/or cloudy.

Appendix A presents a summary of photographs of the STP and NTP from the site inspection. The location, direction, and number for each photograph are noted in Figures 2 (for STP) and 6 (for NTP).

A summary of the observations is included in the inspection reports in Appendices B and C, for the STP and NTP respectively. In general, the STP and NTP were observed to be in good condition at the time of the 2019 annual inspection.

Details of the site inspection are discussed in Sections 5.4 and 5.5.

5.1.2 Review of Background Information

FRO provided the following information for this DSI:

- 2019 FRO site LiDAR topographic data and orthophoto
- tailings pond bathymetric data for the STP from the April and June 2019 surveys
- STP tailings deposition update from FRO for periods between April and June 2019
- dredging records for the STP from April to October 2019
- VW piezometer and pond water level data
- dam movement data: GPS monitoring data and slope inclinometers on the STP and NTP
- records of routine visual inspections by FRO qualified personnel
- site climate data from September 2018 to August 2019

5.2 Dam Consequence Classification

Guidelines for the classification of dams are presented in the HSRC Guidance Document, Section 3.4 (Ministry of Energy and Mines 2016), which references the *Dam Safety Guidelines* (CDA 2013).

Table 11 presents the dam classification criteria. Consequence categories are based on the incremental losses that a failure of the dam may inflict on downstream or upstream areas, or at the dam location itself. Incremental losses are those over and above losses that might have occurred in the same natural event or condition had the dam not failed. The consequences of a dam failure are ranked as Low, Significant, High, Very High, or Extreme for each category. The classification assigned to a dam is the highest rank determined among the categories.

Table 11: Dam Classification

Dam Class	Population at Risk	Incremental Losses		
		Loss of Life	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	Minimal short term loss. No long term loss.	Low economic losses; area contains limited infrastructure or service.
Significant	Temporary only (e.g., seasonal cottage use, passing through on transportation routes, participating in recreation activities)	The appropriate level of safety required depends on the number of people, the exposure time, the nature of their activities, and other considerations	No significant loss or deterioration of fish or wildlife habitat, *or* Loss of marginal habitat only. Restoration or compensation in kind highly possible.	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes.
High	Permanent – ordinarily located in the dam-breach inundation zone (e.g., as permanent residents)	10 or fewer	Significant loss or deterioration of important fish or wildlife habitat. Restoration or compensation in kind highly possible.	High economic losses affecting infrastructure, public transport, and commercial facilities.
Very High	Permanent – ordinarily located in the dam-breach inundation zone (e.g., as permanent residents)	100 or fewer	Significant loss or deterioration of critical fish or wildlife habitat. Restoration or compensation in kind possible but impractical.	Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances).
Extreme	Permanent – ordinarily located in the dam-breach inundation zone (e.g., as permanent residents)	More than 100	Major loss of critical fish or wildlife habitat. Restoration or compensation in kind impossible.	Extreme losses affecting critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances).

Source: HSRC Guidance Document (Ministry of Energy and Mines 2016) Table 3-3 based on CDA (2013) Table 2-1.

5.2.1 Facility Consequence Classification

An inundation study considering both flood-induced (overtopping) and sunny-day (piping) failure modes for the STP and NTP dams was performed to understand the potential incremental impacts on downstream receptors (Golder 2014e). The flood-induced (overtopping) inundation assumed a 1-in-2-year flood event (bankfull conditions) in the Fording River (Golder 2014e). A single classification for the dam system is based on the failure scenario that would result in worse consequences: either sunny-day failure or flood-induced failure (CDA 2013).

The rationale applied for assigning the consequence level for each attribute for the STP and NTP facilities is as follows:

- **Population at risk (High consequence)**—Permanent: as identified by Golder (2014e), some 18 permanent residences are located on the flood plains downstream of the dams within the flood inundation extents. The active water treatment facility-south (AWTF-S) downstream of the STP is undergoing construction.
- **Loss of life (Significant to High consequence)**—Since people are present in the inundation zone, it is foreseeable that there is a possibility for loss of life (for STP and NTP permanent downstream residences, Maxam Yard [site explosive storage facility including Maxam personnel offices], and workers at the AWTF-S). Quantification of off-site loss of life has been inferred from population at risk (Golder 2014e).
- **Environmental and cultural (High to Very High consequence)**—Presence of critical habitat for Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*), a species of Special Concern. Restoration is considered to be possible but difficult. The classification is Very High for the sunny-day failure scenario and High for the flood-induced failure scenarios (Teck Coal 2016).
- **Infrastructure and economics (High consequence)**—Third-party economic losses are anticipated to be high in the event of a failure (Golder 2014e).

The population at risk and potential loss of life for the AWTF-S should be reviewed after completion of the Main Dam breach and inundation study described in Section 3.1.3.

Table 12 presents a summary of the current dam consequence classifications for the FRO facilities.

Table 12: Dam Consequence Classification Results

FRO Facility	Dam Class	Population at Risk	Consequences of Failure		
			Loss of Life	Environment and Cultural Values	Infrastructure and Economics
STP	**Very High**	High	Significant to High	High to Very High	High
NTP	**Very High**	High	Significant to High	High to Very High	High
STP and NTP river flood-induced components	**High**	High	Low to Significant	High	Significant

Note: River flood induced component classification based on dam inundation concurrent with major flood event. Lower design criteria related to “High” classification is for the riprap components of the STP and NTP only and does not change the overall classification of the facility. Refer to Section 2.5.4, CDA 2013.

FRO = Fording River Operations; STP = South Tailings Pond; NTP = North Tailings Pond.

The STP and NTP dams are classified as Very High consequence, while the components for a river flood-induced failure are classified as High consequence. The STP and NTP classifications are governed by the consequences of a potential fair-weather failure scenario.

5.2.2 River Flood Component Consequence Classification

An incremental inundation assessment (Golder 2017d) was completed to assess the consequence of failure of the STP and NTP during 200-year and 500-year Fording River flood events. The assessment concluded that the consequence of a failure occurring coincident with the flood events considered is High.

A risk-informed assessment, which would be supported by a design level flood-induced dam break and inundation assessment, is recommended to determine the appropriate criteria for the flood protection requirements along the downstream toes of the STP and NTP dams.

5.2.3 Review of Downstream and Upstream Conditions

The following are changes or planned changes to the upstream and downstream conditions during the reporting period:

- FRO is completing a feasibility study for replacement of the multiplate culvert crossing the Fording River upstream of the STP and NTP facilities.
- FRO completed a feasibility study to widen the Fording River flood plain west of the STP dam toe and to add riprap bank protection along the dam to reduce the likelihood of a dam failure due to erosion of the dam toe from a flood event. The detailed design of this study is set to commence in Q1 2020.
- FRO is undertaking construction of the AWTF-S downstream of the STP Main Dam. The facility is located above the estimated 500-year return period flood level of the Fording River. Preliminary assessments of a failure of the Main Dam as a result of internal erosion/piping indicated the facility would be within the inundation zone. FRO is developing emergency response measures in collaboration with the EoR in response to this finding.

5.3 Review of Operational Documents

5.3.1 Operation, Maintenance, and Surveillance Manual

The operation, maintenance, and surveillance (OMS) manual for the STP and NTP is Version 2019.03, issued on 27 February 2020 (FRO 2020).

5.3.2 Emergency Preparedness Plan / Emergency Response Plan

An emergency response plan (ERP) was developed for the STP and NTP in conjunction with all tailings storage facilities on site at FRO in 2018 and updated in 2019 (SP&P EP.009; FRO 2019). This document is under final review by senior staff at FRO at the time of writing this report. This document was developed to meet the regulations and related guidelines of the HSRC (Ministry of Energy and Mines 2016, 2017), the CDA (2013), the Mining Association of Canada (MAC 2011), and Teck Resources Limited (Teck Resources 2019).

FRO has also developed a *Tailings Impoundment Flood Response Protocol for the Fording River*. This document was issued on 26 September 2017 (FRO 2017) and should be reviewed prior to the 2020 freshet and updated as required.

The emergency preparedness plan (EPP; EP.008) was last updated on 15 December 2015 (FRO 2015). FRO plans to update the EPP once the ERP is finalized as the document will outline the warnings FRO will issue and the expected actions of local authorities and other responders for dam breach flood emergencies.

The emergency planning documents should continue to be reviewed at least annually, with updates incorporated when required. The ERP should be tested annually. FRO carried out an internal tabletop exercise to test the ERP on 26 November 2019.

5.3.3 Dam Safety Review

The most recent dam safety review of the STP and NTP was completed in 2014 (KCB 2014). A dam safety review is required at a minimum of every five years for all water and tailings storage facilities regardless of dam consequence classification according to HSRC Section 10.5.4 (Ministry of Energy and Mines 2017). The next dam safety review is required in 2019 and is currently underway, with a site inspection of the facilities conducted by a third-party consultant in September 2019.

5.4 South Tailings Pond

The record of inspection for the FRO STP conducted by the EoR team on 10 September 2019 is included in Appendix B. Figure 3 provides a plan of the STP with the location of the monitoring points. The typical sections of the STP dams are shown in Figures 4 and 5.

This section presents an assessment of dam safety for the STP dam based on observations and data review and includes a review of the 2018 recommendations for the facility.

5.4.1 Assessment of Dam Safety Relative to Potential Failure Modes

A summary of the assessment and potential failure modes is presented in Table 13.

Table 13: Assessment of South Tailings Pond Dam Safety Relative to Potential Failure Modes

Potential Failure Mode	Observations/Data	Comments
Internal erosion (suffusion and piping)	Filter compatibility is generally met between dam fill materials and foundation flood plain sand and gravel; however, it is not met for the tailings and the flood plain sand and gravel. Ongoing seepage monitoring since 2015.	The potential filter inadequacy between the foundation and tailings will not impact the stability of the dam (i.e., it does not contribute to potential failure of the dam due to internal erosion), as the stability is not reliant on the tailings. Migration of the tailings through the sand and gravel is considered low risk.
Overtopping	Pond elevation maintained below maximum allowable throughout reporting period. The STP water level TARP and the STP water level TARP for interim operations at high levels were developed following high pond level in 2018, and should be followed through the 2020 freshet period	IDF and freeboard assessment completed (Golder 2018b) with a list of IDF accommodation recommendations provided for STP. Design and plan to construct a spillway to accommodate the IDF per recommended action 2018-03 in Table 25 is underway.
Instability	No evident instability	Static and seismic stability assessment (Golder 2018b) results indicate that the FoS of the dam meet or exceed the Very High consequence static and pseudo-static slope stability FoS design criteria considering 2017 maximum phreatic conditions.
River erosion along dam toe	Riprap in place along STP dam toe up to Sta. 0+680 in good conditions (KWL, Appendix D)	Recommendation 2015-12 remains outstanding for river flood protection south of STP Sta. 0+680, which should be addressed in the detailed design of STP flood widening project starting in early 2020.
Tailings or tailings water pipeline failure	No leakage observed from active tailings pipelines	Continue to manage this failure mode by routine inspection of the pipelines.

STP = South Tailings Pond; TARP = trigger-action-response plan; IDF = inflow design flood; FoS = factor(s) of safety.

5.4.1.1 Internal Erosion (Suffusion and Piping)

Design Basis

The following filter relationships were checked for the STP:

- compatibility between the tailings and the upstream till blanket
- compatibility between the upstream till blanket and CR/CCFR shell
- compatibility between the till cut-off and flood plain sand and gravel foundation
- compatibility between the CR or CCFR shell and the flood plain sand and gravel foundation
- compatibility between tailings and the flood plain sand and gravel foundation
- internal stability of the CR/CCFR shell

Filter compatibility was reviewed based on gradation quality control data from the 2008, 2012, and 2013 as-built reports, as well as the 2002 till evaluation, which were used to confirm filter compatibility of all materials placed (Golder 2002, 2009, 2013, 2014d).

Various methods were used to check filter compatibility, including the United States Department of the Interior, Bureau of Reclamation (USBR 1977), the Sherard criteria (Sherard et al. 1984; Sherard and Dunningan 1989), the Terzaghi method (Terzaghi 1922), US Army Corps of Engineers (USACE 2004), Kenney and Lau (1985), Li et al. (2009), and Fell et al. (2005).

A filter compatibility and internal stability assessment was completed by Golder in 2015 in response to a February 2015 Ministry of Energy, Mines and Petroleum Resources (formerly the Ministry of Energy and Mines) order to undertake an assessment to determine if the tailings facilities dams may be at risk of internal erosion (Golder 2015a).

All materials generally have filter compatibility by all methods except between the tailings and the flood plain sand and gravel. The potential filter inadequacy between the foundation and tailings will not impact the stability of the dam, as the dam stability is not reliant on the tailings. Migration of the tailings through the sand and gravel is expected to be contained by the till cut-off, and therefore a low risk. No tailings have been observed downstream to date.

The internal stability of the CR shell was confirmed (Golder 2015a).

There are some gaps in construction quality control records, particularly for the 1983 to 1984, 1985 to 1990, and 1993 raises; however, the gradation of the CR and CCFR filter/shell material created by the wash plant appears to have remained relatively consistent since the 1970s (Golder 2015a). Where data were available, they indicated that filter compatibility between the local till and the CR/CCFR was achieved. Gaps in the construction quality control records are considered to be very low risk.

Based on the performance of the dam over the last 40 years, piping through the dam due to filter-incompatible materials is considered to have a very rare likelihood of occurrence. Continual seepage is evident in the foundation materials below the toe of the STP dam, particularly along the West Dam, and has been reported for many years. Cloudy seepage water can indicate internal erosion, but records of the seepage from the STP indicate clear water. Regular inspections for evidence of increased seepage and piping should continue.

Quantitative monitoring of seepage at the West Dam began in late 2015 in response to a visual observation of increased year-over-year seepage rates.

Instrumentation Data – Seepage Monitoring

In 1979, shortly after the STP was put into operation, it became apparent that at some location beneath the bottom of the STP, the lower gravel stratum had hydraulic connection with the surficial flood plain gravels that extend over the base of the pond. It is understood that the STP water balance showed unexpected losses.

The total seepage losses from the pond are not measured directly. The estimated rate of seepage loss noted in previous water balances for the STP contains uncertainties resulting from inaccuracies in the water balance modelling, such as not accounting for the mass balance.

Seepage losses from the STP from 1989, 2000, 2003, and 2006 through 2019 are shown in Table 14.

Table 14: Fording River Operations Reported Seepage Losses from the South Tailings Pond

Year	Approximate Average Pond Elevation (m)	Historical FRO Reported Seepage (m^3/min)	GoldSIM Seepage (m^3/min)
1989	1,629.1	7.5	n/a
2000	1,629.7	4.3	n/a
2003	1,629.5	5.5	n/a
2006	1,629.7	0.4	n/a
2007	1,629.0	3.2	n/a
2008	1,629.5	2.8	n/a
2009	1,630.0	2.3	n/a
2010	1,630.1	1.5	n/a
2011	1,631.9	3.4	n/a
2012	1,632.9	3.9	n/a
2013	1,634.5	10.6	n/a
2014	1,635.5	13.1	n/a
2015	1,636.3	n/a	9.9
2016	1,636.3	n/a	10.4
2017	1,636.2	n/a	5.0
2018	1,636.4	n/a	4.8
2019	1,636.5	n/a	4.7

Note: Pond elevations reported in Elk Valley Elevation Datum.

FRO = Fording River Operations; n/a = not applicable.

In response to an increase in the observed seepage below the south end of the West Dam, FRO installed two seepage collection pipes within the seepage area in 2015. Seepage can also be observed and is monitored through twin culverts downstream of the north end of the West Dam. Seepage data from the collection pipes were only taken during the site inspection visit on 10 September 2019. Photograph A-10 in Appendix A shows the location of the collection pipes and the estimated flow measurements during the site inspection. Seepage data should be collected regularly to develop long-term trending of seepage rates in this area.

Observed Performance

The key observations made during the STP dam inspection were as follows:

- Seepage continues along the presumed till/bedrock contact in the diversion channel slope below the West Dam (Appendix A, Photographs A-9 and A-10). The seepage has pushed up mats of organics and created a hummocky, broken surface area. This is consistent with previous years' observations in this area. Seepage from the two collection pipes in this area was measured during the 10 September 2019 site visit and recorded to be 0.27 to 0.2 L/s from the W Seep North and South pipes, respectively. Red staining was noted in some areas of seepage along the bedrock contact.
- Water flow was observed in the ditch along the downstream toe of the north end of the West Dam as seen in previous years. Water was observed in the ditch along the toe downstream of the south end of the West Dam. The water is likely due to seepage exiting the dam and surface water. Vegetation growth was also observed along these ditches.
- Water flow was observed in the twin culverts at the north seepage area. A Greyline MantaRay Portable Area-Velocity Flow Meter was used to measure the flow in the north seep east pipe with result of 10 L/s at the time of the inspection. The flow in the north seep west pipe was too low for the measurement.
- All observed seepage, including external seepage water, was clear and had no sediments.
- No zones of subsidence or any sinkholes were observed that would indicate voids due to either suffusion or piping.

5.4.1.2 Overtopping

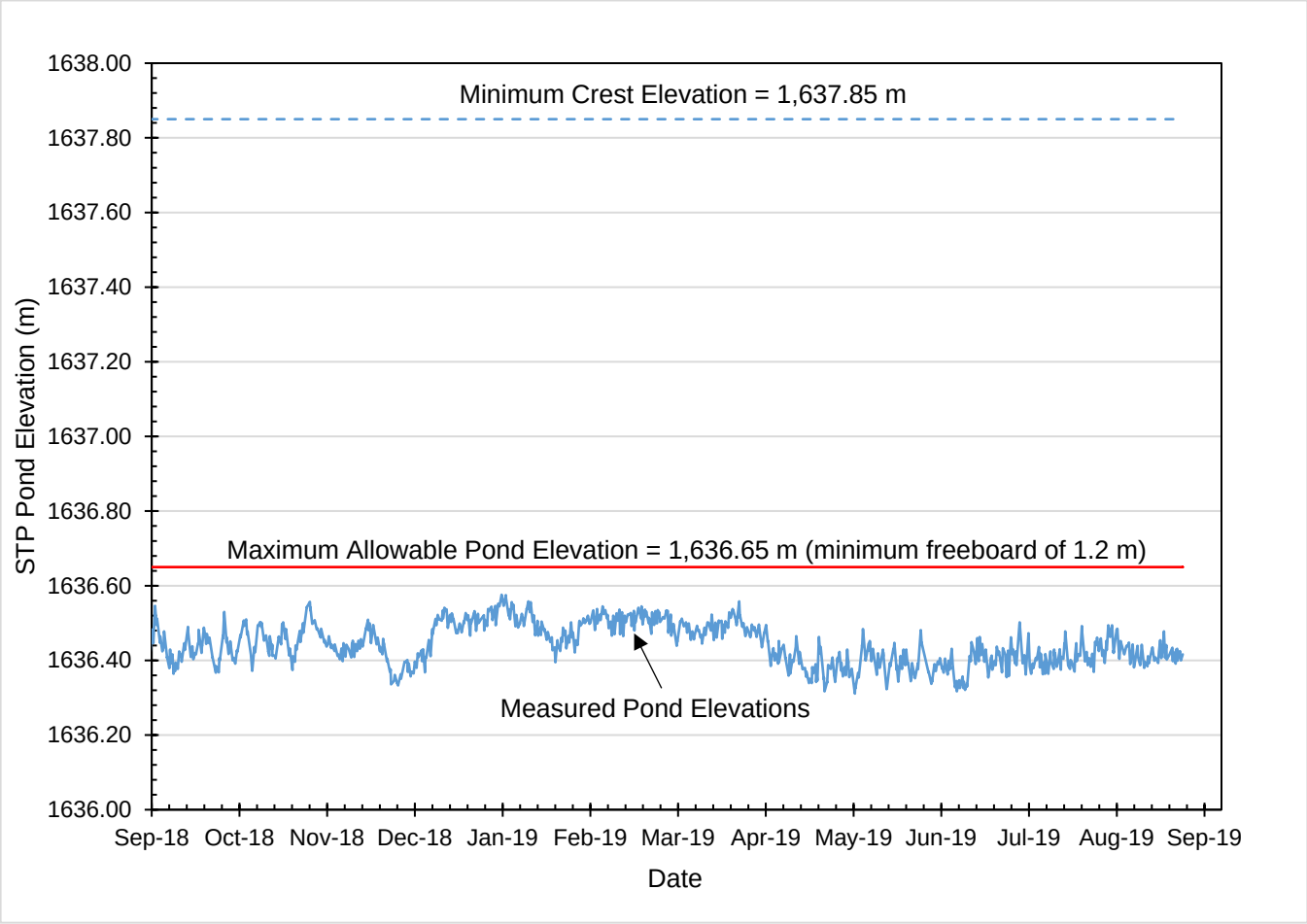
Design Basis

An updated IDF and freeboard assessment for the Very High consequence classification was completed in 2018 (Golder 2018b). The HSRC Guidance Document (Ministry of Energy and Mines 2016) recommends that the IDF be designed to 2/3 between the 1,000-year flood/storm event and the probable maximum flood for a structure classified as Very High consequence. Furthermore, for impoundments with no emergency spillway, HSRC Section 10.1.8 requires a minimum storage volume to contain runoff from a 72-hour IDF. As a result of the reclassification of the STP dam from High to Very High, its freeboard assessment was updated with the above-mentioned HSRC requirements. The result of the updated assessment indicated that:

- The current maximum operating water level of elev. 1,636.65 m, which is 1.2 m below the minimum dam crest, provides the required freeboard during the 72-hour IDF if all external catchment areas are diverted.
- The required minimum freeboard above the IDF is 0.4 m with the maximum flood level (IDF) at elev. 1,637.45 m. This is based on the maximum operating water level of elev. 1,636.65 m and water from all catchment areas being diverted.

Instrumentation Data

Chart 2 presents the pond elevation data for 1 September 2018 to 31 August 2019 at the STP based on data received from FRO. Some erroneous data points were measured either following a power outage or as a single error point in the data, indicated by the change in water level (on the scale of metres) in a single data reading, well beyond a realistic rate of rise. These erroneous data points have been removed from Chart 2.



Note: Pond elevations reported in Elk Valley Elevation Datum.

STP = South Tailings Pond.

Chart 2: South Tailings Pond Water Elevation from 1 September 2018 to 31 August 2019

The STP water level is shown to have been maintained below the maximum allowable water elevation during the reporting period. Water levels in the STP are monitored in real time with a water level sensor located on the water reclaim barge, and levels are actively managed by the FRO processing plant personnel. In the event of high water levels at the STP, the STP water level TARP from Appendix B of the OMS manual would be followed (FRO 2020). Water management options for STP during freshet are also included in the OMS manual.

Observed Performance

The operating pond volume on 3 April 2019 prior to the start of dredging was 364,657 m³, which was near the minimum water reservoir volume of 300,000 m³.

Dredging operations at the STP were started as part of the plan to manage the high tailings volume in the facility. FRO targeted a dredge volume of 1.3 million tonnes for the 2019 season and started dredging on 6 April 2019. Based on a comparison of the bathymetric data from the April and June 2019 surveys, 480,299 m³ of tailings were dredged from the STP as of 25 June 2019. FRO revised its dredging target in September 2019 to 1.7 million tonnes for the remainder of the dredging season.

The key observations made during the STP dam inspection were as follows:

- The pond was clear and free of major debris.
- Makeup water is sent to the STP pond. Water from the seepage return wells and North Loop Pond and reclaim water from the Turnbull TSF was being discharged into the STP.

In response to high water levels during normal operations, the TARP listed in Appendix B of the OMS manual (FRO 2020) should be followed along with the ERP.

The STP is not equipped with an overflow emergency spillway. An emergency spillway is considered to be best practice as it allows excess water to exit the facility passively (i.e., without any active intervention). Golder has prepared a conceptual design of a STP relief channel (Golder 2019c). The design of the permanent spillway is currently underway.

5.4.1.3 Instability

The STP West Dam is susceptible to instability from erosion during flooding of the Fording River. This has been assessed by KWL, and riprap was placed on the toe of the dam in late 2016 to prevent erosion (KWL 2017b). The south section of the West Dam from the pipe bridge southward (south of Sta. 0+680) does not have any erosion protection but consists partially of bedrock, which provides some erosion protection.

Design Basis

As a result of the reclassification of the STP dam from High to Very High, its slope stability and liquefaction assessments were updated to comply with the Very High consequence design criteria (Golder 2018b). An earthquake of ½ between the 1-in-2,475-year and 1-in-10,000-year event was used for Very High consequence dams per the HSRC Guidance Document (Ministry of Energy and Mines 2016). This event corresponded to a peak ground acceleration of 0.23 g and a mean moment magnitude of 6.2 based on the probabilistic analysis results from the site-specific hazard assessment (Golder 2016b). Details of the assessment and results were provided in Golder (2018b). A brief summary of the conclusions is provided below:

- The liquefaction assessment update considered the 2017 topography along with the 2016 riprap construction along the toe of the STP dam. The results indicated that the saturated soils below the dam are unlikely to liquefy during the design earthquake.

- The dam stability update used design criteria based on the HSRC Guidance Document (Ministry of Energy and Mines 2016) Section 3.3 and CDA (2014) for minimum factor of safety (FoS). Both static and pseudo-static conditions were considered in the stability assessment. However, the post-earthquake conditions were not analyzed in the foundation because the liquefaction assessment results indicated that the alluvial soils below the dams and dam materials are unlikely to liquefy during the design earthquake event. The results of the stability assessment indicated that the FoS of the STP dam met or exceeded the Very High consequence static and pseudo-static slope stability design criteria.
- The HSRC Part 10 (Ministry of Energy and Mines 2017) Section 10.1.9 indicates that design downstream slopes steeper than 2H:1V require the manager to submit justification from the EoR for the design slope and receive authorization prior to construction. The STP downstream slopes were constructed before this requirement. As noted above, the results of the stability assessment indicated that the stability FoS met or exceeded the design criteria.

Instrumentation Data – Dam Displacement Monitoring

There are 10 operational GPS units used for displacement monitoring on the STP West and Main dams.

In November 2018, GPS unit STP-GPS 10 was decommissioned and its name changed to STP-GPS 10_old in GeoExplorer.

STP-GPS 09_old last recorded on 3 April 2019 and was replaced with a new unit STP-GPS 09 the same day. STP-GPS 01_old last recorded 25 September 2018 and was replaced with STP-GPS 01 on 9 October 2018.

A summary of the GPS units in use for the 2019 DSI reporting period is presented in Table 15.

Hourly readings from 1 September 2018 to 31 August 2019 were recorded in real time via GeoExplorer for each of the GPS units. The initial readings of the GPS units were used as locations of the GPS monitors and are shown in Figure 3. The tracked location (i.e., northing and easting), 3D point velocity, cumulative relative displacement, and elevation for each GPS monitors were downloaded from GeoExplorer for the Main Dam and West Dam. Due to the manner in which GPS elevation is referenced at FRO, the change in elevation data instead of the measured elevation data is reviewed, as shown in Appendix H.

A review of the GPS data shown in Appendix H did not indicate data or data trends of concern. GPS units that were replaced within the reporting period (e.g., STP-GPS 09 on Figure H-9) showed the data from the old and new units, with their data distinguished by different colors.

STP-GPS 11 did not record any data from 31 December 2018 until 8 February 2019.

The survey data on the Main and West dams indicated little crest displacement during the reporting period.

GPS unit STP-GPS 06 was installed below the till excavation on the riprap placed in 2016 to monitor potential movements in this area following excavation and riprap placement. It experienced increased cumulative displacement starting in November 2018, a spike, and then dropped rapidly in April 2019 (plot for cumulative relative displacement on Figure H-6). This trend was likely due to the GPS unit being situated on an area of surfacing over riprap that was wet with surficial seepage from this area, where the movements recorded were a result of the ground freezing up and settling from spring thaw. Based on the data to date, a GPS unit at this location is no longer needed and this unit can be relocated to another area.

Any offline monitors should be inspected and repaired within one week (FRO 2020).

Table 15: GPS Monitoring Locations on South Tailings Pond

GPS Identification	Reading Start Date	Northing (m)	Easting (m)	Location Description
STP-GPS 01	October 2018	5,560,728.9	651,109.0	West Dam – crest
STP-GPS 02	August 2016	5,560,621.6	651,163.7	West Dam – crest above flood construction
STP-GPS 03	April 2016	5,560,537.4	651,186.9	West Dam – flood construction toe
STP-GPS 04	May 2017	5,560,540.1	651,239.9	West Dam – crest above flood construction
STP-GPS 05	October 2014	5,560,441.9	651,355.6	West Dam – crest above flood construction
STP-GPS 06	April 2016	5,560,349.1	651,369.2	West Dam – flood construction toe
STP-GPS 07	December 2013	5,560,259.9	651,525.9	West Dam – crest
STP-GPS 08	July 2018	5,560,152.6	651,659.4	West Dam – crest
STP-GPS 09_old	April 2016	5,560,081.3	651,844.4	Main Dam – crest
STP-GPS 09	April 2019	5,560,081.1	651,844.7	Main Dam – crest
STP-GPS 10_old [(a)]	April 2016	5,560,022.7	652,029.4	Main Dam – toe
STP-GPS 11	July 2018	5,560,089.4	652,051.2	Main Dam – crest

Note: Northings and Eastings reported in FRO UTM, Sensor locations downloaded from GeoExplorer.

(a) GeoExplorer indicated this GPS unit is decommissioned.

STP = South Tailings Pond; FRO = Fording River Operations; UTM = Universal Transverse Mercator.

Instrumentation Data – Slope Inclinometers

Slope inclinometers were installed at four locations in 2015 along the STP crest (Table 16) to monitor horizontal movement in the dam in addition to the GPS data. The A axis is oriented in the upstream to downstream direction (with negative displacements in the downstream direction) and the B axis is oriented along the dam centreline. The location of the inclinometers on the STP is presented in Figure 3.

Table 16: South Tailings Pond Inclinometers

Inclinometer ID	Northing (m)	Easting (m)	Elevation (m)	A-A Axis Azimuth (°)	Probe Serial No.	Reel Serial No.
TH15-01	5,560,086.2	652,037.3	1,638.2	310	DP15600000	DR21300000
TH15-02	5,560,093.0	651,786.4	1,638.3	10		
TH15-03	5,560,550.6	651,227.5	1,638.7	30		
TH15-04	5,559,997.8	652,003.4	1,604.6	15		

Note: Azimuth is approximate. The upper wheel should face the indicated direction for the first set of readings.

Northings and Eastings reported in Universal Transverse Mercator and elevations are reported in Elk Valley Elevation Datum.

Inclinometer data were supplied to Golder by FRO. Readings have been taken approximately quarterly at the STP inclinometers since December 2015. Starting in September 2018, and as discussed with the EoR, FRO has been reading the inclinometers three times per year (shortly before freshet, in latter part of freshet, and in late summer). A total of three readings were taken at inclinometers TH15-01, TH15-02, TH15-03, and TH15-04 within the DSI reporting period, which include readings from 26 and 27 September 2018, from 15 March and 2 April 2019, and from 24 June 2019. The most recent set of readings was collected by FRO in December 2019 and will be included in the 2020 DSI report.

Inclinometer data are plotted by Golder. All data readings from January 2017 to June 2019, including the initial reading from 18 December 2015 as a reference line, were plotted and are provided in Appendix I.

The inclinometer readings do not indicate any significant trends in deformation, and the maximum cumulative downstream deflection does not exceed 5 mm over a year for depths greater than 2 m below ground, which is in the acceptable range for the slope inclinometer QPO (Table 6).

Instrumentation Data – Piezometers on Main Dam

The VW piezometer and standpipe locations are shown in plan in Figure 3. A summary of the VW piezometer locations and sensor depths on the Main Dam are shown in Table 17. The performance at each VW piezometer was evaluated by assessing whether the warning levels were exceeded. The warning levels were confirmed in Golder (2018b) and are used in GeoExplorer.

Between 9 and 12 August 2019, no data were recorded at any piezometers on site due to a communications issue between the units and GeoExplorer.

Table 17: South Tailings Pond Main Dam Piezometer Installation Details and Performance Summary

Borehole / Piezometer ID	Northing (m)	Easting (m)	Top of Well Elevation (m)	Data Logger Serial No.	Piezometer Serial No.	GeoExplorer Sensor No.	Piezometer Tip Elevation (m)	Soil Unit of Piezometer Sensor	Warning Water Elevation (m)	Minimum Recorded Water Level (2018/2019)	Maximum Recorded Water Level (2018/2019)	Warning Water Elevation Exceeded?	Comments
VW-4	5,560,100.6	651,758.7	1,639.2	DT08079	VW27921	2	1,617.2	Coarse rejects (compacted)	>1,624.0	1,618.4	1,618.6	No	Trending upwards since June 2019
				DT08082	VW27920	1	1,615.0			1,615.6	1,616.1	No	No concerns
VW-5	5,560,106.2	652,102.4	1,639.2	DT08073	VW27929	2	1,615.5	Coarse rejects (compacted)	>1,617.5	1,615.5	1,615.9	No	No concerns
				DT08075	VW27930	1	1,610.4			1,610.4	1,610.8	No	No concerns
TH15-01	5,560,086.2	652,037.3	1,638.2	DT04498	VW33227	1	1,611.1	Dam fill	>1,617.5	1,613.8	1,614.3	No	No concerns
					VW33229	2	1,604.9	Dam fill / foundation fluvial sands and gravel		1,606.4	1,607.2	No	Trending upwards within reporting period (Sept 2018 to August 2019)
					VW33244	3	1,600.9	Foundation fluvial sands and gravel		n/a	n/a	n/a	Likely malfunctioning, negative water pressure, still see similar trend in piezometer data to other sensors
TH15-02	5,560,093.0	651,786.4	1,638.3	DT04499	VW33238	3	1,612.2	Granular drain	>1,624.0	1,613.2	1,613.9	No	Trending upwards within reporting period (Sept 2018 to August 2019)
					VW33233	2	1,605.5	Foundation fluvial sands and gravel		1,611.7	1,612.3	No	Trending upwards since June 2019
					VW33243	1	1,601.5	Bedrock		1,611.5	1,612.1	No	Trending upwards since June 2019
TH15-04	5,559,997.8	652,003.4	1,604.6	DT09637	VW33224	n/a	1,599.6	Foundation fluvial sands and gravel	>1,603.5	1,602.4	1,603.0	No	No concerns
SP-3	5,560,032.4	652,043.8	1,610.4	DT08083	VW27931	n/a	1,600.6	Foundation fluvial sands and gravel	>1,604.0	1,602.4	1,603.1	No	No concerns
SP-5	5,560,057.5	652,163.7	1,605.0	DT08074	VW27918	n/a	1,595.9	Foundation fluvial sands and gravel / till contact	>1,603.5[(a)]	1,601.8	1,605.5	No, see comment	Large spike in April 2019 linked to surface water infiltration from reworked standpipe, then freeze-thaw

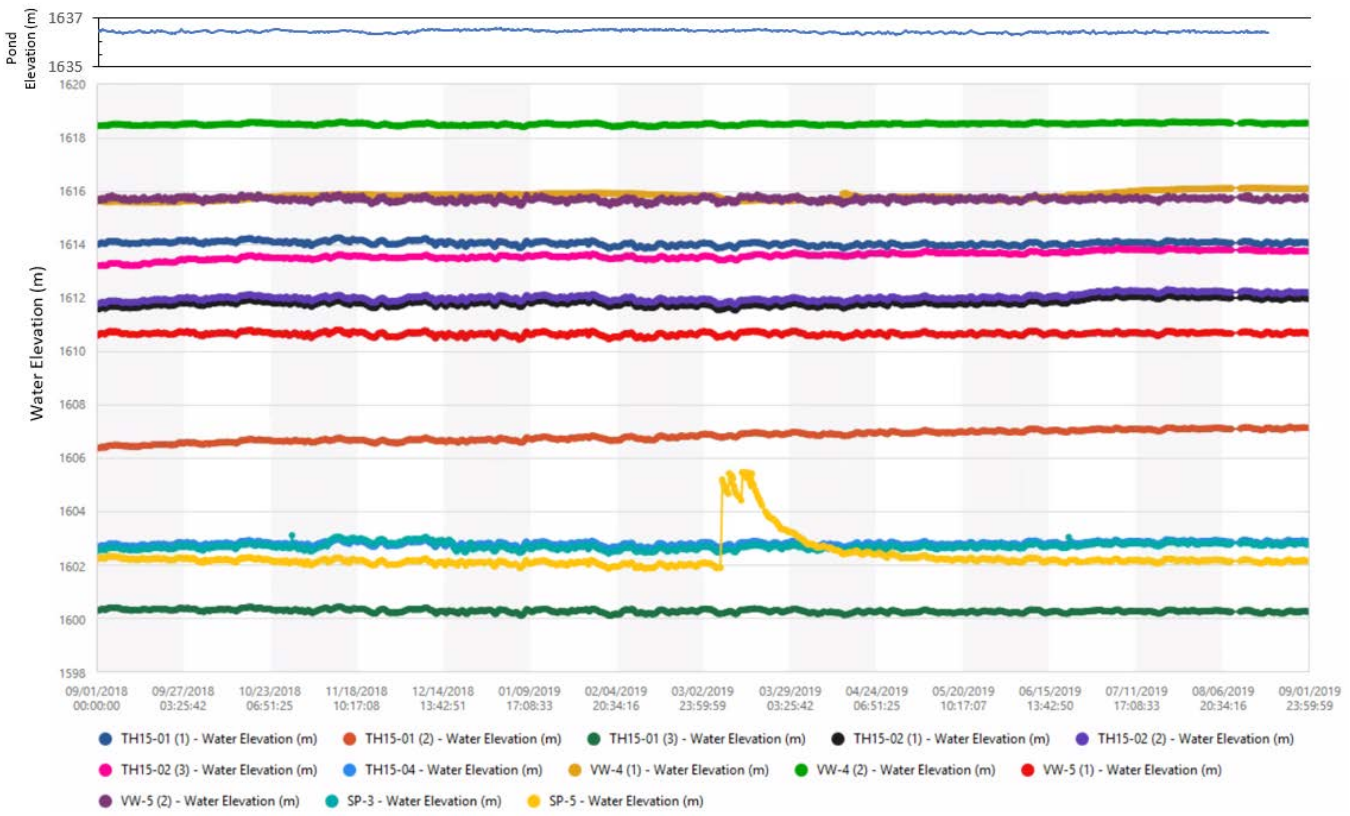
Note: Northings and Eastings reported in Universal Transverse Mercator and elevations reported in Elk Valley Elevation Datum.

Warning water elevations from GeoExplorer.

(a) Warning Water Elevation value not in place at time of April 2019 elevated reading.

n/a = not applicable; > = greater than.

Chart 3 presents the piezometer readings for 1 September 2018 to 31 August 2019, as well as the pond elevation over the same time period. The piezometer plots were taken from GeoExplorer. The number in brackets next to the piezometer ID indicates the sensor number in GeoExplorer (for boreholes with more than one piezometer). The sensor number can be found in Table 17.



Note: Elevations reported in Elk Valley Elevation Datum.

Chart 3: Main Dam Vibrating Wire Piezometer and Standpipe Water Elevations and South Tailings Pond Elevation from 1 September 2018 to 31 August 2019

The phreatic level readings for the time period were generally stable, with very little to no reaction to spring freshet.

In April 2019, abnormal water level readings were measured in SP-5. This was investigated and the cause was determined to be surface water and snowmelt infiltrating into the instrument's steel casing when a data logger was installed in the previous summer. It was also noted that there was not a QPO available for SP-5 at the time of the incident. The steel casing of SP-5 has since been grouted and its warning level established as elev. 1,603.5 m (Table 3) and set up in GeoExplorer.

TH15-01 (sensor 2) and TH15-02 (sensor 2) show a gradual increase in water elevation over the reporting period. VW-4 (sensor 1) and TH15-02 (sensors 1 and 3) show a minor increase in water elevation starting from June 2019.

Instrumentation Data – Piezometers on West Dam

Golder installed two VW piezometers (boreholes BH-CPT18-05A and -07A) in the tailings of the STP during the 2018 drilling program. The readings from the new piezometers are not plotted here as they do not monitor the water levels in the dam, though they are shown in plan view in Figure 3.

Between 9 and 12 August 2019, no data were recorded at any piezometers on site due to a communications issue between the units and GeoExplorer.

A summary of the VW piezometer locations and sensor depths on the West Dam is shown in Table 18.

Table 18: South Tailings Pond West Dam Piezometer Installation Details and Performance Summary

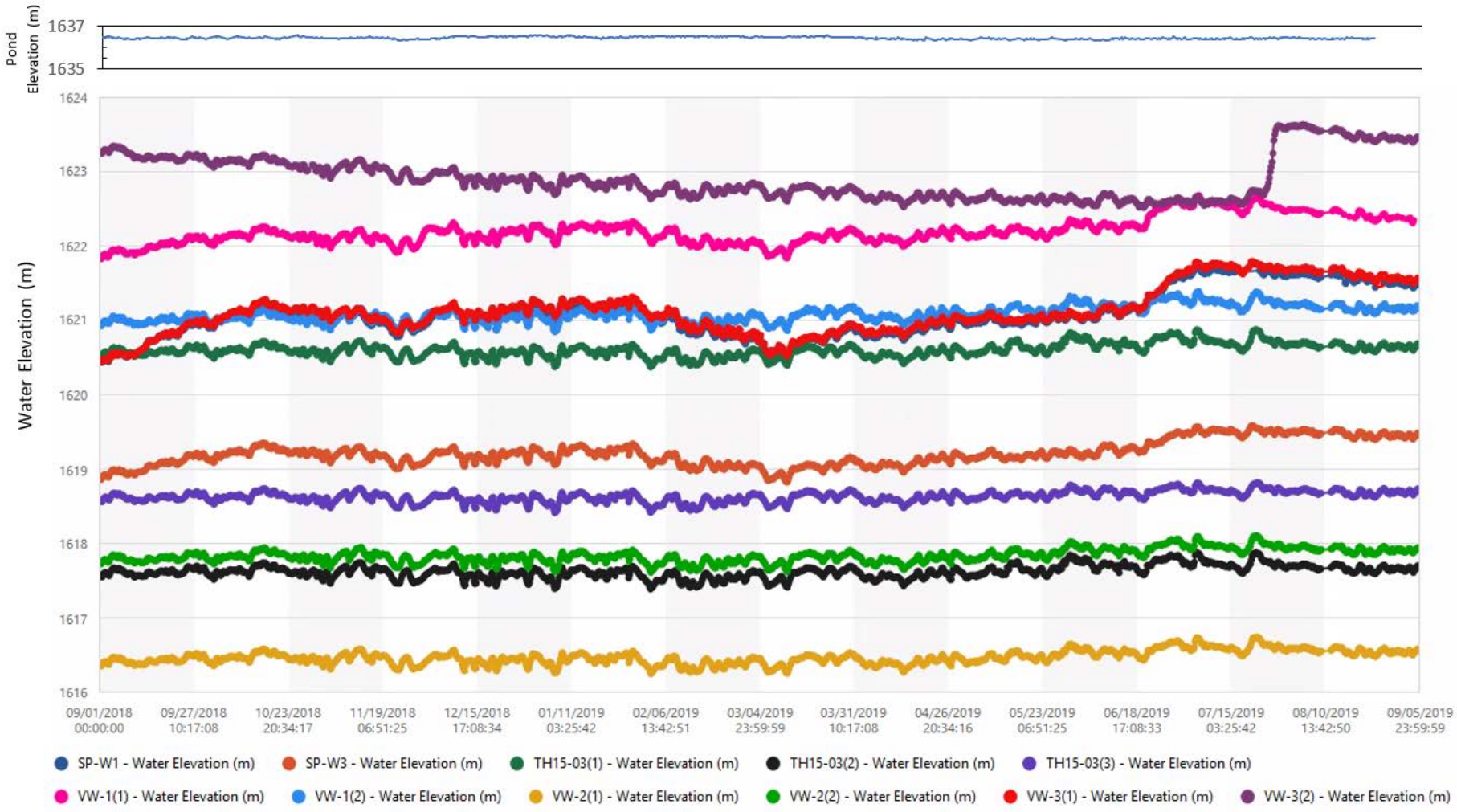
Borehole / Piezometer ID	Northing (m)	Easting (m)	Top of Well Elevation (m)	Data Logger Serial No.	Piezometer Serial No.	GeoExplorer Sensor No.	Piezometer Tip Elevation (m)	Warning Water Elevation (m)	Minimum Recorded Water Level (2018/2019)	Maximum Recorded Water Level (2018/2019)	Warning Water Elevation Exceeded?	Comments
VW-1	5,560,710.9	651,118.1	1,640.0	DT08070	VW27922	2	1,620.4	>1,627.5	1,620.9	1,621.4	No	No concerns
				DT08078	VW27923	1	1,606.4		1,621.8	1,622.7	No	Increased water pressure between April and July 2019, then started to level off
VW-2	5,560,494.1	651,310.0	1,639.3	DT08076	VW27926	2	1,616.9	>1,627.5	1,617.6	1,618.1	No	No concerns
				DT08077	VW27928	1	1,610.5		1,616.2	1,616.7	No	No concerns
VW-3	5,560,278.9	651,509.5	1,638.9	DT08071	VW27925	2	1,622.3	>1,627.0	1,622.5	1,623.6	No	Spike observed in July 2019, linked to tailings discharge channel proximity
				DT08072	VW27924	1	1,611.4		1,620.4	1,621.8	No	Increasing trend observed in June 2019 then levelled off starting in July 2019, linked to tailings discharge channel proximity
TH15-03	5,560,550.6	651,227.5	1,638.7	DT04500	VW33225	3	1,618.2	>1,627.5	1,618.4	1,618.8	No	No concerns
					VW33228	1	1,614.2		1,620.4	1,620.9	No	No concerns
					VW33226	2	1,612.2		1,617.4	1,617.9	No	No concerns
SP-W1	5,560,273.7	651,497.3	1,633.9	DT08081	VW27927	n/a	1,613.4	>1,623.1	1,620.4	1,621.7	No	Increasing trend observed in June 2019 then levelled off starting in July 2019, linked to tailings discharge channel proximity
SP-W3	5,560,255.0	651,481.4	1,624.5	DT08080	VW27919	n/a	1,615.0	>1,623.0	1,618.8	1,619.6	No	Increasing trend observed in June 2019, linked to tailings discharge channel proximity

Note: Northings and Eastings reported in Universal Transverse Mercator and elevations reported in Elk Valley Elevation Datum.

n/a = not applicable; > = greater than.

The VW piezometers and standpipes are presented in plan in Figure 3. Chart 4 presents the piezometer readings for 1 September 2018 to 31 August 2019, as well as the pond elevation over the same time period. The piezometer data were taken from GeoExplorer and the pond elevation was provided by FRO.

The phreatic level readings for the time period were generally stable. Piezometers VW-3, SP-W1, and SP-W3 recorded increased water pressure as a result of dredging in closer proximity to the West Dam. The dredging operation removed some of the tailings that usually lined the upstream slope of the West Dam and pond water migrated towards the dam and re-wetted the dam shell, causing water pressure in the piezometers to rise. No warnings were triggered in GeoExplorer for these piezometers.



Note: Elevations reported in Elk Valley Elevation Datum.

Chart 4: West Dam Vibrating Wire Piezometer and Standpipe Water Elevations and South Tailings Pond Elevation from 1 September 2018 to 31 August 2019

Observed Performance

The key observations made during the STP dam inspection related to assessment of instability were as follows:

- No significant evidence of slope instability on the constructed dam (i.e., significant sloughing, cracking, crest subsidence) was observed during the 2019 DSI.
- Rutting and small depressions were observed on the dam crest due to traffic and usage by the dredging crew.
- Erosion of the Main Dam's upstream slope was observed near the Kilmarnock discharge at the south abutment area (as described in Section 3.1.7).
- Minor erosion has been noted on the downstream slope over the years, generally in the CCFR material, with the exception of a major vertical erosion / gully on the downstream slope of the Main Dam above the seepage collection well. This gully should be repaired in 2020 and it should continue to be monitored before the repair. FRO has repaired previous erosion channels present on the STP by placing breaker rock over geotextile on the eroded areas, creating armoured channels. Current and future erosion should continue to be monitored and repaired in a similar or equivalent manner as part of ongoing maintenance.
- The downstream slope has sections steeper than the design, but the overall embankment has been constructed wider than the design. The over-steepened areas are prone to increased erosion but are not an overall stability concern.
- Ground squirrel burrows were observed on the upstream slope and bench of the Main Dam, and a badger burrow was observed at the toe of the Main Dam near the seepage collection wells. FRO prepared a plan in 2019 to remove the ground squirrel burrows and it was approved by the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. FRO plans to implement the animal burrow removal plan in 2020.
- Water was not draining well in the ditch along the West Dam and had areas of standing water along the toe of the dam, which is next to the lower access road. The ditch should be regraded to drain ponded water.

5.4.1.4 River Erosion Protection (KWL)

KWL completed an inspection of the riprap along the toe of the STP on 18 October 2019, and the inspection report (KWL 2019) is included in Appendix D. KWL reports that the exposed riprap along the STP dams is generally in good condition and the design and status of the STP riprap should be reviewed and revised as needed.

KWL suggested that drone imagery of the riprap embankment be completed once a year as a secondary tool (to the manual inspection by KWL personnel) to monitor the condition of the riprap and identify areas that may be deteriorating faster than others.

This inspection report was reviewed by the EoR as part of this DSI.

5.4.1.5 Release of Tailings or Tailings-Affected Water through Pipeline Failure

Design Basis

The tailings pipeline from the plant to the STP is located at the north abutment and the dredged tailings pipeline from the STP to the Turnbull TSF is located along the south side of the STP. There is a reclaim water line from the STP to the plant and from the Turnbull TSF to the STP. A failure of one of these pipelines could release tailings or tailings-affected water.

Observed Performance

This failure mode is managed by routine inspections of the pipelines.

5.4.2 Review of Previous Deficiencies and Non-conformances

The following deficiencies and non-conformances for the STP were raised in the previous DSI in 2018 (Golder 2019a). The current status of the 2018 DSI recommendations for the STP is provided in Table 19. Items from the 2018 DSI that are incomplete have been brought forward into the 2019 DSI recommendations (Table 25).

A number of recommended actions are in progress and some are incomplete, but Golder considers the work to be appropriately prioritized based on good communication between the EoR team and the FRO Tailings Engineer.

Table 19: Current Status of 2018 Dam Safety Inspection Recommended Actions for South Tailings Pond Facility

ID Number	Deficiency or Non-conformance	Recommended Action	Current Status as of March 2020
2015-12a,b,c	Riprap erosion protection along downstream toe north of STP Sta. 0+680, no riprap south of STP Sta. 0+680; risk-informed protection requirements not yet defined	Perform risk-informed assessment to determine appropriate flood protection requirements for downstream toe of dam along Fording River and timeline to implement.	**Incomplete** – see Table 25 for updated recommendation and timeline.
		Implement required protection measures for the operational phase according to the as-defined schedule.	**In Progress** – see Table 25 for updated recommendation and timeline.
		Execute flood risk mitigation plan until flood protection requirements defined by the risk-informed assessment are in place.	**Complete** – Monitoring and management requirements for the Fording River are documented in *Tailings Impoundment Flood Response Protocol for the Fording River,* FRO (2017).
2016-04	EPP & ERP require updating	Reference to the TARPs needs to be included for actions required based on instrumentation warnings and alarms.	**In progress** – draft ERP is being finalized. EPP will be updated after ERP is finalized. See Table 25 for updated recommendation and timeline.
2017-01	North abutment construction deficiencies	Address construction deficiency, finish dam construction.	**In progress, pending decommission of FortisBC gas pipeline** – see Table 25 for updated recommendation and timeline.
2017-05	Potential overtopping hazard due to tailings liquefaction and redistribution during seismic event needs to be assessed	Complete liquefaction and overtopping assessment for tailings within facility.	**In progress** – drilling completed in 2018, draft assessment issued, final in progress.
2018-02	Planned dredging of tailings to Turnbull TSF is behind schedule and the result is a very high level of tailings in STP, which is causing operational issues (e.g., high levels of solids in STP causing operational difficulties)	Dredging to Turnbull TSF should be started as soon as possible in April 2019 with a minimum annual dredging target of 1.3 million tonnes.	**Complete –** 2019 dredging season started on 6 April and ended on 28 October 2019, and dredged 1.66 million dry metric tonnes**.**
2018-03	The current spillway design does not meet the Very High dam consequence classification IDF	Update design of permanent spillway as per the new inflow design flood and requirements from HSRC Guidance Document (Ministry of Energy and Mines 2016). Develop a construction schedule accordingly.	**In progress** – permanent spillway design is underway.
2018-04a, b, c	Current operation of the facility for water management does not meet the Very High dam consequence classification IDF	Design upstream diversion to divert runoff from upstream catchment (Blackmore Creek). The diversion should be sized to allow the STP to manage the IDF, if possible.	**Superseded by** recommended action 2018-04c**.**
		Construct the upstream diversion of Blackmore Creek.	**Superseded by** recommended action 2018-04c.
		Design a permanent emergency spillway to pass the peak outflow from the 24-hour IDF.	**Superseded by** recommended action 2018-03.
2018-05	No closure plan for STP	Develop a closure plan for STP.	**Incomplete** – see Table 25 for updated recommendation and timeline.
2018-06	Construction of the AWTF-S is underway downstream of the STP Main Dam, potentially increasing the number of workers in the dam breach inundation zone.	Review potential inundation for failure of the Main Dam relative to the downstream facility and develop an emergency response plan for the downstream workers if required.	**In progress** – preliminary results of inundation study have been provided and interim mitigation plans are being advanced.
2018-07	GPS, inclinometer, and NTP freeboard QPOs in the OMS manual do not reflect the most recent recommendations in Golder (2018b)	Update OMS manual with recommended GPS, inclinometer, and NTP freeboard QPOs from Golder (2018b).	**Complete.**

IDF = inflow design flood; STP = South Tailings Pond; NTP = North Tailings Pond; OMS = operation, maintenance and surveillance; HSRC = Health, Safety and Reclamation Code; QPO = Quantifiable performance objectives; EPP = Emergency Preparedness Plan; ERP = Emergency Response Plan; TARP = trigger action response plan; Sta. = Station; AWTF-S = active water treatment facility-south; TSF = tailings storage facility.

5.5 North Tailings Pond

The record of the site inspection for the FRO NTP conducted by the EoR team is included in Appendix C. A plan of the NTP with the location of the monitoring points is shown in Figure 7, and a typical section of the NTP retaining dam is shown in Figure 8.

This section presents an assessment of dam safety for the NTP dam based on observations and data review and includes a review of the 2018 recommendations for the facility.

5.5.1 Assessment of Dam Safety Relative to Potential Failure Modes

A summary of the assessment and potential failure modes is presented in Table 20.

Table 20: Assessment of North Tailings Pond Dam Safety Relative to Potential Failure Modes

Potential Failure Mode	Observations/Data	Comments
Internal erosion (suffusion and piping)	Filter compatibility is generally met between dam fill materials and foundation flood plain sand and gravel; however, this is not met for the tailings and the foundation flood plain sand and gravel.	The potential filter inadequacy between the foundation and tailings will not impact the stability of the dam, as the stability is not reliant on the tailings. Migration of the tailings through the sand and gravel is expected to be contained by the till cut-off, and therefore a low risk.
Overtopping	Pond elevation is managed to be maintained below the maximum allowable pond elevation. A trigger action response plan provides direction if NTP pond elevation approaches a triggers level.	Updated IDF and freeboard assessment completed for Very High dam classification (Golder 2018b), freeboard increased to 1.9 m. Pumping was initiated from NTP pond in July 2019 following the TAPR in response to high pond elevation.
Instability	No evident instability.	Static and seismic stability assessments completed (Golder 2018b) and the results indicated that the FoS of the dam meet or exceed the Very High consequence static and pseudo-static slope stability FoS design criteria considering the 2017 maximum phreatic conditions.
River erosion along dam toe	The exposed riprap along the NTP dam is generally in good condition except in areas where it is up to 0.4 m lower than the design elevation.	Signs of settling or subsidence in the riprap should be confirmed by survey and levels of protection should be raised if required, and that FRO should seek opportunities to cost-effectively achieve the intended 1 m freeboard.
Tailings water pipeline failure	No leakage reported from tailings water pipeline	Continue to manage this failure mode by routine inspection of the pipeline while in use from the NTP to the STP.

IDF = inflow design flood; FoS = factor(s) of safety.

5.5.1.1 Internal Erosion (Suffusion and Piping)

Internal erosion of a dam can be caused by materials migrating out of the dam, leaving voids. This generally happens with materials that do not have filter compatibility; that is, the fines fraction of one material can migrate into or through the voids of the adjacent material under a sufficient hydraulic gradient. Piping is induced by regressive erosion of particles towards an outside environment until a continuous pipe is formed. Suffusion is the migration of soil particles through the soil matrix and can occur in a single material. If a material is internally stable, it is considered resistant to suffusion.

Design Basis

The following filter relationships were checked for the NTP:

- compatibility between the tailings and the upstream till blanket
- compatibility between the upstream till blanket and CR or the CCFR shell
- compatibility between the till cut-off and flood plain sand and gravel foundation
- compatibility between the CR or CCFR shell and the flood plain sand and gravel foundation
- compatibility between the tailings and the flood plain sand and gravel foundation
- internal stability of the CR shell

Filter compatibility was reviewed based on grain size distributions in the construction records (Golder Brawner 1973, 1974b); data obtained during an investigation of the existing coal tailings in 2 Pit, 3 Pit, and the NTP (Golder 2012b); data from the 2013 NTP flood repair works; and results from the 2015 site investigation (FRO 2016).

Various methods are available to check filter compatibility, including the Terzaghi method, the Sherard and Dunningan criteria, and the US Army Corps of Engineers criteria (Terzaghi 1922; Sherard et al. 1984; Sherard and Dunningan 1989; USACE 2004). The CR shell, which acts as a filter for the upstream till blanket, was constructed in accordance with the design. While not explicitly stated in the reports (Golder Brawner 1973, 1974b), the Terzaghi method was likely the method used to confirm filter compatibility during design and construction.

A filter compatibility and internal stability assessment was completed by Golder in 2015 in response to a February 2015 Ministry of Energy, Mines and Petroleum Resources order to undertake an assessment to determine if the tailings facilities dams may be at risk of internal erosion (Golder 2015a). The Sherard and Dunningan criteria and the US Army Corps of Engineers criteria were also checked in this document. Filter compatibility was rechecked using the Sherard and Dunningan criteria after additional foundation information was obtained in 2015.

All materials generally have filter compatibility by all methods except between the tailings and the flood plain sand and gravel. The potential filter inadequacy between the foundation and tailings will not impact the stability of the dam, as the dam stability is not reliant on the tailings. Migration of the tailings through the sand and gravel is expected to be contained by the till cut-off, and therefore a low risk.

The internal stability of the CR shell was confirmed (Golder 2015a).

There are some gaps in construction quality control records. Where data were available, they indicated that filter compatibility was achieved. The gaps in the quality control records are considered to be low risk to confirming filter compatibility.

Based on the performance of the dam over the last 45 years, piping due to filter-incompatible material or suffusion of internally unstable material is considered to have less than a very rare likelihood of occurrence and is not expected to be an issue.

Observed Performance

The key observations made during the NTP dam inspection were as follows:

- No significant zones of external seepage were observed that would indicate the possible development of internal piping.
- No zones of subsidence or sinkholes were observed that would indicate voids due to either suffusion or piping.

5.5.1.2 Overtopping

Design Basis

The CDA (2013) provides two calculations for freeboard; the more critical of the two cases sets the minimum freeboard:

- no overtopping by 95% of the waves caused by the most critical wind with a return period of 1 in 1,000 years, with the pond at its maximum normal operating elevation
- no overtopping by 95% of the waves caused by the most critical wind with a return period of 1 in 2 years (for Very High consequence structures), with the pond at the maximum level during the passage of IDF

The current minimum crest elevation of the dam at the NTP is 1,652.6 m.

The HSRC Guidance Document (Ministry of Energy and Mines 2016) recommends that the IDF be designed to 2/3 between the 1,000-year flood/storm event and the probable maximum flood for a structure classified as Very High consequence. Furthermore, for impoundments with no emergency spillway, HSRC Section 10.1.8 requires a minimum storage volume to contain runoff from a 72-hour IDF. As a result of the reclassification of the NTP dam from High to Very High, its freeboard assessment was updated with the above-mentioned HSRC requirements. The result of the updated assessment indicated that:

- To store the IDF while maintaining the minimum freeboard, the maximum operating pond elevation is 1,650.7 m, 1.9 m below the minimum dam crest.
- The required minimum freeboard is 0.35 m with the IDF level at elev. 1,652.25 m.

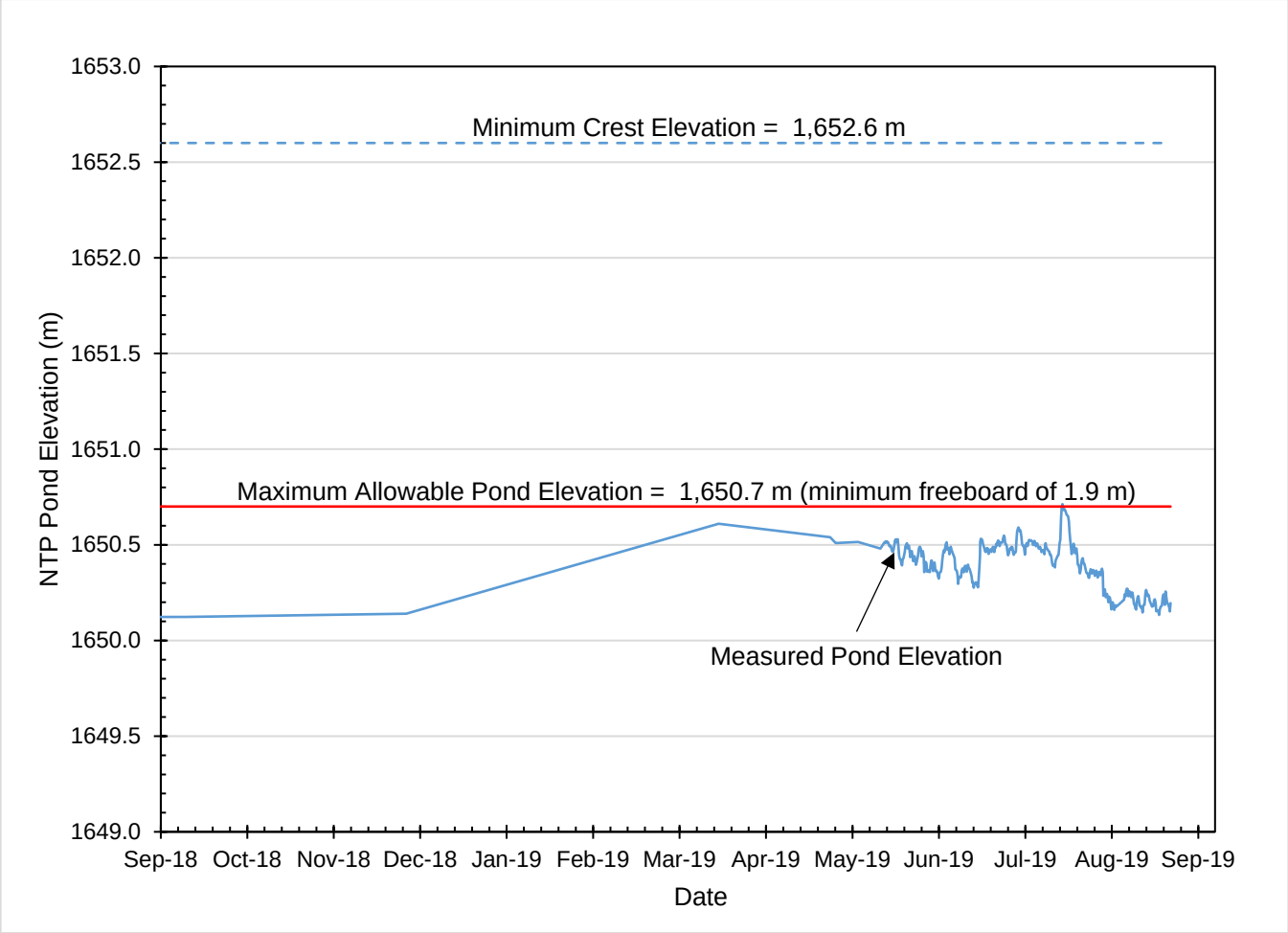
The NTP currently has no inputs of water except direct precipitation and some runoff from a small local catchment area, with outputs from the retained pond being evaporation and seepage. The water levels are generally maintained with 2 m of freeboard, and pumping and dewatering is not required under normal annual conditions. If critical water levels in the pond are approached, the NTP water level TARP in Appendix C of the OMS manual (FRO 2020) includes pumping and water diversion strategies for the NTP. Pumping could be established to transfer NTP water to the STP (as was done in July 2019, described in Section 3.2.1) or Shandley Pit. The NTP is permitted to discharge into STP only and will discharge into Shandley Pit (in violation of its existing permit) if discharging into the STP is not possible for whatever reason. The freeboard of 1.9 m (as assessed for Very High consequence) will be maintained with normal operations or emergency pumping as necessary.

The NTP is not equipped with an emergency spillway. A passive method of controlling water elevation would be a best practice. Golder has produced feasibility level drawings for an emergency spillway on the NTP (Golder 2015b).

An overtopping failure caused by landslide is a possible failure mode for the NTP due to the adjacent CR spoil to the west of the NTP. The CR spoil was resloped in 2015 per previous Golder recommendations and FRO analyses (Golder 2014a,e; FRO 2014). This work was performed to reduce the hazard of a potential spoil failure to impact the NTP and create wave action that could potentially overtop and breach the NTP dam. Based on stability and runout analyses, failure of the reconfigured CR spoil and subsequent wave generation is considered unlikely.

Instrumentation

Surveyed pond elevation data for the NTP were received from FRO from September 2018 to May 2019. On 18 May 2019, a VW piezometer was installed in the NTP pond to record pond elevation onwards. Pond elevation data recorded by the VW piezometer were downloaded from GeoExplorer from 18 May 2019 to 31 August 2019. The VW piezometer was setup to collect readings every six hours. Chart 5 presents the pond elevation from 1 September 2018 to 31 August 2019.



Note: Pond elevations reported in Elk Valley Elevation Datum.
NTP = North Tailings Pond.
Chart 5: North Tailings Pond Water Elevation from 1 September 2018 to 31 August 2019

The NTP water level is shown to be maintained below the maximum allowable water level.

On 21 July 2019, the NTP met the maximum allowable pond elevation (elev. 1,650.7 m) and a pump was set up the next day to pump water from the NTP. The water was pumped via an existing pipeline to the STP over the following four days until the pond level was reduced to around elev. 1,650.5 m.

Observed Performance

The key observations made during the NTP dam inspection were as follows:

- The tailings have filled most of the area upstream of the NTP dam, and there is a small reclaim pond at the southern end. The fetch distance on the surface of the NTP is short, so the potential for generation of significant waves when a pond is present is small.

- Unused and damaged pipelines that extend through the crest of the dam should ideally be removed or grouted to eliminate the hazard of future deformation or settlement of the abandoned pipes creating low points in the dam crest (locations shown in Golder 2017b).
- All pipes should continue to be inspected as part of the monthly NTP inspections to confirm that they remined capped on the upstream side. Pipes should be removed or grouted as part of the NTP decommissioning plan.

5.5.1.3 Instability

The stability of the NTP is monitored with piezometers, inclinometers, GPS units, and regular visual inspections.

Design Basis

The drainage conditions beneath the NTP dam are favourable with respect to structural stability. The downstream slope of sections rebuilt after the June 2013 flood is less steep (1.5 to 1.75H:1V) than the original design (1.3 to 1.4H:1V).

As a result of the reclassification of the NTP dam from High to Very High, its slope stability and liquefaction assessments were updated to comply with the Very High consequence design criteria (Golder 2018b). An earthquake of ½ between the 1-in-2,475-year and 1-in-10,000-year event was used for Very High consequence dams per the HSRC Guidance Document (Ministry of Energy and Mines 2016). This event corresponded to a peak ground acceleration of 0.23 g and a mean moment magnitude of 6.2 based on the probabilistic analysis results from the site-specific hazard assessment (Golder 2016b). Details of the assessment and results were provided in Golder (2018b). A brief summary of the conclusions is provided below:

- The liquefaction assessment update considered the 2017 topography along with the 2016 and 2017 riprap construction along the toe of the NTP dam and the maximum piezometer readings up to the end of 2017. The results indicated that the saturated soils below the dam are unlikely to liquefy during the design earthquake event.
- The dam stability update used design criteria based on HSRC Guidance Document (Ministry of Energy and Mines 2016) Section 3.3 and CDA (2014) for minimum FoS. A sensitivity case was analyzed for post-earthquake conditions for loose CR layers identified in the NTP. Both static and pseudo-static conditions were considered in the stability assessment. However, the post-earthquake conditions were not analyzed in the foundation because the liquefaction assessment results indicated that the alluvial soils below the dams and dam materials are unlikely to liquefy during the design earthquake event. The results of the stability assessment indicated that the FoS of the NTP dam exceeded the Very High consequence static and pseudo-static slope stability design criteria.
- HSRC Part 10 (Ministry of Energy and Mines 2017) Section 10.1.9 indicates that design downstream slopes steeper than 2H:1V require the manager to submit justification from the EoR for the design slope and receive authorization prior to construction. The NTP downstream slopes were constructed before this requirement came into effect. As noted above, the results of the stability assessment indicated that the stability factor of safety met or exceeded the design criteria.

The NTP is also susceptible to instability from erosion during flooding of the Fording River. River erosion has been assessed by KWL, and riprap was placed on the toe of the dam in late 2016 and 2017 (KWL 2017b) to mitigate against river erosion up to a 200-year return period design flow. Risk-informed criteria should be established for the flood erosion protection along the toe of the NTP dam.

Instrumentation Data – Crest Displacement Monitoring

FRO ceased the use of the use of prisms for crest displacement monitoring on the NTP dam in 2018 and began using GPS units solely. Four GPS monitors are located on the dam crest and have replaced the prisms to monitor crest displacement.

GPS data were downloaded from GeoExplorer for dates from 1 September 2018 to 31 August 2019. The survey data are summarized in Appendix H.

The initial coordinates of the GPS units at the NTP are listed in Table 21. Due to the manner in which GPS elevation is referenced at FRO, only change in elevation data is reviewed, as shown in Appendix H.

Table 21: Instrument Monitoring Locations on North Tailings Pond

Instrument Identification	Reading Start Date	Northing (m)	Easting (m)	Location Description
NTP-GPS 01	October 2014	5,562,143.7	651,102.6	Crest
NTP-GPS 02	June 2018	5,561,994.1	651,130.2	Crest
NTP-GPS 03	June 2018	5,561,641.8	651,047.0	Crest
NTP-GPS 04	June 2018	5,561,379.6	650,902.6	Crest

Note: Northings and Eastings reported in FRO UTM, Sensor locations downloaded from GeoExplorer.

NTP = North Tailings Pond; FRO = Fording River Operations; UTM = Universal Transverse Mercator.

Generally, the GPS devices recorded on an hourly frequency. The survey data indicate little crest displacement during the reporting period. Minor spikes in the data are most likely noise in the system and are not a concern. Movements are well below the GeoExplorer alarm trigger for 3D point velocity (150 mm/day, QPO alarm) and the updated QPOs provided by Golder (2018b) and listed in Section 2.5. No warnings were triggered in the reporting period.

NTP04_GPS and NTP02_GPS were offline from 7 to 21 February 2019.

A latent alarm is triggered in GeoExplorer when the measurement age of the GPS unit is greater than a day on the NTP. Any offline monitors will be inspected and repaired within one week (FRO 2020).

Instrumentation Data – Slope Inclinometers

Slope inclinometers were installed at three locations in 2015 along the NTP crest (Figure 7) to monitor horizontal movement in the dam. The A axis is oriented in the upstream to downstream direction (with negative displacements in the downstream direction) and the B axis is oriented along the dam centreline. The location of the inclinometers at the NTP is presented in Table 22.

Table 22: North Tailings Pond Inclinometers

Inclinometer ID	Northing (m)	Easting (m)	Elevation (m)	A-A Axis Azimuth (°)	Probe Serial No.	Reel Serial No.
TH15-05	5,561,992.0	651,130.8	1,653.6	235	DP15600000	DR21300000
TH15-06	5,561,641.0	651,047.2	1,653.7	290		
TH15-07	5,561,379.7	650,904.4	1,653.4	305		

Note: Azimuth is approximate. The upper wheel should face the indicated direction.

Elevations reported in Elk Valley Elevation Datum.

Slope inclinometer data were supplied to Golder by FRO. Readings were collected approximately quarterly at the NTP inclinometers since December 2015. Starting in September 2018, and as discussed with the EoR, FRO has been reading the inclinometer three times per year (shortly before freshet, in the latter part of freshet, and in late summer).

A total of three readings were taken at inclinometers TH15-05, TH15-06, and TH15-07 within the DSI reporting period, which include readings from 26 September 2018, 2 April 2019, and 24 June 2019. The most recent set of readings was collected by FRO in Fall 2019 and will be included in the next version of this report. Received inclinometer data were plotted by Golder (Appendix I). Data readings are from 23 January 2017 to 24 June 2019 and include the initial reading from 18 December 2015 as a reference line.

The inclinometer readings do not indicate any significant trends in deformation and the maximum cumulative downstream deflection below a depth of 2 m from the crest does not exceed 5 mm over a year, which is in the acceptable range for the slope inclinometer QPO (Table 5). The reading taken on 2 April 2019 at TH15-05 shows near 15 mm displacement within 2 m of the dam crest elevation, which does not appear again in the 24 June 2109 readings, and was assumed to be a temporary deformation of the casing near surface at the time of the 2 April 2019 reading.

Instrumentation Data – Piezometers

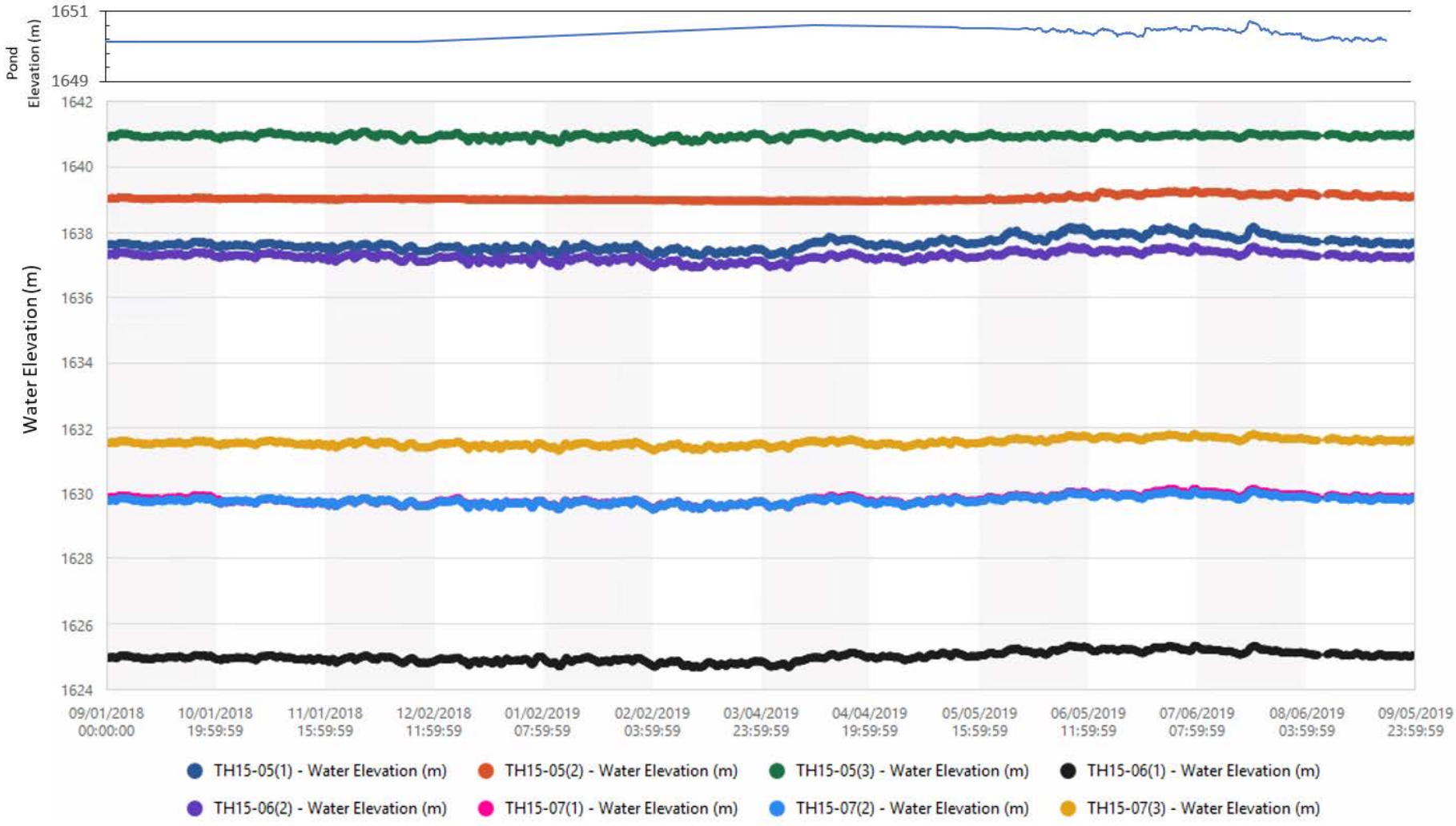
VW piezometers were installed in 2015 at three locations along the NTP crest to monitor water levels in and below the dam (Figure 7). In 2018 Norwest Corporation (Norwest 2018) installed seven new piezometers at three locations in the NTP tailings, upstream of the dam. The piezometers located in the NTP dam are listed in Table 23. Data for the piezometers were downloaded from GeoExplorer. The piezometer readings from 1 September 2018 to 31 August 2019 are presented in Chart 6. Readings have been taken at TH15-05, TH15-06, and TH15-07 since August 2015.

During the time period of 9 August to 12 August 2019, no data were recorded at any piezometers on site due to a communications issue between the units and GeoExplorer.

Table 23: North Tailings Pond Piezometer Installation Details and Performance Summary

Borehole / Piezometer ID	Northing (m)	Easting (m)	Collar Elevation (m)	Data Logger Serial No.	Piezometer Serial No.	GeoExplorer Sensor No.	Piezometer Tip Elevation (m)	Minimum Water Elevation (2018/2019)	Maximum Water Elevation (2018/2019)	Comments
TH15-05	5,561,992.0	651,130.8	1,653.6	DT09633	VW33222	3	1,641.3	n/a	n/a	Reading negative pressure head (dry)
				DT09636	VW33223	2	1,638.7	1,639.0	1,639.3	No concerns
				DT09638	VW33241	1	1,635.6	1,637.3	1,638.2	No concerns
TH15-06	5,561,641.0	651,047.2	1,653.7	DT09641	VW33240	2	1,628.5	1,636.9	1,637.6	No concerns
				DT09643	VW33239	1	1,626.3	n/a	n/a	Likely malfunctioning, reporting negative water level
TH15-07	5,561,379.7	650,904.4	1,653.4	DT094501	VW33231	3	1,630.0	1,631.3	1,631.8	No concerns
					VW33230	2	1,624.0	1,629.5	1,630.1	No concerns
					VW33242	1	1,614.7	1,629.5	1,630.1	No concerns

Note: Coordinates reported in Universal Transverse Mercator and elevations reported in Elk Valley Elevation Datum.
n/a = not applicable.



Note: Elevations reported in Elk Valley Elevation Datum.

Chart 6: North Tailings Pond Vibrating Wire Piezometers and Pond Elevation from 1 September 2018 to 31 August 2019

The phreatic level readings for the time period were generally stable, with minor increases noted around spring freshet in early March 2019, and likely were responding to freshet conditions. No warnings were triggered in GeoExplorer for these piezometers.

The upper VW sensor in TH15-05 (3) or VW33222, was above the phreatic surface and was dry (negative water level readings). The lower VW sensor in TH15-06 (VW33239) is likely malfunctioning because it recorded negative water level while the upper piezometer was reading approximately 9 m of water above the piezometer.

All piezometers on NTP collect data in real time. The piezometers should continue to be monitored regularly as outlined in the OMS manual (FRO 2020).

GeoExplorer shows “No Communication” and “No Frequency” alarms that alert FRO when the piezometers are not reading data. FRO uses these alarms as an indication that the piezometers are malfunctioning and will send someone to check on the instrument in question.

Observed Performance

No evidence of major slope instability was observed during the 2019 DSI. The key observations made during the NTP dam inspection were as follows:

- A wet area of ponding water was noted downstream of the NTP dam near Sta. 1+200 (Appendix A, Photograph A-32). FRO plans to regrade this area then place cobbles and gravel on the ground surface to minimize ponding.
- Parts of the area downstream of dam toe near Sta. 1+350 were excavated for the drill pad of monitoring well FR-ME-NTPSE.
- Ground squirrel burrows were present at the south end of NTP, near Sta. 1+400. FRO prepared a plan in 2019 to remove the ground squirrel burrows and it was approved by the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. FRO plans to implement the animal burrow removal plan in 2020.

5.5.1.4 River Erosion Protection (KWL)

KWL completed an inspection of the riprap along the toe of the NTP on 18 October 2019 and the inspection report (KWL 2019) is included in Appendix D. KWL reports that the exposed riprap along the NTP dam is generally in good condition except in areas where the NTP riprap is up to 0.4 m lower than the design elevation. At those areas, KWL indicated the signs of settling or subsidence should be confirmed by survey and levels of protection should be raised if required, and that FRO should seek opportunities to cost-effectively achieve the intended 1 m freeboard.

KWL suggested that drone imagery of the riprap embankment be completed once a year as a secondary tool (to the manual inspection by KWL personnel) to monitor the condition of the riprap and identify areas that may be deteriorating faster than others.

This inspection report was reviewed by Golder as part of this DSI.

5.5.1.5 Release of Tailings-Affected Water through Pipeline Failure

Design Basis

There is a pipeline connecting the NTP to STP which is inactive except during emergency situations when pond level in the NTP needs to be lowered and the water is sent to the STP. A failure of this pipeline could release tailings-affected water.

Observed Performance

This failure mode is managed by routine inspections of the pipeline.

5.5.2 Review of Previous Deficiencies and Non-conformances

The deficiencies and non-conformances presented in Table 24 were noted in the previous DSI in 2018 (Golder 2019a). Table 24 provides the current status of the 2018 DSI recommendations for the NTP. Items from the 2018 DSI that are incomplete have been brought forward into the 2019 DSI recommendations (Table 25).

A number of recommendations are in progress and some are incomplete, but Golder considers the work to be appropriately prioritized based on good communication between the EoR team and the FRO Tailings Engineer.

Table 24: Current Status of 2018 Dam Safety Inspection Recommended Actions for North Tailings Pond Facility

ID Number	Deficiency or Non-conformance	Recommended Action	Updated Status as of March 2020
2015-05a,b	No passive emergency system against overtopping; emergency system requires active response	Assess the need for spillway after finalizing the NTP closure plan.	**Ongoing** – closure planning ongoing as part of the NTP Flood Mitigation Project, which should document when a spillway is required as part of facility closure. Real-time monitoring from GeoExplorer alerts tailings group of water level changes.
		If required, determine a construction schedule.	
2015-06a,b,c	Risk-informed criteria for flood erosion protection along toe of dams not defined	Perform risk-informed assessment to determine appropriate flood protection requirements for downstream toe of dam along the Fording River and the timeline to implement.	**Incomplete** – see Table 25 for updated recommendation and timeline.
		Implement required protection measures for the operational phase according to the as-defined schedule.	**Incomplete** – see Table 25 for updated recommendation and timeline.
		Execute the flood risk mitigation plan until the flood protection requirements defined by the risk-informed assessment are in place.	**Complete** – Monitoring and management requirements for the Fording River are documented in *Tailings Impoundment Flood Response Protocol for the Fording River* FRO (2017).
2015-07a,b	Buried pipes passing through crest locations	Inspect steel pipes as part of regular dam inspections until NTP closure plans are finalized. Include inspections in OMS manual update.	**Complete** – inspection requirements have been added to the OMS manual and routine NTP inspection forms.
		Execute abandonment plan for PVC pipes.	**Incomplete** – the pipes will be removed as part of the NTP Flood Mitigation Project construction. See Table 25 for updated recommendation and timeline.
2016-04	EPP & ERP require updating	Reference to the TARPs needs to be included for actions required based on instrumentation warnings and alarms.	**In progress** – draft ERP is being finalized. EPP will be updated after ERP is finalized. See Table 25 for updated recommendation and timeline.
2016-06	No closure plan for NTP	Develop closure plan for NTP based on results of feasibility investigation into NTP decommissioning.	**In progress** – as part of the NTP Flood Mitigation Project. See Table 25 for updated recommendation and timeline.
2018-01	Real-time water level readings are not available, and water level readings are limited during winter months when there is ice cover on the pond.	Install a real-time water level instrument in the NTP pond and connect this to the site GeoExplorer system	**Complete** – real-time water level monitoring instrument was installed in May 2019.
2018-07	GPS, inclinometer, and NTP freeboard QPOs in the OMS manual do not reflect the most recent recommendations in Golder (2018b)	Update OMS manual with recommended GPS, inclinometer, and NTP freeboard QPOs from Golder (2018b).	**Complete.**

NTP = North Tailings Pond; OMS = operation, maintenance and surveillance; PVC = polyvinyl chloride; QPO = Quantifiable performance objectives; EPP = Emergency Preparedness Plan; ERP = Emergency Response Plan; TARP = trigger-action-response plan.

6.0 SUMMARY AND RECOMMENDATIONS

6.1 Summary of Activities

In June 2019, signage was installed at the dam toe, crest, and vicinity of STP and NTP to notify passersby that the structure is a tailings dam and to provide direction and contact information to report any issues observed or any proposed work in the vicinity.

Activities conducted for the STP during the reporting period were as follows:

- A workshop was facilitated with FRO's stakeholders to determine the EDF (Golder 2019d).
- A dam breach study of the STP Main Dam was conducted and potential inundation of the AWTF-S assessed (Golder 2019e, draft under FRO review).
- A site investigation on the STP tailings was conducted in December 2018 (Golder 2019f, factual report in draft and in the process of being finalized by Golder).
- Stockpiled excavated tailings from near the north single point discharge area were regraded.
- A design to conduct a cut of the STP dam crest and temporary relief channel in the case of an emergency is being developed.
- The design of a permanent spillway to pass the peak outflow from the 24-hour IDF is being developed.
- The design of a ditch to divert water from Blackmore Creek to Kilmarnock Ponds to reduce the upstream catchment to STP in the event of a flood was assessed, and based on initial results this work has been placed on hold, with a preference to advance the permanent spillway design.
- The STP was inspected by FRO geotechnical personnel throughout the year at the following frequencies:
  - once per week from May to October
  - twice a month from November to April
- Water sampling and testing was conducted by FRO Environment team.
- Two bathymetric surveys were conducted in April and June 2019 by FRO to monitor remaining capacity in the facility.
- Ground squirrel burrows were observed on the upstream slope and bench of the Main Dam, and a badger burrow was observed at the toe of the Main Dam near the seepage collection wells. FRO prepared a plan in 2019 to remove the ground squirrel burrows and it was approved by the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. FRO plans to implement the animal burrow removal plan in 2020.
- Dredging of 1.66 million dry metric tonnes of tailings to the Turnbull TSF was carried out from 6 April to 28 October 2019.
- Site drainage was sent to the STP in January and February 2019; it was diverted to the North Loop Settling Pond the rest of the time.

Activities conducted for the NTP during the reporting period were as follows:

- Water was pumped to the STP in July 2019 when the NTP water level reached its maximum allowable pond elevation.
- Two new groundwater monitoring wells were installed by FRO.
- Monthly inspections were conducted by FRO geotechnical personnel.
- An animal burrow removal plan to remove the ground squirrel burrows was developed by FRO Environment and it was approved by the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development. FRO plans to implement the animal burrow removal plan in 2020.

6.2 Summary of Climate and Water Balance

The climate data indicated the annual precipitation received at FRO from 1 September 2018 to 31 August 2019 was lower than the long-term annual average.

The water balance model of the NTP estimates an increase in volume in the NTP pond. This is consistent with the observed small increase in pond elevation. The estimated seepage loss from the pond is similar to previous years.

The water balance model of the STP estimates a decrease in volume in the STP pond. This is consistent with the observed decrease in pond elevation and increased dredging volume in 2019. The estimated seepage loss from the STP pond is similar to previous years.

6.3 Summary of Performance and Changes

The STP and NTP facilities were observed to be in good condition at the time of the 2019 DSI field inspection.

No significant changes in visual monitoring records, dam stability, and surface water control were noted.

6.4 Consequence Classification

Both of the dams are classified as Very High consequence, following the dam consequence classification guidelines from HSRC Guidance Document Section 3.4 (Ministry of Energy and Mines 2016). The population at risk and potential loss of life for the AWTF-S should be reviewed after completion of the main dam breach and inundation study. The results should be used to update the Loss of Life assessment input to the STP dam consequence classification.

6.5 Current Deficiencies and Non-conformances

Table 25 summarizes the recommended actions for both the STP and NTP facilities.

Table 25: 2019 Dam Safety Inspection Recommended Actions for the South and North Tailings Pond Facilities

Facility	ID Number	Deficiency or Non-conformance	Applicable Guideline or OMS Manual Reference	Recommended Action	Priority Level	Recommended Timing for the Action
STP	2015-12a, b	Riprap erosion protection along downstream toe north of STP Sta. 0+680, no riprap south of STP Sta. 0+680; risk-informed protection requirements not yet defined	HSRC §10.1.8	Perform risk-informed assessment to determine appropriate flood protection requirements for downstream toe of dam along Fording River and timeline to implement.	2	2020
				Implement required protection measures for the operational phase according to the as-defined schedule.	2	2020 and 2021
	2017-01	North and south abutment construction deficiencies	HSRC §10.5.1(3)	Address construction deficiency by commencing office engineering then finishing dam construction at north abutment following gas line decommissioning and grout decommissioned gas line in south abutment. TARPs and controls are in place in the interim if excess seepage is observed at the abutments.	3	Q3 2020
	2017-05	Potential overtopping hazard due to tailings liquefaction and redistribution during seismic event needs to be assessed	n/a	Complete liquefaction and overtopping assessment for tailings within facility.	2	2020
	2018-03	The current spillway design does not meet the Very High dam consequence classification IDF	HSRC §10.6.10	Update design of permanent spillway as per the new inflow design flood and requirements from HSRC Guidance Document (Ministry of Energy and Mines 2016). Develop a construction schedule accordingly.	2	Q2 2020
	2018-05	No closure plan for STP	HSRC §10.6.7 MAC TSM	Develop a closure plan for STP.	4	Q3 2020
	2018-06	Construction of the AWTF-S is underway downstream of the STP Main Dam, potentially increasing the number of workers in the dam breach inundation zone.	HSRC §10.1.7 CDA 2013	Review credible failure modes and potential for inundation from a failure of the Main Dam relative to the downstream facility and develop an emergency response plan for the downstream workers if required.	2	Q1 2020
	2019-01	Portions of the Main Dam were eroded as a result of discharge of effluent on undesignated areas of the dam	CDA 2013 §3.5.3	Repair by placing breaker rock over geotextile on the eroded areas.	2	2020
	2019-02	The existing water level sensor is located near the upstream slope of the dam, where the sensor would detect dam/ground surface if the water level is lower	HSRC §4.4.1 CDA 2013 §3.6.3	Dredge the tailings under the relocated existing water level sensor to re-establish free water or add a new sensor.	3	Q2 2020

Table 25: 2019 Dam Safety Inspection Recommended Actions for the South and North Tailings Pond Facilities

Facility	ID Number	Deficiency or Non-conformance	Applicable Guideline or OMS Manual Reference	Recommended Action	Priority Level	Recommended Timing for the Action
NTP	2015-05a,b	No passive emergency system against overtopping; emergency system requires active response	n/a	Assess the need for spillway after establishing an NTP closure plan.	4	Q2 2020
				If required, determine a construction schedule.	4	2020
	2015-06a,b	Risk-informed criteria for flood erosion protection along toe of dams not defined	CDA 2013 §6.2	Perform risk-informed assessment to determine appropriate flood protection requirements for downstream toe of dam along the Fording River and the timeline to implement.	2	2020
				Implement required protection measures for the operational phase according to the as-defined schedule.	2	2020
	2015-07b	Buried pipes passing through crest locations	n/a	Execute abandonment plan for identified pipes.	3	2020
	2016-06	No closure plan for NTP	HSRC §10.6.7 MAC TSM	Develop a closure plan for NTP.	4	2020
	2019-03	A part of the downstream toe area below the NTP dam was excavated for access for a monitoring well installation program in 2019	HSRC §10.5.8	Backfill and grade excavated area.	3	Q3 2020
	2019-04	A loose CR layer was identified in the NTP dam investigation, which is currently unsaturated. This loose CR layer may liquefy if it becomes saturated during the design earthquake event.	HSRC §10.1.8	Currently, FRO does not plan to put NTP back into operation. The next update to the OMS manual shall document that if the NTP facility is put back into operation or for any proposed dam modifications, liquefaction and stability assessments considering the loose CR layer must be carried out.	3	2020
STP and NTP	2016-04	EPP & ERP require updating	HSRC §10.4.2(1)	Update the ERP and EPP with emergency response actions from the STP Main Dam breach and inundation study results and EoR designate/backup contacts	4	Q2 2020
	2019-05	The document *Tailings Impoundment Flood Response Protocol for the Fording River* (FRO 2017) requires an update	n/a	Review the *Tailings Impoundment Flood Response Protocol for the Fording River* and update as required prior to the 2020 freshet.	3	Q1 2020
	2019-06	The facilities' risk assessments were not reviewed in 2019	HSRC §10.4.2(1d)	Review and update (if required) the risk assessments of NTP and STP to reflect current conditions	3	Q4 2020

IDF = inflow design flood; STP = South Tailings Pond; NTP = North Tailings Pond; OMS = operation, maintenance and surveillance; CDA = Canadian Dam Association; HSRC = Health, Safety and Reclamation Code; QPO = Quantifiable performance objectives; EPP = Emergency Preparedness Plan; ERP = Emergency Response Plan; Sta. = Station; AWTF-S = active water treatment facility-south; TARP = trigger-action response plan; n/a = not applicable.

Priority Level	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant risk of regulatory enforcement.
2	If not corrected could likely result in dam safety issues leading to injury, environmental impact or significant regulatory enforcement; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice – Further improvements are necessary to meet industry best practices or reduce potential risks.

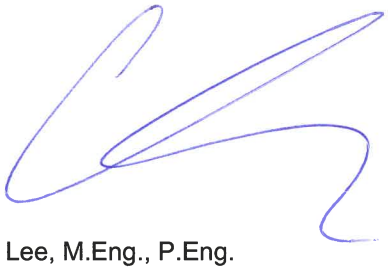
Source: HSRC Guidance Document, Section 4.2 (Ministry of Energy and Mines 2016).

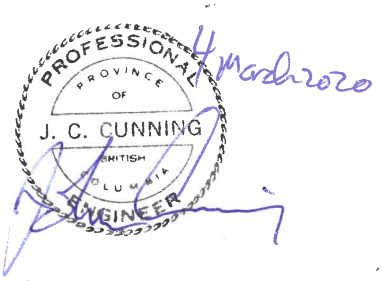
7.0 CLOSURE

The reader is referred to the Study Limitations section, which follow the text and forms an integral part of this report.

We trust the above meets your present requirements. If you have any questions or further requirements, please contact the undersigned.

Golder Associates Ltd.





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STUDY LIMITATIONS

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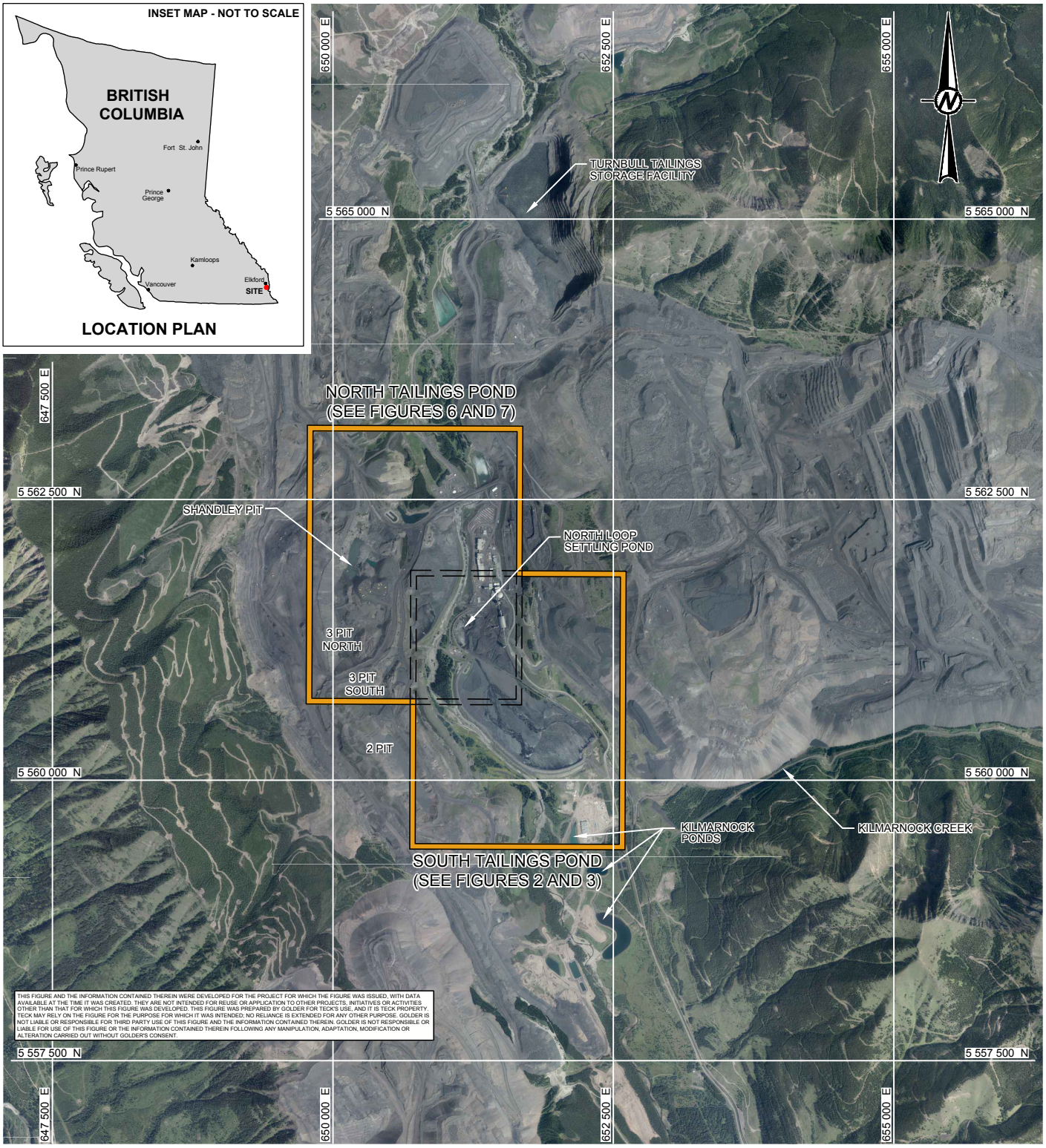


REFERENCE

1. 2019 AERIAL PHOTO PROVIDED BY TECK COAL LIMITED, FORDING RIVER OPERATIONS. FLOWN ON 21 TO 29 JULY 2019. RECEIVED IN NOVEMBER 2019.

NOTES

1. ALL UNITS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES ARE IN UTM ZONE 11, ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.

0 1,000 2,000
1:50,000 METRES

CLIENT
TECK COAL LIMITED
FORDING RIVER OPERATIONS
ELKFORD, B.C.

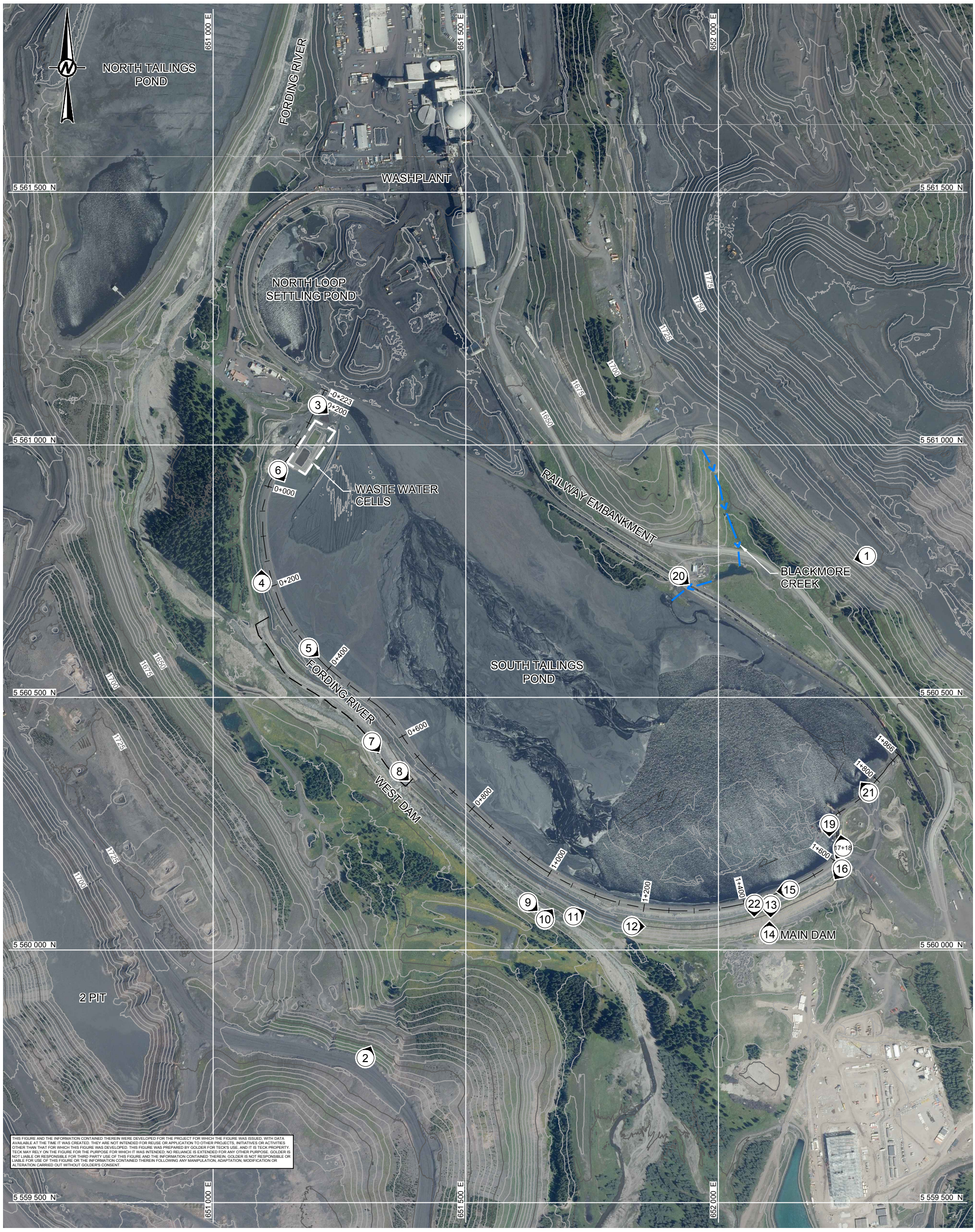
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

CONSULTANT
GOLDER

YYYY-MM-DD	2020-02-24
DESIGNED	C. LEE
PREPARED	A. KIM
REVIEWED	C. LEE
APPROVED	J. CUNNING

TITLE
FORDING RIVER OPERATIONS SITE PLAN

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
18110785	1000/1006/2019-159	0	01



LEGEND

- TOPOGRAPHIC CONTOURS
- BATHYMETRY CONTOURS
- EXTENT OF STP DOWNSTREAM RIPRAP
- (#) 2019 SITE VISIT PHOTOGRAPH LOCATION
- STP DAM REFERENCE LINE AND STATION

NOTES

1. ALL UNITS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES ARE IN UTM ZONE 11, ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.
3. TOPOGRAPHIC CONTOURS SHOWN AT 5.0 m MINOR AND 25.0 m MAJOR INTERVAL.
4. BATHYMETRY CONTOURS SHOWN AT 1.0 m MINOR AND 5.0 m MAJOR INTERVAL.

REFERENCES

1. 2019 AERIAL PHOTO AND TOPOGRAPHY PROVIDED BY TECK COAL LIMITED, FORDING RIVER OPERATIONS. FLOWN ON 21 TO 29 JULY 2019. RECEIVED IN NOVEMBER 2019.
2. STP RIPRAP EXTENTS PROVIDED BY KERR WOOD LEIDAL ASSOCIATES LTD. RECEIVED: 17 JANUARY 2018.
3. 2019 BATHYMETRY DATA SURVEYED BY TECK COAL LIMITED FORDING RIVER OPERATIONS ON 3 APRIL 2019. FILE NAME: "BATH SURFACE_RECEIVED23APRIL2019."

0 125 250
1:7,500 METRES

CLIENT
TECK COAL LIMITED
FORDING RIVER OPERATIONS
ELKFORD, B.C.

CONSULTANT
GOLDER

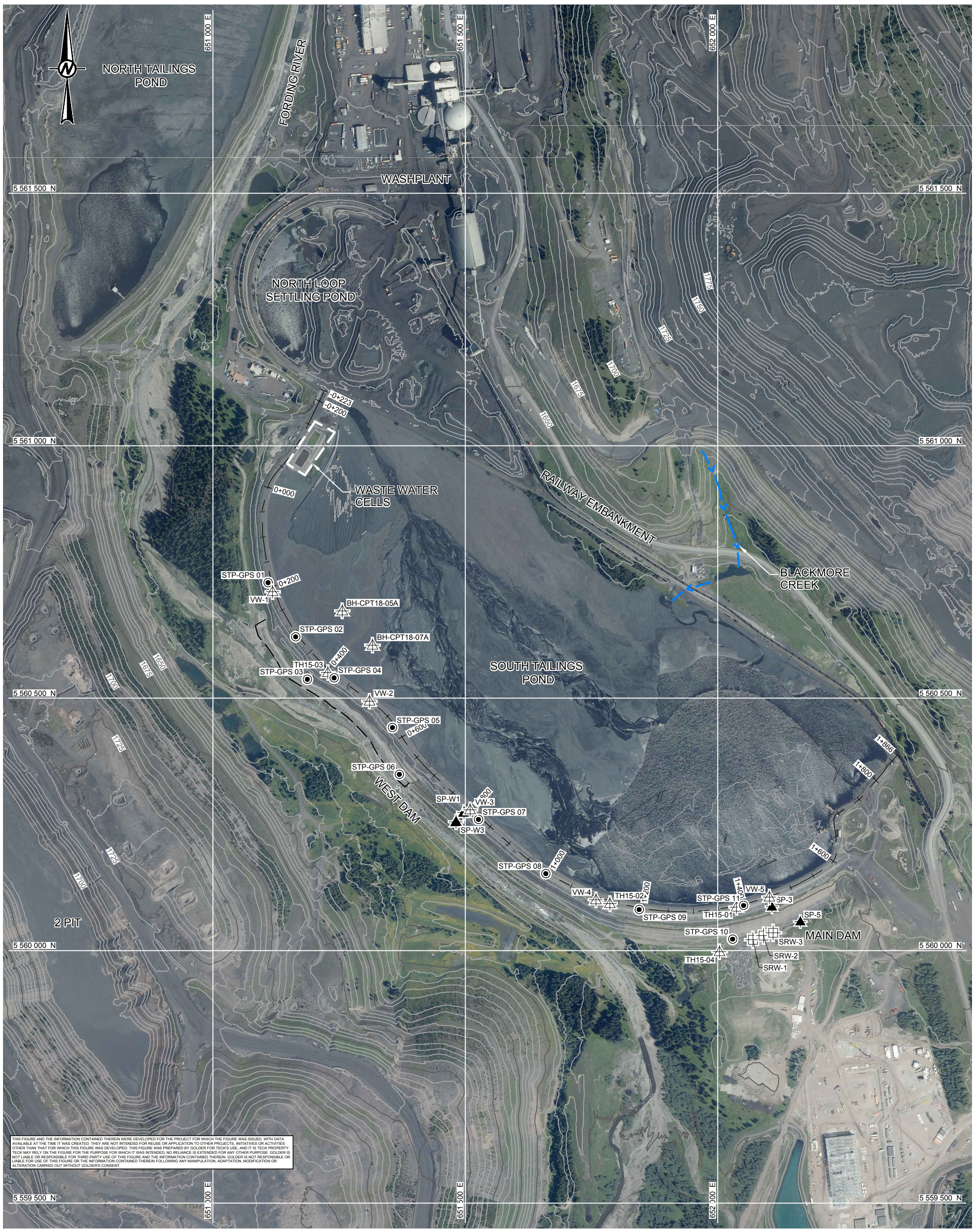
YYYY-MM-DD	2020-02-24
DESIGNED	C. LEE
PREPARED	A. KIM
REVIEWED	C. LEE
APPROVED	J. CUNNING

PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND
PHOTOGRAPH LOCATION

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
18110785	1000/1006/2019-159	0	02

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25 mm
0



THIS FIGURE AND THE INFORMATION CONTAINED THEREIN WERE DEVELOPED FOR THE PROJECT FOR WHICH THE FIGURE WAS ISSUED, WITH DATA AVAILABLE AT THE TIME IT WAS CREATED. THEY ARE NOT INTENDED FOR REUSE OR APPLICATION TO OTHER PROJECTS, INITIATIVES OR ACTIVITIES OTHER THAN THAT FOR WHICH THIS FIGURE WAS DEVELOPED. THIS FIGURE WAS PREPARED BY GOLDER FOR TECK'S USE, AND IT IS TECK PROPERTY. TECK MAY RELY ON THE FIGURE FOR THE PURPOSE FOR WHICH IT WAS INTENDED; NO RELIANCE IS EXTENDED FOR ANY OTHER PURPOSE. GOLDER IS NOT LIABLE OR RESPONSIBLE FOR THIRD PARTY USE OF THIS FIGURE AND THE INFORMATION CONTAINED THEREIN. GOLDER IS NOT RESPONSIBLE OR LIABLE FOR USE OF THIS FIGURE OR THE INFORMATION CONTAINED THEREIN FOLLOWING ANY MANIPULATION, ADAPTATION, MODIFICATION OR ALTERATION CARRIED OUT WITHOUT GOLDER'S CONSENT.

LEGEND

- TOPOGRAPHIC CONTOURS
- BATHYMETRY CONTOURS
- EXTENT OF STP DOWNSTREAM RIPRAP
- GPS MONITORING LOCATION
- VIBRATING WIRE PIEZOMETER AND INCLINOMETER LOCATION
- RETROFIT STANDPIPE WITH VIBRATING WIRE PIEZOMETER LOCATION
- SEEPAGE RETURN WELL LOCATION
- STP DAM REFERENCE LINE AND STATION

0 125 250
1:7,500 METRES

NOTES

1. ALL UNITS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES ARE IN UTM ZONE 11, ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.
3. TOPOGRAPHIC CONTOURS SHOWN AT 5.0 m MINOR AND 25.0 m MAJOR INTERVAL.
4. BATHYMETRY CONTOURS SHOWN AT 1.0 m MINOR AND 5.0 m MAJOR INTERVAL.

REFERENCES

1. 2019 AERIAL PHOTO AND TOPOGRAPHY PROVIDED BY TECK COAL LIMITED, FORDING RIVER OPERATIONS. FLOWN ON 21 TO 29 JULY 2019. RECEIVED IN NOVEMBER 2019.
2. STP RIPRAP EXTENTS PROVIDED BY KERR WOOD LEIDAL ASSOCIATES LTD. RECEIVED: 17 JANUARY 2018
3. GPS MONITORING LOCATIONS BASED ON INITIAL READINGS OF DATA DOWNLOADED FROM GEOEXPLORER ACCESSED 13 DECEMBER 2017.
4. LOCATIONS OF STANDPIPE PIEZOMETERS BASED ON SURVEY DATA DOWNLOADED FROM GEOEXPLORER, ACCESSED 13 DECEMBER 2017.
5. LOCATIONS OF 2014 VIBRATING WIRE PIEZOMETERS BASED ON SURVEY DATA DOWNLOADED FROM GEOEXPLORER, ACCESSED 13 DECEMBER 2017.
6. LOCATIONS OF 2015 VIBRATING WIRE PIEZOMETERS AND INCLINOMETERS BASED ON SURVEY DATA DOWNLOADED FROM GEOEXPLORER, ACCESSED 13 DECEMBER 2017.
7. 2019 BATHYMETRY DATA SURVEYED BY TECK COAL LIMITED FORDING RIVER OPERATIONS ON 3 APRIL 2019. FILE NAME: "BATH SURFACE_RECEIVED23APRIL2019."
8. SEEPAGE RETURN WELL LOCATIONS APPROXIMATED FROM 2018 AERIAL PHOTO.
9. LOCATIONS OF 2018 VIBRATING WIRE PIEZOMETERS CASED ON SURVEY DATA FROM GEOEXPLORER, ACCESSED 24 OCTOBER 2019.

CLIENT
TECK COAL LIMITED
FORDING RIVER OPERATIONS
ELKFORD, B.C.

CONSULTANT
GOLDER

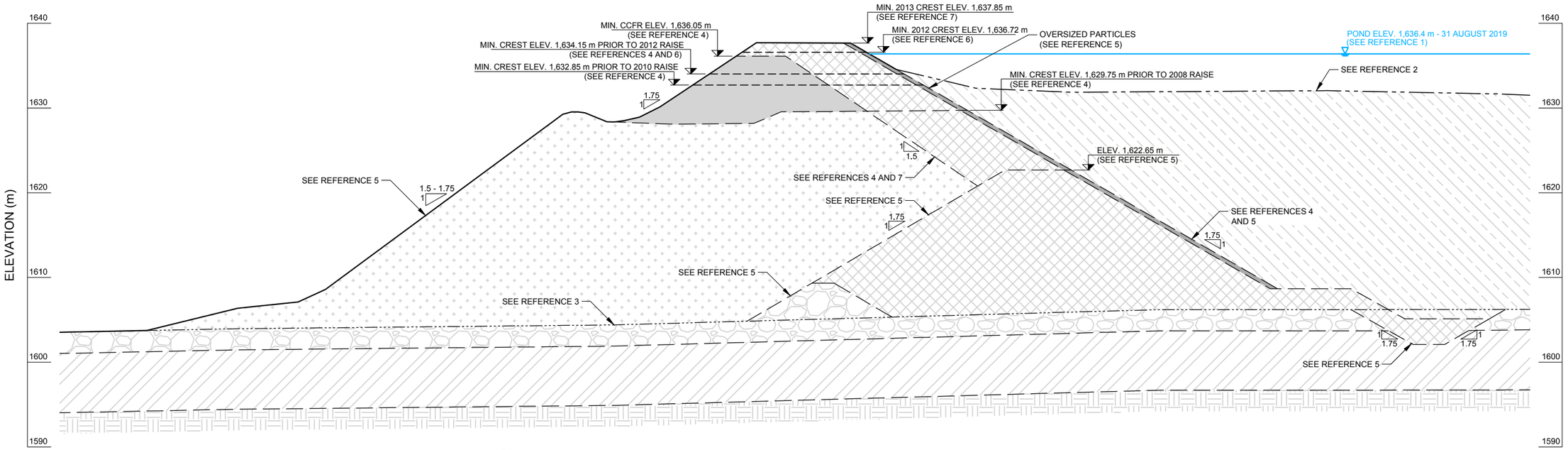
YYYY-MM-DD	2020-02-24
DESIGNED	C. LEE
PREPARED	A. KIM
REVIEWED	C. LEE
APPROVED	J. CUNNING

PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND
MONITORING LOCATIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
18110785	1000/1006/2019-159	0	03

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25 mm
0



SCALE 1:500 m

B TYPICAL SECTION THROUGH MAIN DAM (STN 1+150 TO STN 1+600) AND WEST DAM (STN 0+000 TO 0+400)

LEGEND

- APPROXIMATE GROUND SURFACE
- APPROXIMATE POND ELEVATION
- APPROXIMATE PREVIOUSLY DESIGNED CREST
- APPROXIMATE ORIGINAL GROUND SURFACE
- APPROXIMATE MATERIALS BOUNDARY BENEATH SURFACE
- APPROXIMATE TAILINGS SURFACE
- COARSE REJECTS (CR)
- COMBINED COARSE AND FINE REJECTS (CCFR)
- TILL
- IN SITU TILL
- FLOODPLAIN DEPOSITS (SAND AND GRAVEL)
- TAILINGS
- BEDROCK

NOTES

1. ALL UNITS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
2. MATERIALS SHOWN SCHEMATICALLY ONLY.
3. RIPRAP PRESENT FROM APPROXIMATELY 0+205 TO 0+680, NOT SHOWN ON SECTION.
4. ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.

REFERENCES

1. POND ELEVATION IS LAST RECORDED READING FROM DATA PROVIDED BY TECK COAL LIMITED FORDING RIVER OPERATIONS, RECEIVED: 3 SEPTEMBER 2019.
2. TAILINGS SURFACE SHOWN FOR MAIN DAM SECTION AND ESTIMATED BASED ON 2017 BATHYMETRY PROVIDED BY TECK COAL LIMITED FORDING RIVER OPERATIONS, RECEIVED: 28 NOVEMBER 2017. SURVEYED: 11 SEPTEMBER 2017.
3. ORIGINAL GROUND ESTIMATED BASED ON 1968 ORIGINAL GROUND SURFACE CONTOURS PROVIDED BY TECK COAL LIMITED FORDING RIVER OPERATIONS, FILE NAME: "1968_CONTOURS_BG.dwg", RECEIVED: 8 DECEMBER 2015 AND GOLDER. 1976. TAILINGS STORAGE PROPOSED 1977 EXTENSION. REPORT PREPARED FOR FORDING COAL LTD. REFERENCE NO. V75193. SUBMITTED JANUARY 1976 (GROUND SURFACE DIGITIZED BY GOLDER FROM COMINCO DRAWING (UNNAMED), FIGURE 1 LOCATION OF BOREHOLES).
4. FRO (TECK COAL LIMITED FORDING RIVER OPERATIONS). 2010. SOUTH TAILINGS POND DESIGN AND CONSTRUCTION REPORT JULY-SEPTEMBER 2010. SUBMITTED NOVEMBER 2010.
5. GOLDER (GOLDER ASSOCIATES). 1976. REPORT TO FORDING COAL LTD. ON TAILINGS STORAGE PROPOSED 1977 EXTENSION. REPORT PREPARED FOR FORDING COAL LTD. REFERENCE NO. V75193. SUBMITTED JANUARY 1976.
6. GOLDER (GOLDER ASSOCIATES LTD.). 2013. SOUTH TAILINGS POND DAM 2012 CONSTRUCTION DAM RAISE AS-BUILT REPORT. REPORT PREPARED FOR TECK COAL LIMITED FORDING RIVER OPERATIONS. PROJECT NO. 1214270098-2013-303-R-REV0-6400. SUBMITTED 1 APRIL 2013.
7. GOLDER. 2014D. SOUTH TAILINGS POND DAM CONSTRUCTION RECORD REPORT FOR THE 2013 DAM RAISE. REPORT PREPARED FOR TECK COAL LIMITED FORDING RIVER OPERATIONS. REFERENCE NO. 1314270098-2014-542-R-REV0-6000. SUBMITTED 30 OCTOBER 2014.

0 10 20
1:500 METRES

CLIENT
TECK COAL LIMITED
FORDING RIVER OPERATIONS
ELKFORD, B.C.

CONSULTANT
GOLDER

YYYY-MM-DD	2020-02-24
DESIGNED	C. LEE
PREPARED	A. KIM
REVIEWED	C. LEE
APPROVED	J. CUNNING

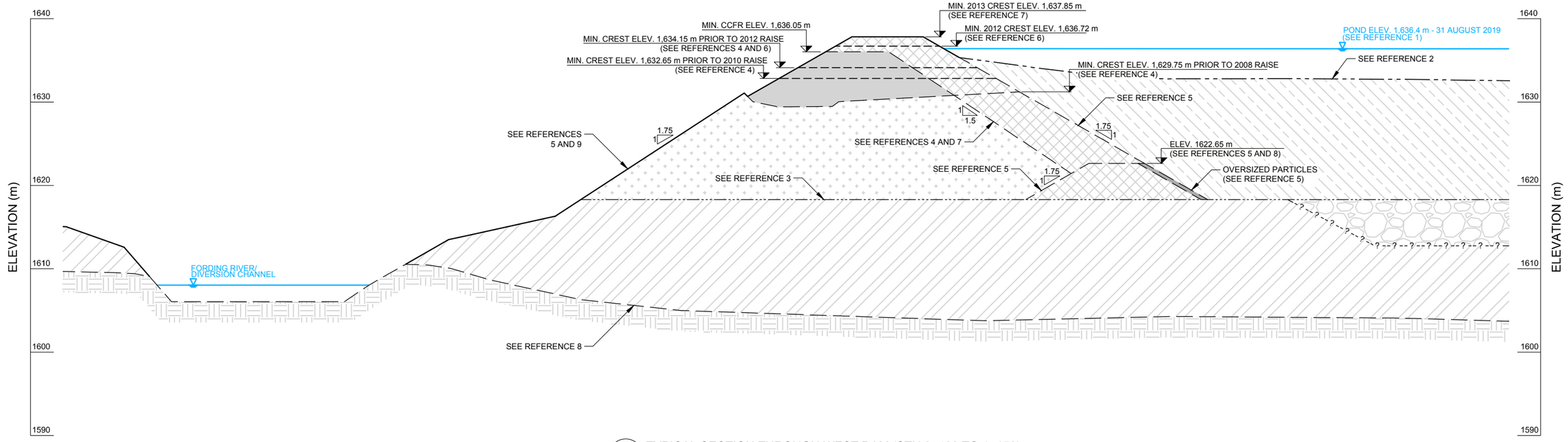
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND
TYPICAL SECTION THROUGH MAIN DAM (STN. 1+150 TO 1+600) AND WEST DAM (STN. 0+000 TO 0+400)

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
18110785	1000/1006/2019-159	0	04

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm



SCALE 1:500 m C TYPICAL SECTION THROUGH WEST DAM (STN 0+400 TO 1+150)

LEGEND

- APPROXIMATE GROUND SURFACE
- APPROXIMATE POND ELEVATION
- APPROXIMATE PREVIOUSLY DESIGNED CREST
- APPROXIMATE ORIGINAL GROUND SURFACE
- APPROXIMATE MATERIALS BOUNDARY BENEATH SURFACE
- APPROXIMATE TAILINGS SURFACE
- COARSE REJECTS (CR)
- COMBINED COARSE AND FINE REJECTS (CCFR)
- TILL
- IN SITU TILL
- FLOODPLAIN DEPOSITS (SAND AND GRAVEL)
- TAILINGS
- BEDROCK

NOTES

1. ALL UNITS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
2. MATERIALS SHOWN SCHEMATICALLY ONLY.
3. RIPRAP PRESENT FROM APPROXIMATELY 0+205 TO 0+680, NOT SHOWN ON SECTION.
4. ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.

REFERENCES

1. POND ELEVATION IS LAST RECORDED READING FROM DATA PROVIDED BY TECK COAL LIMITED FORDING RIVER OPERATIONS, RECEIVED: 3 SEPTEMBER 2019.
2. TAILINGS SURFACE ESTIMATED BASED ON 2017 BATHYMETRY PROVIDED BY TECK COAL LIMITED FORDING RIVER OPERATIONS, RECEIVED: 28 NOVEMBER 2017. SURVEYED: 11 SEPTEMBER 2017.
3. ORIGINAL GROUND ESTIMATED BASED ON 1968 ORIGINAL GROUND SURFACE CONTOURS PROVIDED BY TECK COAL LIMITED FORDING RIVER OPERATIONS, FILE NAME: "1968_CONTOURS_BG.dwg", RECEIVED: 8 DECEMBER 2015 AND GOLDER. 1976. TAILINGS STORAGE PROPOSED 1977 EXTENSION. REPORT PREPARED FOR FORDING COAL LTD. REFERENCE NO. V75193. SUBMITTED JANUARY 1976 (GROUND SURFACE DIGITIZED BY GOLDER FROM COMINCO DRAWING (UNNAMED), FIGURE 1 LOCATION OF BOREHOLES).
4. FRO (TECK COAL LIMITED FORDING RIVER OPERATIONS). 2010. SOUTH TAILINGS POND DESIGN AND CONSTRUCTION REPORT JULY-SEPTEMBER 2010. SUBMITTED NOVEMBER 2010.
5. GOLDER (GOLDER ASSOCIATES). 1976. REPORT TO FORDING COAL LTD. ON TAILINGS STORAGE PROPOSED 1977 EXTENSION. REPORT PREPARED FOR FORDING COAL LTD. REFERENCE NO. V75193. SUBMITTED JANUARY 1976.
6. GOLDER (GOLDER ASSOCIATES LTD.). 2013. SOUTH TAILINGS POND DAM 2012 CONSTRUCTION DAM RAISE AS-BUILT REPORT. REPORT PREPARED FOR TECK COAL LIMITED FORDING RIVER OPERATIONS. REFERENCE NO. 1214270098-2013-303-R-REV0-6400. SUBMITTED 1 APRIL 2013.
7. GOLDER. 2014D. SOUTH TAILINGS POND DAM CONSTRUCTION RECORD REPORT FOR THE 2013 DAM RAISE. REPORT PREPARED FOR TECK COAL LIMITED FORDING RIVER OPERATIONS. REFERENCE NO. 1314270098-2014-542-R-REV0-6000. SUBMITTED 30 OCTOBER 2014.
8. GOLDER (GOLDER ASSOCIATES LTD.). 2015. SOUTH TAILINGS POND WEST DAM GEOPHYSICAL INVESTIGATION. REPORT PREPARED FOR TECK COAL LIMITED FORDING RIVER OPERATIONS. REFERENCE NO. 1522835-2015-002-R-REV0-3000. SUBMITTED 26 MAY 2015.
9. KWL (KERR WOOD LEIDAL ASSOCIATES LTD.). 1976. DRAWING NO. 8-76-3. DRAWING PREPARED FOR FORDING COAL LTD. SUBMITTED 1976.

0 10 20
1:500 METRES

CLIENT
TECK COAL LIMITED
FORDING RIVER OPERATIONS
ELKFORD, B.C.

CONSULTANT
GOLDER

YYYY-MM-DD	2020-02-24
DESIGNED	C. LEE
PREPARED	A. KIM
REVIEWED	C. LEE
APPROVED	J. CUNNING

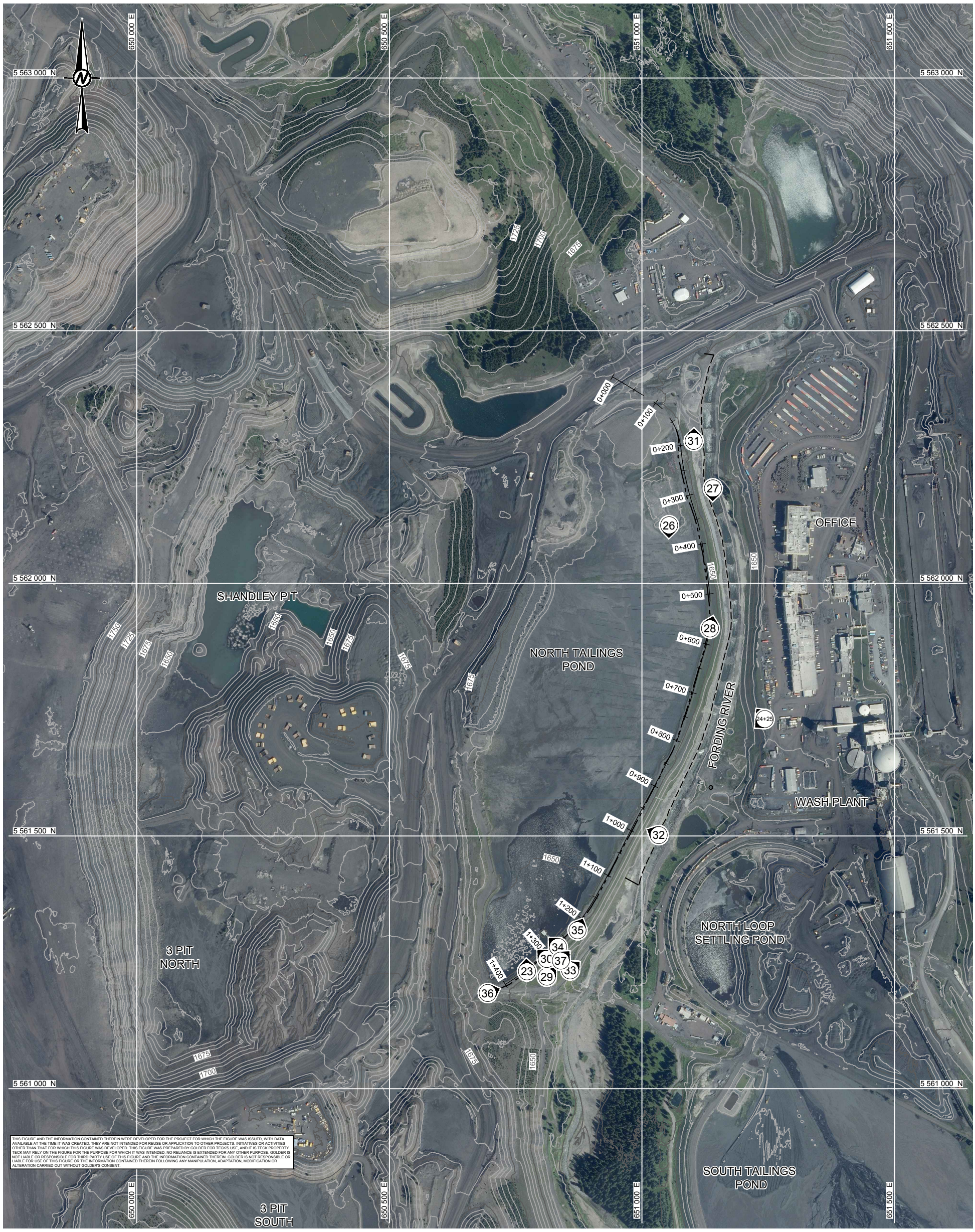
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND
TYPICAL SECTION THROUGH WEST DAM (STN. 0+400 TO 1+150)

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
18110785	1000/1006/2019-159	0	05

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm



LEGEND

- TOPOGRAPHIC CONTOURS
- BATHYMETRY CONTOURS
- 2017 NTP CREST SURVEY
- EXTENT OF NTP DOWNSTREAM RIPRAP
- # 2019 SITE VISIT PHOTOGRAPH LOCATION
- NTP DAM REFERENCE LINE AND STATION

NOTES

1. ALL UNITS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES ARE IN UTM ZONE 11, ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.
3. TOPOGRAPHIC CONTOURS SHOWN AT 5.0 m MINOR AND 25.0 m MAJOR INTERVAL.
4. BATHYMETRY CONTOURS SHOWN AT 1.0 m MINOR AND 5.0 m MAJOR INTERVAL.

REFERENCES

1. 2019 AERIAL PHOTO AND TOPOGRAPHY PROVIDED BY TECK COAL LIMITED FORDING RIVER OPERATIONS. FLOWN ON 21 TO 29 JULY 2019. RECEIVED IN NOVEMBER 2019.
2. GOLDER. 2018. TECK COAL LIMITED, FORDING RIVER OPERATIONS - TURNBULL TSF AND NORTH TAILINGS POND BATHYMETRY SURVEY. GOLDER DOC. NO. 18100013-2018-130-TM-REV0-1000. 29 NOVEMBER 2018.
3. 2017 NTP CREST SURVEY PROVIDED BY TECK COAL LIMITED FORDING RIVER OPERATIONS. RECEIVED: 8 JANUARY 2018. FILE NAME: NTP CREST SURVEY - 171121C.xls.
4. NTP RIPRAP EXTENTS PROVIDED BY KERR WOOD LEIDAL ASSOCIATES LTD. RECEIVED: 17 JANUARY 2018.

0 125 250
1:7,500 METRES

CLIENT
TECK COAL LIMITED
FORDING RIVER OPERATIONS
ELKFORD, B.C.

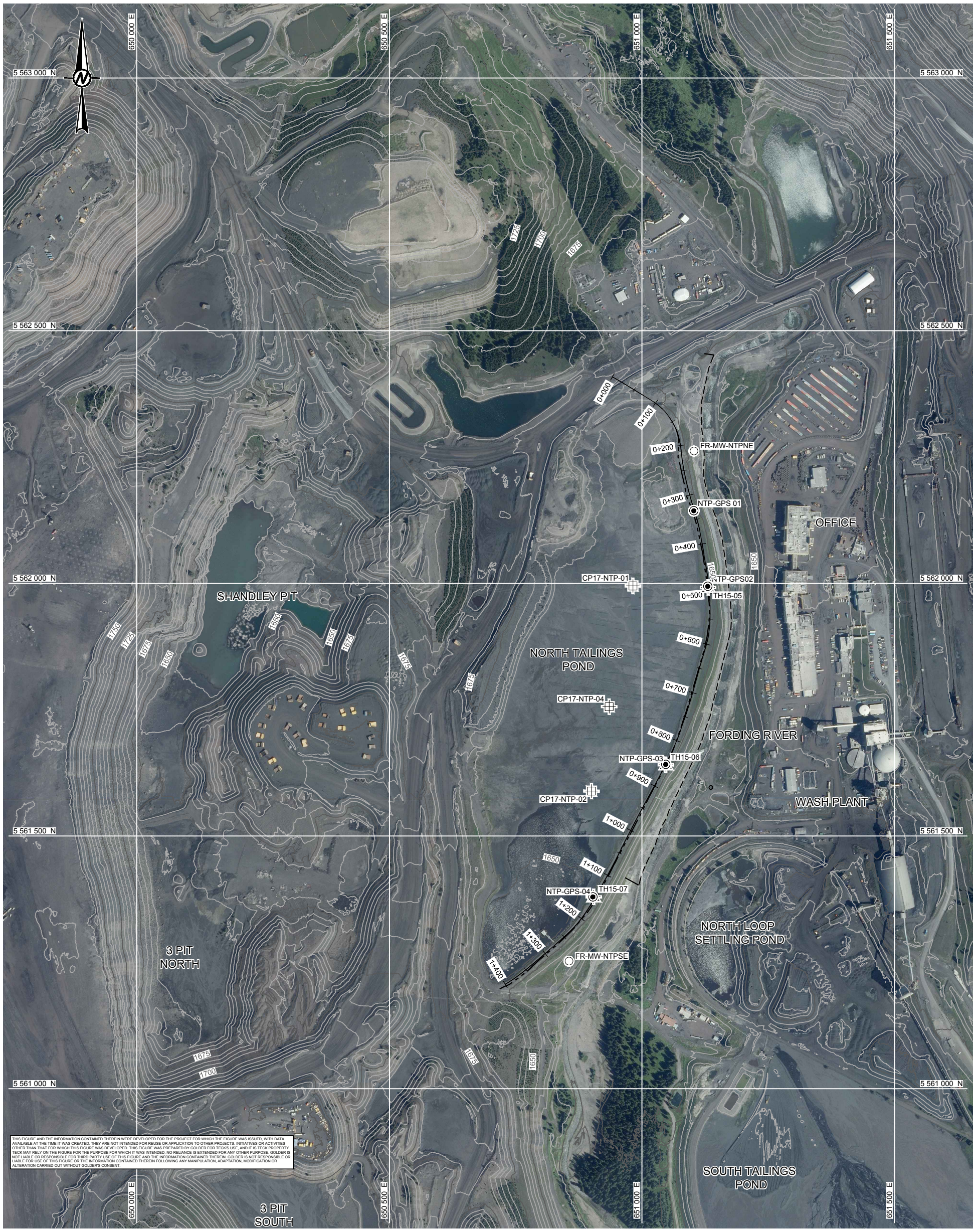
CONSULTANT
GOLDER

YYYY-MM-DD	2020-02-24
DESIGNED	C. LEE
PREPARED	A. KIM
REVIEWED	C. LEE
APPROVED	J. CUNNING

PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
NORTH TAILINGS POND
PHOTOGRAPH LOCATION

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
18110785	1000/1006/2019-159	0	06



LEGEND

- TOPOGRAPHIC CONTOURS
- BATHYMETRY CONTOURS
- 2017 NTP CREST SURVEY
- EXTENT OF NTP DOWNSTREAM RIPRAP
- VIBRATING WIRE PIEZOMETER AND INCLINOMETER LOCATION
- VIBRATING WIRE PIEZOMETER LOCATION
- GPS MONITORING LOCATION
- 2018 FRO MONITORING WELL LOCATION
- NTP DAM REFERENCE LINE AND STATION

0 125 250
1:7,500 METRES

NOTES

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2. COORDINATES ARE IN UTM ZONE 11, ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.
3. TOPOGRAPHIC CONTOURS SHOWN AT 5.0 m MINOR AND 25.0 m MAJOR INTERVAL.
4. BATHYMETRY CONTOURS SHOWN AT 1.0 m MINOR AND 5.0 m MAJOR INTERVAL.

REFERENCES

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2. GOLDER. 2018. TECK COAL LIMITED, FORDING RIVER OPERATIONS - TURNBULL TSF AND NORTH TAILINGS POND BATHYMETRY SURVEY. GOLDER DOC. NO. 18100013-2018-130-TM-REV0-1000. 29 NOVEMBER 2018.
3. GPS MONITORING LOCATIONS BASED ON INITIAL READINGS OF DATA FROM GEOEXPLORER, ACCESSED: 13 DECEMBER 2017.
4. NTP RIPRAP EXTENTS PROVIDED BY KERR WOOD LEIDAL ASSOCIATES LTD. RECEIVED: 17 JANUARY 2018.
5. LOCATION OF INCLINOMETERS AND ALL VIBRATING WIRE PIEZOMETERS (EXCEPT FOR CP17-NTP-01, -02, AND -04) DOWNLOADED FROM FRO'S GEOEXPLORER, ACCESSED ON 13 DECEMBER 2017.
6. 2017 NTP CREST SURVEY PROVIDED BY TECK COAL LIMITED FORDING RIVER OPERATIONS. RECEIVED 8 JANUARY 2018. FILE NAME: NTP CREST SURVEY - 171121C.xls
7. LOCATION OF VIBRATING WIRE PIEZOMETERS CP17-NTP-01, -02, AND -04 FROM NORWEST CORPORATION. 2018. FORDING RIVER OPERATIONS NORTH TAILINGS POND - GEOTECHNICAL INVESTIGATION RESULTS. PROJECT NO. 324-37. MAY 17, 2018.

CLIENT
TECK COAL LIMITED
FORDING RIVER OPERATIONS
ELKFORD, B.C.

CONSULTANT
GOLDER

YYYY-MM-DD	2020-02-24
DESIGNED	C. LEE
PREPARED	A. KIM
REVIEWED	C. LEE
APPROVED	J. CUNNING

PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
NORTH TAILINGS POND
MONITORING LOCATIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
18110785	1000/1006/2019-159	0	07

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25 mm
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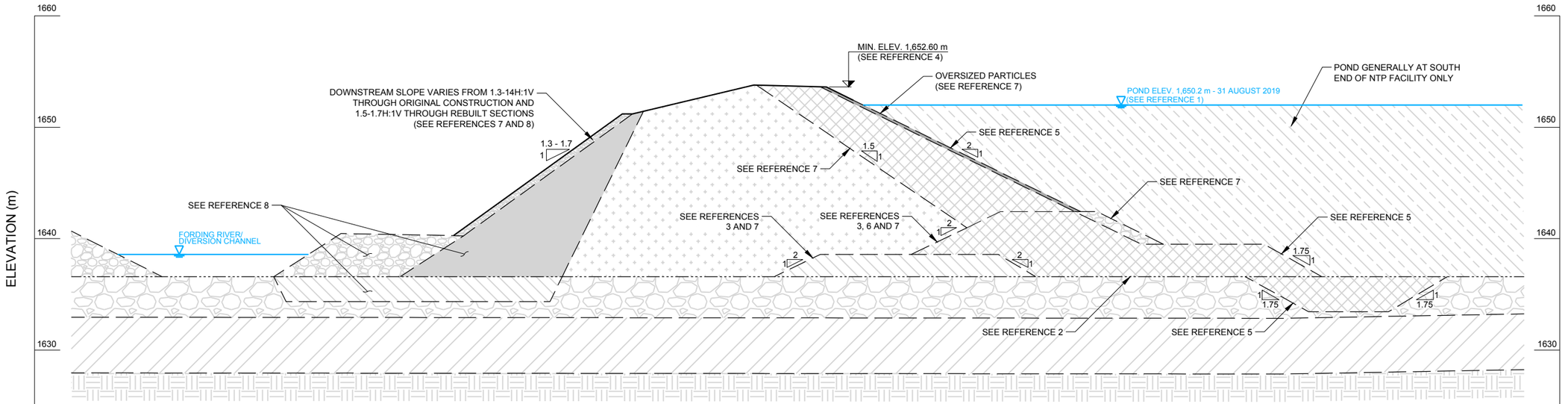


SCALE 1:400 m (A) TYPICAL SECTION THROUGH DAM

LEGEND

- APPROXIMATE GROUND SURFACE
- APPROXIMATE POND ELEVATION
- APPROXIMATE ORIGINAL GROUND SURFACE
- APPROXIMATE MATERIALS BOUNDARY BENEATH SURFACE
- COARSE REJECTS (CR)
- COARSE REJECTS (CR) OR REBUILT WITH COMBINED COARSE AND FINE REJECTS (CCFR)
- TILL
- IN SITU TILL
- FLOODPLAIN DEPOSITS (SAND AND GRAVEL)
- FLOODPLAIN DEPOSITS (SAND AND GRAVEL) OR REBUILT RIPRAP
- RIPRAP
- TAILINGS
- TOPSOIL
- BEDROCK

NOTES

1. ALL UNITS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
2. MATERIAL ZONING SHOWN SCHEMATICALLY ONLY.
3. ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.

REFERENCES

1. POND ELEVATION DOWNLOADED FROM GEOEXPLORER. ACCESSED : 3 SEPTEMBER 2019.
2. ORIGINAL GROUND ESTIMATED BASED ON 1968 ORIGINAL GROUND SURFACE CONTOURS PROVIDED BY TECK COAL LIMITED FORDING RIVER OPERATIONS, FILE NAME: "1968_CONTOURS_BG.dwg", RECEIVED: 8 DECEMBER 2015.
3. COMINCO (COMINCO LTD.). 1973. FEASIBILITY PROPOSAL FOR FORDING OPERATIONS TAILINGS DIKE EXTENSION TO ELEVATION 5,400 FEET. SUBMITTED 3 JULY 1973.
4. 2017 NTP CREST SURVEY PROVIDED BY TECK COAL LIMITED FORDING RIVER OPERATIONS. RECEIVED 8 JANUARY 2018. FILE NAME: NTP CREST SURVEY - 171121C.xls
5. GOLDER BRAWNER (GOLDER BRAWNER ASSOCIATES). 1970. SECOND REPORT TO COMINCO LTD., ON TAILINGS POND AND DYKE PROPOSED FORDING RIVER COAL PROJECT FORDING RIVER BRITISH COLUMBIA. REPORT PREPARED FOR COMINCO LTD. REFERENCE NO. V6994. SUBMITTED APRIL 1970.
6. GOLDER BRAWNER. 1974. REPORT TO FORDING COAL LTD. ON PHASE II TAILINGS DAM CONSTRUCTION SPARWOOD B.C. REPORT PREPARED FOR FORDING COAL LTD. REFERENCE NO. V73020-5. SUBMITTED FEBRUARY 1974.
7. GOLDER (GOLDER ASSOCIATES). 1975. REPORT TO FORDING COAL LTD. RE CONSTRUCTION OF PHASE 4, ZONE 1b OF THE FORDING COAL TAILINGS DYKE. REPORT PREPARED FOR FORDING COAL LTD. REFERENCE NO. V75013. SUBMITTED 17 FEBRUARY 1975.
8. GOLDER. 2014D. NORTH TAILINGS POND DAM 2013 FLOOD REPAIRS CONSTRUCTION SUMMARY. REPORT PREPARED FOR TECK COAL LIMITED FORDING RIVER OPERATIONS. PROJECT NO. 1314270098-2014-R-REV0-7000. SUBMITTED OCTOBER 30, 2014.

0 10 20
1:400 METRES

CLIENT
TECK COAL LIMITED
FORDING RIVER OPERATIONS
ELKFORD, B.C.

CONSULTANT
GOLDER

YYYY-MM-DD	2020-02-24
DESIGNED	C. LEE
PREPARED	A. KIM
REVIEWED	C. LEE
APPROVED	J. CUNNING

PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
NORTH TAILINGS POND
TYPICAL SECTION THROUGH DAM

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
18110785	1000/1006/2019-159	0	08

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

APPENDIX A

Site Photographs

Photograph A-1: STP Overview, looking Northeast, 10 September 2019

Photograph A-2: South Tailings Pond (STP) Overview, looking West, 10 September 2019

Photograph A-3: STP, North single point discharge, make up water pipelines, and channel to main pond, looking South, 10 September 2019

Photograph A-4: STP West Dam Downstream Slope Looking North along mid slope bench Near Station 0+200, 10 September 2019

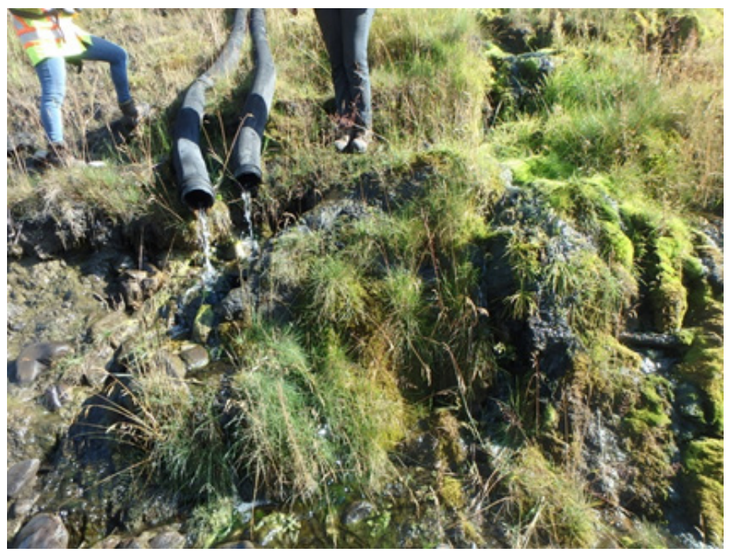
Photograph A-5: STP West Dam, looking South Along Dam Crest, near Station 0+400, 10 September 2019

Photograph A-6: STP West Dam near Station 0+000, Regraded tailings to 0.2 m below STP dam crest and minimum 10 m Wide Channel was Maintained between Regarded Tailings and Upstream Slope of Dam during Tailings Regrading Work, looking South, 10 September 2019

Photograph A-7: STP West Dam Downstream Slope, on Access Road near Station 0+550, looking Southeast toward Pipeline Ridge for old Dredge Pipelines to 2P-3P TSA, 10 September 2019

Photograph A-8: STP West Dam Downstream Slope, Looking Southeast at the Pipeline Bridge at Station 0+650, 10 September 2019

Photograph A-9: STP West Dam, looking South at the Toe of the Cut Slope Above Fording River Diversion, Seepage was Observed to be Coming out of the Slope Adjacent to the West Seepage Pipes, 10 September 2019



Photograph A-10: STP West Dam, looking at the West Seepage Pipes Discharging Cut Slope above Fording River Diversion near Station 1+000, 10 September 2019, Seepage Rate was 0.27 L/sec for the North Pipe (left) and 0.2 L/sec for the South Pipe (right)

Photograph A-11: STP Downstream Slope at Transition Between West and Main Dam, Looking Northeast Toward the Crest from the Toe Near Station 1+150, 10 September 2019

Photograph A-12: STP Main Dam Downstream Slope, looking Northeast, 10 September 2019

Photograph A-13: STP Main Dam, Looking Southeast At Erosion Channel Along Downstream Slope At Station 1+450, 10 September 2019

Photograph A-14: STP Main Dam, Looking Up At Downstream Slope From Dam Toe At Erosion Gullies From Photo A-13, 10 September 2019

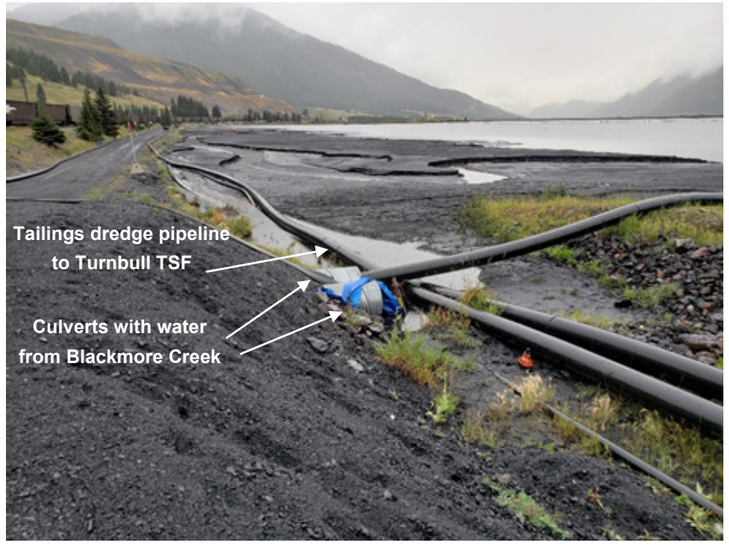
Photograph A-15: STP Main Dam Crest, Looking Southwest, near Station 1+500, 10 September 2019

Photograph A-16: STP Main Dam Downstream Slope, looking Southwest from Station 1+600 Across Dam Slope, 10 September 2019

Photograph A-17: On STP Main Dam Crest and Upstream Slope near Reclaim Water Barge, looking Southwest, 10 September 2019

Photograph A-18: On STP Main Dam, Reclaim Water Barge, looking Northeast, 10 September 2019

Photograph A-19: On Walkway of Reclaim Water Barge, looking Southwest, 10 September 2019



Photograph A-20: On STP Railway Embankment, Makeup Water from Blackmore Creek via Twin Culverts and Dredge Pipeline to Turnbull TSF, looking South 10 September 2019

Photograph A-21: STP South Abutment Till Blanket Area, Makeup Water Pipelines from Kilmarnock Ponds with Rip Rap Protection on Blanket, Looking Northeast, 10 September 2019

Photograph A-22: STP Main Dam Downstream Slope, looking Southwest at Rip Rap Stockpile From the Dam Crest near Station 1+450, 10 September 2019

Photograph A-23: North Tailings Pond (NTP), Overview Looking North from Station 1+400, 11 September 2019

Photograph A-24: NTP Downstream Slope Overview, Looking Southwest from the Wash Plant Area, 11 September 2019

Photograph A-25: NTP Downstream Slope Overview, Looking North From The Wash Plant Area, 11 September 2019

Photograph A-26: NTP, looking South over Tailings Surface, 11 September 2019

Photograph A-27: NTP, looking South Along the Downstream Slope and Toe of the Dam near Station 0+300, 11 September 2019

Photograph A-28: NTP, Looking North Along the Downstream Slope of the Dam near Station 0+550, 11 September 2019

Photograph A-29: NTP looking North along Downstream Slope and Toe near Station 1+300, 1 September 2019

Photograph A-30: NTP Looking Northwest at Water Level Staff Gauge near Station 1+360, 11 September 2019

Photograph A-31: On Riprap along Fording River, looking North, at Station 0+200, 11 September 2019

Photograph A-32: NTP Dam Downstream Slope and Toe and Stepped Erosion and Area of Ponding Water, at Station 1+200, 11 September 2019

Photograph A-33: NTP Downstream Slope, looking Northeast at Monitoring Well FR-MW-NTPSE from Station 1+350, 11 September 2019

Photograph A-34: NTP looking Northwest at Unused Reclaim Barge Near Station 1+275, 11 September 2019

Photograph A-35: On NTP Upstream Slope, Unused Reclaim Pipelines (capped pipeline that go into dam section and cross under dam crest), looking North, 11 September 2019

Photograph A-36: NTP looking Northeast along Dam Crest, Road to South Access Ramp to the Right, at Station 1+400, 11 September 2019

Photograph A-37: NTP looking Northeast at Downstream Slope and Crest from Station 1+300, 11 September 2019

APPENDIX B

South Tailings Pond Inspection Report

Client:	**Teck Coal Limited, Fording River Operations**	**By:**	**John Cunning, P.Eng., Clara Lee, P.Eng.**
Project:	**18110785 FRO Tailings Facilities Annual Dam Safety Inspection**	**Date:**	**10 September 2019**
Location:	**South Tailings Pond**	**Reviewed:**	**John Cunning**

GENERAL INFORMATION			
Dam Type:	Zoned Earth Fill		
Weather Conditions:	Raining and cloudy	**Temp:**	4°C to 8°C

Inspection Item	Observations/Data	Photo	Comments & Other Data
1.0 DAM CREST		5, 15, 17	
1.1 Crest Elevation	Elev. 1,637.85 m (minimum) for Main Dam		Confirmed using 2019 LiDAR survey data from FRO.
1.2 Reservoir Level / Freeboard	Elev.1,636.43 m (10 September 2019) 1.42 m freeboard		
1.3 Distance To Tailings Pond (if applicable)	**0 m (south end)** Sta.1+050 to 1+800 and 1+850 to 1+866 **Full beach** along West dam Sta. -0+200 to 1+050 and 1+800 to 1+850	1, 2	Usually no beach along Main Dam.
1.4 Surface Cracking	None		
1.5 Unexpected Settlement	None		
1.6 Lateral Movement	None		
1.7 Other Unusual Conditions or Structures	Rutting and small depressions on dam crest due to traffic and usage by dredging crew	15, 17	

Inspection Item	Observations/Data	Photo	Comments & Other Data
2.0 UPSTREAM SLOPE		15, 17, 18, 19, 21	
2.1 Slope Angle	Generally 1.4 H to 1.75 H : 1 V		Crest graded to drain upstream. Riprap placed along upstream slope of Main Dam and part of West Dam in 2017.
Signs of Erosion	2 areas of erosion, at 5 m east and west of the Kilmarnock discharge pipelines approx. 1+780		Erosions due to a vacuum truck discharging into non-designated locations on the upstream slope.
2.3 Signs of Movement (Deformation)	None		
2.4 Cracks	None		
2.5 Face Liner Condition (if applicable)	N/A		
2.5 Other Unusual Conditions	Ground squirrel burrows observed on upstream slope of Main Dam near the Kilmarnock discharge. Vegetation growth along all upstream slopes of Main and West Dams.		Unused dredge line along upstream slope of Main Dam.
3.0 DOWNSTREAM SLOPE		4, 7, 8, 11, 12, 13 ,14, 16	
3.1 Slope Angle	± 1.5 to 1.75H:1V		Lower portion of Main Dam slope locally oversteepened with respect to design, bench in Main Dam slope provides and overall slope around 1.75 H:1 V.
3.2 Signs of Erosion	Yes. No new erosion observed in repaired erosion channels	7, 11, 12, 13, 14	■ One area of a larger vertical erosion channel down face of Main Dam above seepage collection well observed. ■ Minor erosion channels on till and CCFR faces of downstream slope. ■ Erosion channels in Main and West Dam should be filled with coarse rock fill as was done for previously repaired channels.
3.3 Signs of Movement (Deformation)	None		
3.4 Cracks	None		
3.5 Seepage or Wet Areas	None		

Inspection Item	Observations/Data	Photo	Comments & Other Data
3.6 Vegetation Growth	Good on lower portion of Main Dam Poor on West Dam	4, 7, 8, 11, 12, 13 ,14, 16	Limited growth noted along Till and CCFR downstream slopes.
3.7 Other Unusual Conditions	A ground squirrel burrow was observed on a bench of Main Dam		
4.0 DOWNSTREAM TOE AREA			
4.1 Seepage from Dam	Yes, below West and Main Dams	4, 9,10	West Dam ■ Persistent seepage from till bench above Fording River diversion channel below West Dam south of Sta. 0+700. ■ Ponding in ditch along downstream toe at south end of West Dam CR shell, minor flow in ditch, south of Sta. 1+000. ■ Flow observed in ditch below north end of West Dam between Sta. 0+200 and 0+400.
4.2 Signs of Erosion	None		
4.3 Signs of Turbidity in Seepage Water	None		
4.4 Discoloration/Staining	Yes (green, red), below West Dam	9	■ Green and red mineral deposits and minor areas with red colored staining in seepage face at bedrock contact in Fording River diversion channel cut below West Dam.
4.5 Outlet Operating Problem (if applicable)	N/A		
4.6 Other Unusual Conditions	Badger burrows at toe of Main Dam near seepage collection well		
5.0 ABUTMENTS		1, 3, 21	
5.1 Seepage at Contact Zone (abutment/embankment)	None		
5.2 Signs of Erosion	None		
5.3 Excessive Vegetation	None		
5.4 Presence of Rodent Burrows	None		
5.5 Other Unusual Conditions	Yes		■ Gas main pipeline in north abutment area did not allow for abutment section of dam to tie into interim berm built. ■ Till berm constructed near north abutment in 2017 remains in good condition.

Inspection Item	Observations/Data	Photo	Comments & Other Data
6.0 RESERVOIR			
6.1 Stability of Slopes	Stable	1	■ Railway embankment on east side of impoundment has a buttress berm and tailings beach upstream. ■ Small natural ground slope present north of the railway embankment on east side of reservoir (low potential for slide generation).
6.2 Distance to Nearest Slide (if applicable)	Rail embankment adjacent to impoundment		■ Slide from adjacent slopes would impact tailings beach.
6.3 Estimate of Slide Volume (if applicable)	Minor		■ Potential slide volume from railway embankment or small slope estimated to be small.
6.4 Floating Debris	None		
6.5 Other Unusual Conditions	Yes	1, 2, 6	■ Excavators and dozers regrading surficial tailings beach at the north end of STP, near the tailings discharge location. ■ Tailings being dredged to Turnbull TSF from April to October 2019. Dredge line was under repair at time of inspection. ■ Waste water cells in operation near the north abutment.
7.0 EMERGENCY SPILLWAY/ OUTLET STRUCTURE			■ No spillway or emergency outlet.
7.1 Surface Condition	N/A		
7.2 Signs of Erosion	N/A		
7.3 Signs of Movement (Deformation)	N/A		
7.4 Cracks	N/A		
7.5 Settlement	N/A		
7.6 Presence of Debris or Blockage	N/A		
7.7 Closure Mechanism Operational	N/A		
7.8 Slope Protection	N/A		
7.9 Instability of Side Slopes	N/A		
7.10 Other Unusual Conditions	N/A		

Inspection Item	Observations/Data	Photo	Comments & Other Data
8.0 INSTRUMENTATION			
8.1 Piezometers	Yes		West Dam (see Section 5.4 of the DSI report): ■ 2 standpipes (not read). ■ 2 retrofit standpipes with vibrating wire. ■ 4 VW piezometers. Main Dam (see Section 5.4 of the DSI report): ■ 1 standpipe (not read). ■ 2 retrofit standpipes with vibrating wire. ■ 5 VW piezometers. Two new piezometers installed in tailings in 2018 (BH-CPT18-05A and -07A). Locations shown in plan in Figure 3 of the DSI report.
8.2 Settlement Cells	None		
8.3 Thermistors	None		
8.4 Settlement Monuments	Yes		GPS units monitor crest and toe movements – see Appendix F of the DSI report. Locations shown in plan in Figure 3 of the DSI report.
8.5 Accelerograph	None		
8.6 Inclinometer	Yes		West Dam ■ 1 location. Main Dam ■ 3 locations. See Appendix G. Locations shown in plan in Figure 3.
8.7 Weirs and Flow Monitors	Yes	10	Below West Dam, seepage flow monitoring from collection pipes, north seepage area culverts, and ditch at south end of West Dam see Section 5.4.1.1.
8.8 Data Logger(s)	Yes		On piezometers and GPS units, all instrumentation connected to GeoExplorer system.
8.9 Other	Water level sensor	19	Sensor is mounted on the reclaim barge walkway.

Inspection Item	Observations/Data	Photo	Comments & Other Data
9.0 DOCUMENTATION			
9.1 Operation, Maintenance and Surveillance (OMS) Manual 9.1.1 OMS Manual Exists	Yes		FRO Tailings Facility OMS Manual Version 2019.03.
9.1.2 OMS Plan Reflects Current Dam Conditions	Yes		
9.1.3 Date of Last Revision	27 February 2020		
9.2 Emergency Preparedness Plan (EPP) 9.2.1 ERP Exists	Yes ERP: Internal to Teck EPP: External to Teck		**ERP:** STP included in site tailings facilities ERP (SP&P EP.009). **EPP:** SP&P EP.008.R1.
9.2.2 ERP Reflects Current Conditions	ERP reflects current conditions on site, EPP to be updated based on ERP once finalized.		
9.2.3 Date of Last Revision	**ERP**: May 2019, in draft **EPP**: 15 December 2015		

10. NOTES

- Signage added at access points and along the crest and toe of the facility to notify passersby that the structure is a tailings facility. The signage also provides direction and contact information to report any issues observed or prior to any work in the vicinity.
- The north abutment construction has been on hold since 2013 due to gas main pipeline; interim berm in place until gas main relocated or north abutment redesigned.
- The STP is not equipped with an overflow emergency spillway. FRO has increased annual dredging plan for 2019 which should result increased operating pond size. Golder is preparing design for a permanent emergency spillway.

Inspectors:	Clara Lee, P.Eng., and John Cunning, P.Eng.	**Date:**	10 September 2019

APPENDIX C

North Tailings Pond Inspection Report

Client:	**Teck Coal Limited, Fording River Operations**	**By:**	**John Cunning, P.Eng., Clara Lee, P. Eng.**
Project:	**18110785 FRO Tailings Facilities Annual Dam Safety Inspection**	**Date:**	**11 September 2019**
Location:	**North Tailings Pond**	**Reviewed:**	**John Cunning**

GENERAL INFORMATION			
Dam Type:	Zoned Earth Fill		
Weather Conditions:	Cloudy	**Temp:**	4°C to 8°C

Inspection Item	Observations/Data	Photo	Comments & Other Data
1.0 DAM CREST		23, 36, 37	
1.1 Crest Elevation	Elev. 1,652.6 m (minimum)		Confirmed by 2019 LiDAR survey data from FRO.
1.2 Reservoir Level/ Freeboard	Elev. 1,650.2 m / (11 September 2019) 2.4 m freeboard	23	From GeoExplorer reading of a piezometer installed in the pond.
1.3 Distance to Tailings Pond (if applicable)	**0 m (south end)** Approx. Sta. 1+100 to 1+400 **Full beach** Approx. Sta. 0+000 to 1+100	23 24, 25, 26	Usually no beach at south end.
1.4 Surface Cracking	None		
1.5 Unexpected Settlement	None		
1.6 Lateral Movement	None		
1.7 Other Unusual Conditions	Yes	35	Abandoned pipes crossings under the crest all observed to be closed on upstream at time of inspection: ■ Site 1: old tailings delivery pipe at former bridge abutment – capped. ■ Site 2: dual steel pipes – capped. ■ Site 3: steel pipe valve closed on upstream, leading to pipe in culvert on downstream face. ■ Site 4: black shallow PVC pipes only observed on downstream face.

Inspection Item	Observations/Data	Photo	Comments & Other Data
2.0 UPSTREAM SLOPE		26, 35	
2.1 Slope Angle	1.4 to 1.5H:1V		
2.2 Signs of Erosion	Minor surficial erosion		
2.3 Signs of Movement (Deformation)	None		
2.4 Cracks	None		
2.5 Face Liner Condition (if applicable)	N/A		
2.6 Other Unusual Conditions	Yes	34, 35, 37	■ Unused reclaim pipes near barge. ■ Small trees and vegetation growth. ■ Old tires on downstream slope.
3.0 DOWNSTREAM SLOPE		24, 25, 27, 28, 29, 32, 33, 37	
3.1 Slope Angle	1.4 to 1.75 H:1 V		Original design of 1.4 H:1 V; rebuilt design of 1.5 to 1.75H:1 V following 2013 flood repairs.
3.2 Signs of Erosion	Minor surficial erosion, not a stability concern	24, 25, 29, 32	■ Minor stepped erosion throughout downstream slope. ■ Repaired vertical channel at south abutment remains stable following 2016 repairs.
3.3 Signs of Movement (Deformation)	None		
3.4 Cracks	None		
3.5 Seepage or Wet Areas	Dry		
3.6 Vegetation Growth	Variable	24, 25, 27, 28, 29, 32, 33, 37	Good grass growth along most areas of the downstream slope.
3.7 Other Unusual Conditions	Yes	24, 29	Vertical culvert and abandoned pipes on downstream slope.

Inspection Item	Observations/Data	Photo	Comments & Other Data
4.0 DOWNSTREAM TOE AREA		27, 29, 32, 33	
4.1 Seepage from Dam	None		
4.2 Signs of Erosion	No	24, 25	Riprap placed to protect from Fording River erosion, in good condition.
4.3 Signs of Turbidity in Seepage Water	None		
4.4 Discoloration/Staining	None		
4.5 Outlet Operating Problem (if applicable)	N/A		
4.6 Other Unusual Conditions	Ponded water at downstream toe near Stn. 1+200 Monitoring wells FR-ME-NTPSE and FR-ME-NTPNE installed in dam toe area	32 33	Fill and re-grade toe at Stn. 1+200 to divert water away from dam toe. Parts of area downstream of dam toe was excavated for drill pad of FR-ME-NTPSE, should be backfilled.
5.0 ABUTMENTS		23, 26, 36	
5.1 Seepage at Contact Zone (Abutment/Embankment)	None		
5.2 Signs of Erosion	Minor		
5.3 Excessive Vegetation	None		
5.4 Presence of Rodent Burrows	Yes		Animal burrows in downstream toe area near south abutment.
5.5 Other Unusual Conditions	Yes		■ Surface runoff from haul road reports to north end of tailings beach. ■ Ponded water in Liverpool outlet channel at fish barrier outside north end of NTP.

Inspection Item	Observations/Data	Photo	Comments & Other Data
6.0 RESERVOIR		23, 30, 34	
6.1 Stability of Slopes	Good, Spoils west of tailings storage facility Till stockpile operated west of north end of NTP	24, 25	Spoils re-sloped in March 2015. Ongoing erosion noted,
6.2 Distance to Nearest Slide (if applicable)	N/A		
6.3 Estimate of Slide Volume (if applicable)	N/A		
6.4 Floating Debris	None		
6.5 Other Unusual Conditions	Yes	34 24, 25, 26	■ Barge is crooked from being stuck in tailings, barge not in use. ■ Silt fences installed on tailings surface for dust control. ■ Could build graded access to pump intake location (Shandley Line connection).
7.0 EMERGENCY SPILLWAY/ OUTLET STRUCTURE			No spillway or emergency outlet.
7.1 Surface Condition	N/A		
7.2 Signs of Erosion	N/A		
7.3 Signs of Movement (Deformation)	N/A		
7.4 Cracks	N/A		
7.5 Settlement	N/A		
7.6 Presence of Debris or Blockage	N/A		
7.7 Closure Mechanism Operational	N/A		
7.8 Slope Protection	N/A		
7.9 Instability of Side Slopes	N/A		
7.10 Other Unusual Conditions	N/A		

Inspection Item	Observations/Data	Photo	Comments & Other Data
8.0 INSTRUMENTATION			
8.1 Piezometers	Yes		■ Piezometers installed in three vertical boreholes drilled form dam crest in 2015. ■ Seven piezometers installed in tailings in 2017 at CP17-NTP-01, -02, and -04 to support closure studies. ■ See Section 5.5 of DSI report for details of the instrumentation. ■ Locations shown in plan in Figure 7 of the DSI report.
8.2 Settlement Cells	None		
8.3 Thermistors	None		
8.4 Settlement Monuments	Yes		■ GPS units were used to monitor crest movements over the reporting period of 1 September 2018 to 31 August 2019. ■ GPS (NTP04_GPS600) next to piezometer/SI TH15-07. ■ GPS (NTP03_GPS600) next to piezometer/SI TH15-06. ■ GPS (NTP02_GPS600) next to piezometer/SI TH15-05. ■ Locations shown in plan in Figure 7. ■ Plots of data from GPS units in Appendix F of the DSI report.
8.5 Accelerograph	None		
8.6 Inclinometer	Yes		■ Three inclinometers installed in 2015 – see Appendix I of the DSI report. ■ Locations shown in plan in Figure 7 of the DSI report.
8.7 Weirs and Flow Monitors	None		
8.8 Data Logger(s)	Yes		On piezometers and GPS, all instrumentation connected to GeoExplorer system.
8.9 Other	Water Level Monitor		Piezometer has been placed in ponded water to read water level in the pond.

Inspection Item	Observations/Data	Photo	Comments & Other Data
9.0 DOCUMENTATION			
9.1 Operation, Maintenance and Surveillance (OMS) Manual 9.1.1 OMS Manual Exists	Yes		FRO Tailings Facility OMS Manual Version 2019.03.
9.1.2 OMS Manual Reflects Current Dam Conditions	Yes		
9.1.3 Date of Last Revision	27 February 2020		
9.2 Emergency Preparedness Plan (EPP) 9.2.1 ERP Exists	Yes ERP: Internal to Teck EPP: External to Teck		**ERP:** NTP included in site tailings facilities ERP (SP&P EP.009). **EPP:** SP&P EP.008.R1.
9.2.2 ERP Reflects Current Conditions	ERP reflects current conditions on site, EPP to be updated based on ERP once finalized.		
9.2.3 Date of Last Revision	**ERP**: May 2019, in draft **EPP**: 15 December 2015		
10. NOTES ■ Signage added at access points and along the crest and toe of the facility to notify passersby that the structure is a tailings facility. The signage also provides direction and contact information to report any issues observed or prior to any work in the vicinity. ■ Currently, there is no active deposition of tailings into the NTP. The barge is not being operated and pipes are not connected. ■ On 21 July 2019, water level in the NTP was detected to be El. 1650.7 m. A pump was set up the next day to pump water from NTP via an existing pipeline to the STP until the pond level was dropped below El. 1650.5 m on 26 July 2019. ■ The NTP facility remains inactive and its future use is under review by FRO.			
Inspectors:	Clara Lee, P.Eng., and John Cunning, P.Eng.	**Date:**	11 September 2019

APPENDIX D

Kerr Wood Leidal Riprap Inspection Report

KERR WOOD LEIDAL
consulting engineers

Okanagan
202 - 3334 30th Avenue
Vernon, BC V1T 2C8
T 250 503 0841
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Technical Memorandum

DATE: December 4, 2019

TO: Patrick Lea
Teck Coal Ltd. – Fording River Operations

CC: John Cunning, P.Eng.
Golder Associates Ltd.

FROM: Jason Miller, P.Eng.

RE: **TECK COAL LIMITED – FORDING RIVER OPERATIONS**
2019 NTP/STP Riprap Inspection
Our File 8.274 – 300

Introduction

Teck Coal Ltd. – Fording River Operations (FRO) retained Kerr Wood Leidal Associates Ltd. (KWL) to complete an inspection of the riprap along the North Tailings Pond (NTP) and South Tailings Pond (STP). Jason Miller, P.Eng. of KWL is the design engineer of record for bank protection works along the NTP and STP.

The riprap inspection is a component of the Annual Dam Safety Inspection (DSI) currently being completed by Golder Associates Ltd. (Golder). Golder is the Engineer of Record (EoR) for the tailings storage facilities at FRO. This technical memorandum summarizes the findings of KWL's riprap inspection and will be appended to the Golder 2019 Annual DSI.

Background

KWL has a long history working at FRO. KWL was involved in the design and construction of the Fording River diversion to allow the construction of the STP. KWL has also provided hydrotechnical support to FRO following major flood events on the Fording River.

A severe flood on the Fording River in June 2013 caused extensive damage to FRO infrastructure, and necessitated emergency mitigation works. Post-flood works included design and construction of a new riprap revetment to protect the NTP and part of the STP. Construction of bank protection works occurred in 2013, 2014, 2016 and 2017. Upon completion, continuous bank protection works had been constructed along the Fording River channel where it flows along the toe of the NTP dam, and along about one-third of the channel where it flows along the toe of the STP dam. The existing NTP and STP riprap is designed to the 200-year return period flood[1]. FRO is continuing a parallel process to establish an appropriate Fording River design flow for long-term upgrading and operation of its tailings storage facilities.

[1] Kerr Wood Leidal Associates Ltd. 2016 Bank Protection Design for NTP/STP – Design Brief. Prepared for Teck Coal Ltd. – Fording River Operations. January 2017.

Field Inspection

A site visit was conducted on October 18, 2019 by Jason Miller, P.Eng. of KWL to assess the condition of the NTP and STP riprap bank protection works. The assessment began at the north end of the NTP and moved downstream to the STP. At the time of the inspection, the ground and riprap were snow free.

NTP Inspection

Riprap extends from upstream of the NTP to about Sta. 1+075 of the Golder NTP dam baseline as shown on Figure 1. Visual inspection of the lower riprap slope was impeded by gravel placed over the riprap during 2013 construction. The upper riprap slope placed during 2016/2017 was visible and appears to be well-interlocked. The exposed toe of the revetment was also observed and appears to be in good condition with no visual signs of scour or displacement. Riprap was visible on the entire slope in one short section approximately between Sta. 0+750 and Sta. 0+830. The exposed riprap is in good condition and appears to remain well interlocked. The slope of the exposed riprap is about 1.5H:1V.

The buried section of riprap (Sta. 0+100 to 0+200) is not visible. The ground covering the riprap was checked for signs of movement such as cracks or settlement. No visual signs of movement were observed over the length of the buried riprap.

Gravel-covered sections of the revetment were checked for signs of movement such as cracks or openings in the gravel along the slope that would indicate voids developing within the revetment or settlement of the upper riprap. No visual signs of movement were observed over the length of the revetment slope. However, there is a small 0.35 m diameter sinkhole that has formed on top of the riprap about 1.5 m from the top of the slope (approximate Sta. 0+710). The 0.3 m deep opening appears to be the result of finer material placed over the riprap as a road surface falling into the voids between the large riprap pieces. It does not appear that the riprap has degraded below the road surface at this location.

Some of the locally-supplied rock is known to weather and degrade. Degradation was observed on several rocks along the revetment with increased degradation from the 2018 riprap inspection; however, the degradation is intermittent and has not affected the overall integrity of the protection works; however, should additional rock continue to degrade, the average size (mass) of the riprap will decrease and rock interlocking may be compromised. Both of these processes can reduce the level of protection provided by the riprap. Remedial work may be required if future inspections confirm ongoing weathering and degradation. This year's inspection did not include any test holes to review rock degradation below the visible rock layer.

Previously, test holes were excavated in 2016 and 2017 during riprap upgrades and found the riprap placed in 2013 to be of good quality, but the riprap gradation was smaller than the expected gradation at the top of the test holes, possibly a result of selective placement to construct an access road on top of the revetment. In the absence of further test holes, it is reasonable to assume that degradation of the buried rock is similar to that of exposed sections.

Generally, the crest of the NTP riprap revetment is +/- 0.1 m of the design elevation; however, there are a few areas where the riprap crest is up to 0.4 m lower than the design elevation (refer to profile on record drawings in in completion report[2]). This reduces the freeboard in these areas from the design freeboard of 1.0 m to 0.6 m. A reduced freeboard means that the revetment has a reduced capacity to handle variations from the design conditions; 0.6 m freeboard is considered the minimum acceptable freeboard for many flood protection projects throughout BC. Particular attention should be paid to these areas on regular inspection. Signs of settling or

[2] Kerr Wood Leidal Associates Ltd. 2016/2017 Bank Protection for NTP/STP – Completion Report. Prepared for Teck Coal Ltd. – Fording River Operations. December 2017.

subsidence should be confirmed by survey and levels of protection should be raised if required. FRO should take advantage of future opportunities to cost-effectively raise the revetment to achieve the design freeboard (e.g., if future work is required along the river side slope of the NTP).

STP

A riprap revetment protects the STP embankment toe from Sta. 0+240 to 0+685 of the Golder STP dam baseline (refer to Figure 2). Most of the riprap slope is exposed and visible along the length of the revetment, with the exception of a 20 m length at the upstream end which is covered in finer rock (200 mm minus rock). The riprap is well interlocked with smaller riprap filling the voids of the larger riprap. The riprap slope is about 2H:1V.

The top of the riprap apron is covered in river gravel and is not visible for inspection; its condition is assumed similar to that observed along the revetment slope. The gravel-covered apron was checked for signs of movement such as cracks or openings in the gravel that would indicate voids or settlement developing within the toe apron. No signs of movement were observed. The Fording River currently flows on the opposite side of the channel for most of the length with the exception of the downstream end where the floodplain narrows to the edge of the channel. The Fording River was not flowing directly against the riprap during the inspection.

There is continued weathering (cracking and flaking) of individual riprap pieces along the entire length of the STP protection works. Currently, the degradation remains intermittent and has not affected the overall integrity of the protection works; however, should additional rock continue to degrade, the average size (mass) of the riprap will decrease and rock interlocking may be compromised. Both of these processes can reduce the level of protection provided by the riprap. Remedial work may be required if future inspections confirm ongoing weathering and degradation.

General Observations

All riprap used for NTP and STP bank protection works was salvaged from toes of spoils or sorted from spoils or hauled directly from the pit. The resistance to weathering is therefore expected to vary locally throughout both revetments. Over time, inspections may identify pockets of more resistant and/or less resistant material. More frequent monitoring should occur in areas where a significant portion of the riprap slope (i.e., more than the occasional rock) is found to be showing signs of degradation.

Teck may consider using a drone to capture the riprap embankment on an annual basis as a secondary tool for comparing the riprap condition year over year. Test pits should be completed to confirm (and if needed, remediate) the quality and integrity of buried riprap at any location where settlement, cracking, voids, or other signs of movement become visible on the surface. Each annual inspection should review the inspection history and highlight potential changes.

Summary and Recommendations

Exposed riprap along the NTP and STP is generally in good condition and is designed to provide erosion protection during the 200-year return period flood. There continues to be deterioration of some of the riprap from weathering located intermittently along the NTP and STP riprap revetments. This is also expected to be the case for buried riprap. The field assessment did not identify any evidence that raises concerns about the performance of concealed (i.e., buried or gravel-covered) riprap, and its condition is assumed to be comparable or better than that of equivalent exposed sections.

Inspections of the riprap should be completed at least annually. The riprap should continue to be monitored for weathering during these annual inspections. Teck may consider developing a flight path and obtain drone imagery of the riprap embankment on an annual basis as a secondary tool to monitor the condition of the riprap.

This would allow the imagery to be compared year over year to help identify areas that may be deteriorating faster than others.

Test pits may be required if surface deformation suggests potential problems with buried riprap. Mitigative action (e.g., riprap replacement) may be required if several rocks in close proximity to one another show evidence of degradation. Supplementary inspections should be conducted after high water events on the Fording River, which could include freshet or precipitation driven events. Any deficient sections should be repaired as soon as possible to limit further degradation and risk to the NTP or STP.

There are a few areas along the NTP riprap where the riprap is up to 0.4 m lower than the design elevation. This reduces the freeboard in these areas to 0.6 m. Particular attention should be paid to these areas on regular inspection. Signs of settling or subsidence should be confirmed by survey and levels of protection should be raised if required. Teck should seek opportunities to cost-effectively achieve the intended 1 m freeboard (e.g., by combining with an independent but adjacent construction project).

Design of the riprap erosion protection works is based on the 200-year return period flood, which is subject to numerous uncertainties. For example, the energy of the flood can significantly change channel conditions. In addition, larger floods are possible, including the breach of an upstream valley-spanning structure like the Fording River Multiplate embankment. The design and status of the NTP and STP riprap should be reviewed and revised as needed within the context of FRO's larger review of design and performance requirements for the NTP and STP tailings storage facilities.

Closure

We trust this provides a satisfactory assessment of the riprap protection along the NTP and STP. Should you have any questions, please contact the undersigned.

KERR WOOD LEIDAL ASSOCIATES LTD.

Prepared by:

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
2019-12-04
J. W. MILLER
34433

Jason Miller, P.Eng.
Water Resources Engineer

Reviewed by:

David Roche, M.A.Sc., P.Eng.
Senior Water Resources Engineer

/jm

Encl.: Photos, Figure 1, Figure 2

Statement of Limitations

Copyright Notice

Revision History

Revision #	Date	Status	Revision Description	Author
0	December 4, 2019	Original		JM

Photos

Photo 1: Looking upstream along alignment of NTP riprap that is buried (approx. Sta. 0+100)

Photo 2: Looking downstream at NTP riprap covered by gravel (approx. Sta. 0+180)

Photo 3: Looking downstream at NTP riprap (approx. Sta. 0+450)

Photo 4: Small sinkhole about 1.5 m from top of bank on running surface of riprap along the NTP riprap (approx. Sta. 0+710)

Photo 5: Looking downstream at NTP riprap (approx. Sta. 0+860)

Photo 6: Riprap degradation due to weathering on a surface of a piece of riprap (approx. Sta. 0+900)

Photo 7: Looking downstream at STP riprap (approx. Sta. 0+275)

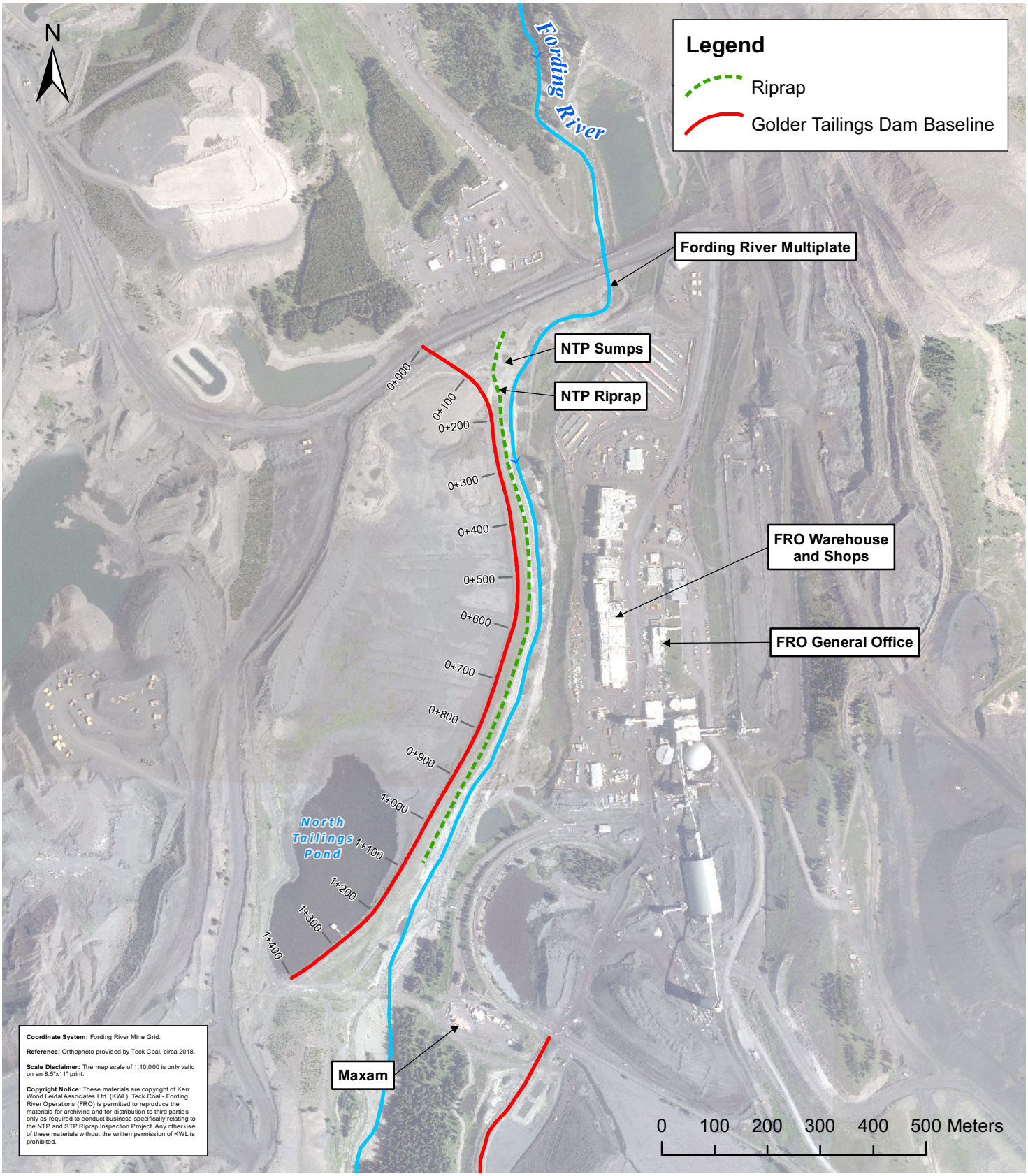
Photo 8: Looking downstream at STP riprap (approx. Sta. 0+330)

		
Photo 9: Looking upstream at STP riprap (approx. Sta. 0+580)		Photo 10: Riprap degradation due to weathering on several pieces of riprap
		
Photo 11: Looking upstream at STP riprap (approx. Sta. 0+670)		Photo 12: STP riprap tie-in to pipe bridge abutment (approx. Sta. 0+685)

Teck Coal - Fording River Operations (FRO)

NTP and STP Riprap Inspection

KERR WOOD LEIDAL consulting engineers



Coordinate System: Fording River Mine Grid.

Reference: Orthophoto provided by Teck Coal, circa 2018.

Scale Disclaimer: The map scale of 1:10,000 is only valid on an 8.5"x11" print.

Project No.	8-274
Date	November 2019
Scale	1:10,000

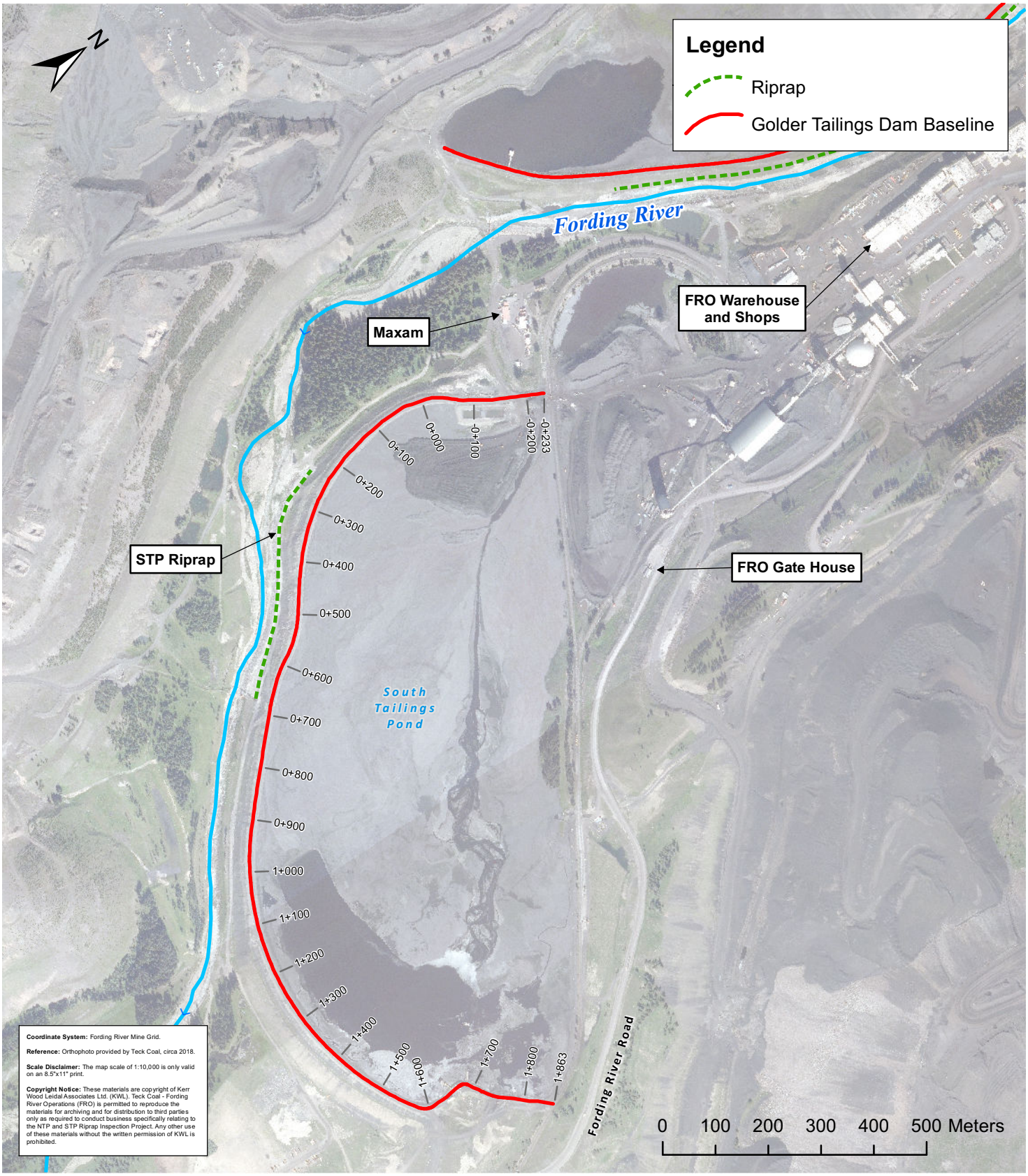
North Tailings Pond

Figure 1

Teck Coal - Fording River Operations (FRO)

NTP and STP Riprap Inspection

KERR WOOD LEIDAL consulting engineers



Coordinate System: Fording River Mine Grid.

Reference: Orthophoto provided by Teck Coal, circa 2018.

Scale Disclaimer: The map scale of 1:10,000 is only valid on an 8.5"x11" print.

Project No.	8-274
Date	November 2019
Scale	1:10,000

South Tailings Pond

Figure 2

APPENDIX E

Summary of FRO Dam Inspection Action Items

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: ~~H. Brickner~~ Ross Rosengrave

Inspection Date: Sept. 7/2018

Weather & Temperature: Sunny, 18°

reviewed: H. Brickner

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	No issues		

Fording River Operations

Monthly Tailings Dam Inspection Form

Teck

Inspected By: H. Brickner

Inspection Date: Sept. 11/12/13, 2018

Weather & Temperature: as noted for each dam/facility

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	no issues		

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: H. Brickner

Inspection Date: Sept. 21/2018

Weather & Temperature: cloudy/rain, 7°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	no issues.		

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: H. Brickner

Inspection Date: Sept. 26/2018

Weather & Temperature: cloudy 10°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	no issues.		

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: H. Brickner

Inspection Date: Oct. 5/18

Weather & Temperature: 3°C, cloudy

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	no issues		

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: H. Brickner

Inspection Date: Oct. 11/2018

Weather & Temperature: sunny 4°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	no issues.		

Monthly Tailings Dam Inspection Form

Teck

Inspected By: H. Brickner

Inspection Date: Oct 19/2018

Weather & Temperature: sunny, 3°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	no concerns.		

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: Ross Rosingrave

Inspection Date: Oct 25th 2018

Weather & Temperature: Sunny, 11°C

reviewed: H.Brickner

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
1)	Erosion rill created by water. Minor with No structural consequence to the dam	4	
2)	same as location (1).	4	

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: H. Brickner

Inspection Date: November 1/2018

Weather & Temperature: cloudy 4°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	no issues		

Monthly Tailings Dam Inspection Form

Teck

Inspected By: H. Brickner

Inspection Date: November 28, 2018

Weather & Temperature: cloudy, 0°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	no issues.		

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: H. Brickner

Inspection Date: December 14/2018

Weather & Temperature: 1°C, cloudy

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	no issues.		

Inspected By: H. Brickner
Inspection Date: December 17 / 19, 2018
Weather & Temperature: cloudy 2°C / mostly sunny 2°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	no issues		

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: H. Brickner

Inspection Date: Jan. 11 | 2019

Weather & Temperature: overcast 0°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	no issues.		

Monthly Tailings Dam Inspection Form

Teck

Inspected By: H. Brickner

Inspection Date: Feb. 5/2019

Weather & Temperature: sunny, -10°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	no concerns.		

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: H. Brickner / R. Roseingrave

Inspection Date: Feb. 22/2019

Weather & Temperature: partly cloudy, -15°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
STP Main Dam upstream slope	Erosion from vac truck off-loading, requires repair	3	Q2 2019
STP main Dam, d/s slope	Monitor erosion gully during inspections, repair if required.	4	all inspections.

Inspected By: Ross Rosenegrave
Inspection Date: March 1, 2019
Weather & Temperature: -14°C, Snowing, approx 15cm of fresh snow

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location		Item Description & Responsibility	Priority	Target Completion Date
	No Concerns			

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: R. Roseingrave / N. Carrière

Inspection Date: 13 March 2019

Weather & Temperature: Cloudy, 0°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
STP Main Dam, ds slope	Monitor erosion gullies during inspections, repair if required	4	All inspections
STP Main Dam, piezo SP-5	High water level reading, plug after thaw	3	Q2 2019

Monthly Tailings Dam Inspection Form

Teck

Inspected By: R. Roseingrave/N. Carrière / J. Hindmarsh

Inspection Date: 21 March 2019 & 22 March 2019

Weather & Temperature: 6°C - 12°C, sunny

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: Natasha Carrière

Inspection Date: 2 April 2019

Weather & Temperature: Sunny with clouds, -2° C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
STP d/s Slope	Monitor erosion gully during inspections, repair if required	4	all inspections

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: Natasha Carriere

Inspection Date: 18 April 2019

Weather & Temperature: 4°C, cloudy

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
STP dls slope	Monitor erosion gullies during all inspections; repair if required	4	All inspections

Inspected By: R. Roseingrave / N. Carriere / R. McCutcheon
Inspection Date: 25 April 2019
Weather & Temperature: 2°C Sunny with clouds

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
NTP South West crest and ramp	Small leaks in Shandley water return line contacted pump crew to repair as best practice (not a stability/environment concern)	4	May 2019

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: N. Carrière

Inspection Date: 1 May 2019

Weather & Temperature: 1°C, snowing

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
MD and WD downstream slope	Erosion gullies to be monitored during all inspections; repair if required	4	all inspections

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: Clara Lee

Inspection Date: May 7, 2019 at 2:30pm

Weather & Temperature: Cloudy, 10°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: N. Carriere

Inspection Date: 17 May 2019

Weather & Temperature: 4°C Cloudy

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
Downstream slope	Continue to monitor erosion gullies	4	All inspections

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: Natasha Carrière

Inspection Date: 22 May 2019

Weather & Temperature: 8°C Sunny with clouds

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
Downstream Slope	Continue to monitor erosion gullies on downstream slope on main and west dams	4	All inspections at STP

Fording River Operations

Monthly Tailings Dam Inspection Form

Teck

Inspected By: Natasha Carrière

Inspection Date: 28 May 2019

Weather & Temperature: 18°C, Sunny

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
STP Main Dam toe	Ground Squirrels & their burrows observed. Receive permit to trap & re locate	4	Q3 2019

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: Clara Lee

Inspection Date: June 3, 2019

Weather & Temperature: 20°C, sunny

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	None		

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: Natasha Carriere

Inspection Date: June 12/2019

Weather & Temperature: 12°C Sunny

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
STP MD 2 WD downstream slope	Continued monitoring of erosion gullies Repair if needed	4	all inspection

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: Natasha Camere

Inspection Date: June 20/2019

Weather & Temperature: 4°C Rainy

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
STP north tailings discharge	Tailings/Water Ponding at North discharge. Follow TARP and lower ponding levels	2	Ongoing to Q3 2019

Fording River Operations

Monthly Tailings Dam Inspection Form

Teck

Inspected By: Natasha Carriere

Inspection Date: June 26/2019

Weather & Temperature: Sunny with clouds, 7°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
North Tailings Discharge Area STP	Tailings/Water Ponding at North discharge. Follow TARP and lower ponding levels	2	Ongoing to Q3 2019

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: Natasha Carriere / R. McCutcheon / P. Lea

Inspection Date: July 3/2019

Weather & Temperature: 9°C Sunny with Clouds

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
North Tailings Discharge	Tailings Water ponding at North discharge. follow TARP and lower ponding levels. Long arm excavator on site & operating	2	Ongoing to Q3 2019

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: Patrick Lea / Clara Lee

Inspection Date: 9 - July - 2019

Weather & Temperature: Overcast w/Sunny Breaks 20°c

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
South Abutment	Animal Activity: South Abutment on up stream slope, approx. 3 burrows note, Ground Squirrels in the area. Ground squirrels need to be relocated, investigate back filling burrows	3	August 2019

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: PATRICK LEA / Natasha Carriere

Inspection Date: 16 July 2019

Weather & Temperature: Overcast, + 18°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
STP MD & WD downstream slope	Continue to monitor Erosion gullies, repair if required.	4	ongoing.

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: Natasha Carriere

Inspection Date: July 25/2019

Weather & Temperature: Sunny with clouds, +10°C

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
MD & WD downstream slope	Continue to monitor erosion gullies repair if required	4	Ongoing

Inspected By: PATRICK LEA / NATASHA CARRIERE

Inspection Date: 29 - July - 2019

Weather & Temperature: 15 — 25 °C Sunny

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	n/a		

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: PATRICK LEA / NATASHA CARRIERE

Inspection Date: 7 August 2019

Weather & Temperature: 20°C Sunny, no wind,

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
MD & WD Downstream slope	Continue to monitor erosion gullies, repair as required	4	ongoing

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: PATRICK LEA / CLARA LEE

Inspection Date: 13 August 2019

Weather & Temperature: 20°C, sunny

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
MD & WD Downstream slope	Continue to monitor erosion Gullies repair as required	4	ongoing.

Fording River Operations

STP Dam Inspection Form

Weekly Inspections from May – October, Inspections twice per month from November – April

Teck

Inspected By: PATRICK LEA / NATASHA CARRIERE

Inspection Date: 21 August 2019

Weather & Temperature: 15 - 20°C, Sunny

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
MD & WD Downstream slope	Continue to monitor erosion gullies, repair as required	4	Ongoing

Monthly Tailings Dam Inspection Form

Teck

Inspected By: PATRICK LEA/ NATASHA CARRIERE

Inspection Date: 28 August 2019

Weather & Temperature: 23°c, Sunny

ACTION ITEMS

Record any items of concern noted during the inspection; location of each action item shall be marked on the attached facility maps. If required, additional items can be included in the "Additional Comments" section.

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

Location	Item Description & Responsibility	Priority	Target Completion Date
	N/A		

APPENDIX F

FRO Water Quality Data

FRO Water Quality Data
STP North Seep

		Location	FR_STPNSEEP	FR_STPNSEEP
		Date	2018-06-19	2018-10-23
		Sample Type	NP	NP
Fraction	**Analyte**	**Unit**	**Result**	**Result**
D	Aluminum	mg/l	< 0.0010	< 0.0010
D	Antimony	ug/l	0.16	0.18
D	Arsenic	ug/l	< 0.10	< 0.10
D	Barium	mg/l	0.0726	0.119
D	Beryllium	ug/l	< 0.020	< 0.020
D	Bismuth	mg/l	< 0.000050	< 0.000050
D	Boron	mg/l	0.014	0.016
D	Bromide	mg/l	0.067	< 0.25
D	Cadmium	ug/l	0.111	0.0908
D	Carbon, Dissolved Organic	mg/l	0.74	1.10
D	Chloride	mg/l	8.55	12.8
D	Chromium	ug/l	0.10	0.10
D	Cobalt	ug/l	0.33	0.71
D	Copper	ug/l	0.20	< 0.20
D	Fluoride	mg/l	0.221	0.20
D	Iron	mg/l	< 0.010	< 0.010
D	Lead	ug/l	< 0.050	< 0.050
D	Lithium	mg/l	0.0296	0.0318
D	Manganese	mg/l	0.00216	0.00097
D	Mercury	ug/l	< 0.0050	< 0.0050
D	Molybdenum	mg/l	0.00119	0.000976
D	Nickel	ug/l	0.80	1.45
D	Selenium	ug/l	16.2	32.4
D	Silver	ug/l	< 0.010	< 0.010
D	Strontium	mg/l	0.144	0.227
D	Sulphate (AS SO4)	mg/l	148	278
D	Thallium	ug/l	< 0.010	< 0.010
D	Tin	mg/l	< 0.00010	< 0.00010
D	Titanium	ug/l	< 10	< 10
D	Uranium	ug/l	1.81	2.21
D	Vanadium	ug/l	< 0.50	< 0.50
D	Zinc	ug/l	1.4	1.4
N	Alkalinity, Total (As CaCO3)	mg/l	197	220
N	Conductivity, Field	us/cm	555.2	823
N	Conductivity, Lab	us/cm	649	924
N	Dissolved Oxygen, Field	mg/l	8.12	8.48
N	Hardness, Total or Dissolved CaCO3	mg/l	358	467
N	Nitrate Nitrogen (NO3), AS N	mg/l	4.32	8.27
N	Nitrite Nitrogen (NO2), AS N	mg/l	0.0011	< 0.0050
N	Nitrogen, Ammonia (AS N)	mg/l	0.0105	0.0145
N	Ortho-Phosphate	mg/l	0.0021	0.0018
N	pH, Field	ph units	7.47	7.64
N	pH, LAB	ph units	8.26	8.39
N	Phosphorus	mg/l	< 0.0010	0.0024
N	Temperature, Field	deg c	6.5	8.7
N	Total Dissolved Solids (Residue, Filterable)	mg/l	491	650
N	Total Kjeldahl Nitrogen	mg/l	0.218	0.196
N	Total Suspended Solids, Lab	mg/l	1.2	< 1.0
N	TurbidityLab	ntu	0.13	0.22
T	Aluminum	mg/l	0.0048	< 0.0030
T	Antimony	ug/l	0.15	0.18
T	Arsenic	ug/l	0.13	0.12
T	Barium	mg/l	0.0705	0.120
T	Beryllium	ug/l	< 0.020	< 0.020
T	Bismuth	mg/l	< 0.000050	< 0.000050
T	Boron	mg/l	0.014	0.018
T	Cadmium	ug/l	0.113	0.0837
T	Calcium	mg/l	88.1	133
T	Chromium	ug/l	0.21	0.19
T	Cobalt	ug/l	0.33	0.76
T	Copper	ug/l	< 0.50	< 0.50
T	Iron	mg/l	< 0.010	< 0.010
T	Lead	ug/l	0.173	< 0.050
T	Lithium	mg/l	0.0303	0.0412
T	Magnesium	mg/l	31.2	43.1
T	Manganese	mg/l	0.00338	0.00130
T	Mercury	ug/l	< 0.0050	< 0.00050
T	Molybdenum	mg/l	0.00119	0.00113
T	Nickel	ug/l	0.87	1.50
T	Potassium	mg/l	1.61	2.29
T	Selenium	ug/l	13.5	26.6
T	Silver	ug/l	< 0.010	< 0.010
T	Sodium	mg/l	3.77	4.81
T	Strontium	mg/l	0.143	0.256
T	Thallium	ug/l	< 0.010	< 0.010
T	Tin	mg/l	< 0.00010	< 0.00010
T	Titanium	ug/l	< 10	< 10
T	Total Organic Carbon	mg/l	0.70	1.02
T	Uranium	ug/l	1.92	2.49
T	Vanadium	ug/l	< 0.50	< 0.50
T	Zinc	ug/l	< 3.0	< 3.0

FRO Water Quality Data
STP North Seep

		Location	FR_STPSWSEEP	FR_STPSWSEEP	FR_STPSWSEEP
		Date	2018-06-19	2018-10-23	2018-12-18
		Sample Type	NP	NP	NP
Fraction	**Analyte**	**Unit**	**Result**	**Result**	**Result**
D	Aluminum	mg/l	< 0.0010	0.0012	< 0.0010
D	Antimony	ug/l	< 0.10	< 0.10	< 0.10
D	Arsenic	ug/l	< 0.10	< 0.10	< 0.10
D	Barium	mg/l	0.0823	0.0716	0.0761
D	Beryllium	ug/l	< 0.020	< 0.020	< 0.020
D	Bismuth	mg/l	< 0.000050	< 0.000050	< 0.000050
D	Boron	mg/l	0.038	0.030	0.031
D	Bromide	mg/l	< 0.050	< 0.25	< 0.25
D	Cadmium	ug/l	0.356	0.340	0.365
D	Carbon, Dissolved O	mg/l	0.85	1.27	0.92
D	Chloride	mg/l	7.03	7.1	6.2
D	Chromium	ug/l	< 0.10	< 0.10	< 0.10
D	Cobalt	ug/l	1.05	0.97	0.94
D	Copper	ug/l	< 0.20	< 0.20	< 0.20
D	Fluoride	mg/l	0.340	0.34	0.31
D	Iron	mg/l	< 0.010	< 0.010	0.011
D	Lead	ug/l	< 0.050	< 0.050	< 0.050
D	Lithium	mg/l	0.109	0.0831	0.0968
D	Manganese	mg/l	0.432	0.326	0.553
D	Mercury	ug/l	< 0.0050	< 0.0050	< 0.0050
D	Molybdenum	mg/l	0.00222	0.00185	0.00205
D	Nickel	ug/l	5.39	4.66	5.71
D	Selenium	ug/l	0.056	< 0.050	0.07
D	Silver	ug/l	< 0.010	< 0.010	< 0.010
D	Strontium	mg/l	0.238	0.227	0.216
D	Sulphate (AS SO4)	mg/l	367	350	329
D	Thallium	ug/l	0.039	0.018	0.022
D	Tin	mg/l	< 0.00010	< 0.00010	< 0.00010
D	Titanium	ug/l	< 10	< 10	< 10
D	Uranium	ug/l	5.83	5.84	5.59
D	Vanadium	ug/l	< 0.50	< 0.50	< 0.50
D	Zinc	ug/l	2.3	2.3	3.0
N	Alkalinity, Total (As	mg/l	328	338	334
N	Conductivity, Field	us/cm	1107	1016	1134
N	Conductivity, Lab	us/cm	1150	1110	1100
N	Dissolved Oxygen, F	mg/l	6.45	7.16	8.78
N	Hardness, Total or D	mg/l	709	636	666
N	Nitrate Nitrogen (NO	mg/l	0.0135	< 0.025	< 0.025
N	Nitrite Nitrogen (NO	mg/l	< 0.0010	< 0.0050	< 0.0050
N	Nitrogen, Ammonia	mg/l	0.0092	0.0166	0.0164
N	Ortho-Phosphate	mg/l	< 0.0010	0.0017	0.0218
N	pH, Field	ph units	7.43	7.52	7.56
N	pH, LAB	ph units	8.28	8.32	8.27
N	Phosphorus	mg/l	< 0.0010	< 0.0020	0.0040
N	Temperature, Field	deg c	16.6	8.4	5.087
N	Total Dissolved Solic	mg/l	904	833	810
N	Total Kjeldahl Nitrog	mg/l	0.057	0.173	0.090
N	Total Suspended Sol	mg/l	8.4	< 1.0	2.9
N	TurbidityLab	ntu	0.35	0.23	1.85
T	Aluminum	mg/l	< 0.0030	< 0.0030	0.0045
T	Antimony	ug/l	< 0.10	< 0.10	0.12
T	Arsenic	ug/l	0.12	0.13	0.16
T	Barium	mg/l	0.0829	0.0739	0.0773
T	Beryllium	ug/l	< 0.020	< 0.020	< 0.020
T	Bismuth	mg/l	< 0.000050	< 0.000050	< 0.000050
T	Boron	mg/l	0.041	0.032	0.036
T	Cadmium	ug/l	0.444	0.329	0.506
T	Calcium	mg/l	144	136	154
T	Chromium	ug/l	< 0.10	< 0.10	< 0.10
T	Cobalt	ug/l	1.03	1.01	1.01
T	Copper	ug/l	< 0.50	< 0.50	< 0.50
T	Iron	mg/l	0.020	0.015	0.047
T	Lead	ug/l	< 0.050	< 0.050	< 0.050
T	Lithium	mg/l	0.112	0.0983	0.115
T	Magnesium	mg/l	81.7	76.3	84.5
T	Manganese	mg/l	0.427	0.320	0.713
T	Mercury	ug/l	< 0.0050	< 0.00050	
T	Molybdenum	mg/l	0.00230	0.00200	0.00262
T	Nickel	ug/l	5.39	4.78	6.25
T	Potassium	mg/l	5.93	6.34	5.90
T	Selenium	ug/l	0.052	0.051	0.056
T	Silver	ug/l	< 0.010	< 0.010	< 0.010
T	Sodium	mg/l	6.81	6.43	7.40
T	Strontium	mg/l	0.238	0.236	0.247
T	Thallium	ug/l	0.036	0.017	0.035
T	Tin	mg/l	< 0.00010	< 0.00010	< 0.00010
T	Titanium	ug/l	< 10	< 10	< 10
T	Total Organic Carbo	mg/l	0.80	1.30	1.13
T	Uranium	ug/l	6.01	6.34	6.37
T	Vanadium	ug/l	< 0.50	< 0.50	< 0.50
T	Zinc	ug/l	< 3.0	< 3.0	< 3.0

Appendix F
FRO Water Quality Data
STP North Seep

		Location	FR_STPWSEEP	FR_STPWSEEP	FR_STPWSEEP
		Date	2018-06-19	2018-10-23	2018-12-18
		Sample Type	NP	NP	NP
Fraction	**Analyte**	**Unit**	**Result**	**Result**	**Result**
D	Aluminum	mg/l	< 0.0010	< 0.0010	< 0.0010
D	Antimony	ug/l	< 0.10	< 0.10	< 0.10
D	Arsenic	ug/l	< 0.10	< 0.10	< 0.10
D	Barium	mg/l	0.0991	0.106	0.0999
D	Beryllium	ug/l	< 0.020	< 0.020	< 0.020
D	Bismuth	mg/l	< 0.000050	< 0.000050	< 0.000050
D	Boron	mg/l	0.033	0.032	0.032
D	Bromide	mg/l	< 0.050	< 0.25	< 0.25
D	Cadmium	ug/l	0.756	0.775	0.723
D	Carbon, Dissolved O	mg/l	0.69	1.59	0.91
D	Chloride	mg/l	5.84	5.8	5.2
D	Chromium	ug/l	< 0.10	< 0.10	< 0.10
D	Cobalt	ug/l	1.41	1.64	1.11
D	Copper	ug/l	< 0.20	< 0.20	< 0.20
D	Fluoride	mg/l	0.404	0.41	0.39
D	Iron	mg/l	< 0.010	< 0.010	< 0.010
D	Lead	ug/l	< 0.050	< 0.050	< 0.050
D	Lithium	mg/l	0.108	0.0902	0.103
D	Manganese	mg/l	0.485	1.03	0.153
D	Mercury	ug/l	0.0150	< 0.0050	< 0.0050
D	Molybdenum	mg/l	0.00250	0.00305	0.00259
D	Nickel	ug/l	5.50	6.68	4.54
D	Selenium	ug/l	0.129	0.082	0.138
D	Silver	ug/l	< 0.010	< 0.010	< 0.010
D	Strontium	mg/l	0.228	0.225	0.220
D	Sulphate (AS SO4)	mg/l	323	300	294
D	Thallium	ug/l	0.034	0.061	0.027
D	Tin	mg/l	< 0.00010	< 0.00010	< 0.00010
D	Titanium	ug/l	< 10	< 10	< 10
D	Uranium	ug/l	7.29	7.21	7.15
D	Vanadium	ug/l	< 0.50	< 0.50	< 0.50
D	Zinc	ug/l	2.0	2.6	2.2
N	Alkalinity, Total (As	mg/l	369	368	353
N	Conductivity, Field	us/cm	1083	975	1091
N	Conductivity, Lab	us/cm	1150	1080	1070
N	Dissolved Oxygen, F	mg/l	6.9	1.01	10.3
N	Hardness, Total or D	mg/l	699	625	668
N	Nitrate Nitrogen (NO	mg/l	0.0148	< 0.025	< 0.025
N	Nitrite Nitrogen (NO	mg/l	< 0.0010	< 0.0050	< 0.0050
N	Nitrogen, Ammonia	mg/l	0.0116	0.0342	0.0136
N	Ortho-Phosphate	mg/l	< 0.0010	0.0022	0.0213
N	pH, Field	ph units	7.43	7.24	7.93
N	pH, LAB	ph units	8.32	8.30	8.27
N	Phosphorus	mg/l	< 0.0010	< 0.0020	0.0021
N	Temperature, Field	deg c	9.9	9.1	6.786
N	Total Dissolved Solic	mg/l	866	750	766
N	Total Kjeldahl Nitrog	mg/l	< 0.050	0.393	< 0.050
N	Total Suspended Sol	mg/l	< 1.0	2.1	1.7
N	TurbidityLab	ntu	0.12	0.26	0.85
T	Aluminum	mg/l	< 0.0030	0.0033	< 0.0030
T	Antimony	ug/l	< 0.10	< 0.10	< 0.10
T	Arsenic	ug/l	< 0.10	0.15	0.13
T	Barium	mg/l	0.0984	0.111	0.0928
T	Beryllium	ug/l	< 0.020	< 0.020	< 0.020
T	Bismuth	mg/l	< 0.000050	< 0.000050	< 0.000050
T	Boron	mg/l	0.034	0.032	0.034
T	Cadmium	ug/l	0.768	0.790	0.701
T	Calcium	mg/l	139	127	149
T	Chromium	ug/l	0.12	< 0.10	< 0.10
T	Cobalt	ug/l	1.35	1.75	1.24
T	Copper	ug/l	< 0.50	< 0.50	< 0.50
T	Iron	mg/l	< 0.010	0.033	< 0.010
T	Lead	ug/l	< 0.050	< 0.050	< 0.050
T	Lithium	mg/l	0.107	0.0963	0.112
T	Magnesium	mg/l	78.9	73.0	83.0
T	Manganese	mg/l	0.501	1.12	0.250
T	Mercury	ug/l	< 0.0050	< 0.00050	
T	Molybdenum	mg/l	0.00263	0.00291	0.00301
T	Nickel	ug/l	5.47	7.19	4.81
T	Potassium	mg/l	5.78	6.41	5.79
T	Selenium	ug/l	0.093	0.085	0.081
T	Silver	ug/l	< 0.010	< 0.010	< 0.010
T	Sodium	mg/l	6.02	6.06	7.39
T	Strontium	mg/l	0.224	0.224	0.241
T	Thallium	ug/l	0.034	0.051	0.027
T	Tin	mg/l	< 0.00010	< 0.00010	< 0.00010
T	Titanium	ug/l	< 10	< 10	< 10
T	Total Organic Carbo	mg/l	0.70	1.32	1.04
T	Uranium	ug/l	7.42	7.53	7.53
T	Vanadium	ug/l	< 0.50	< 0.50	< 0.50
T	Zinc	ug/l	< 3.0	< 3.0	3.1

APPENDIX G

Tailings Storage Facility Registry

Mine Name: Fording River Operations
Permit No: No. C-3 (and amendments)

General Mine Information	
Owner/company	Teck Resources Ltd.
Nearest community	Elkford
Region	Elk Valley / East Kootenay
Ore(s) mined	Coal
Mine operational status	Operational
Number of tailings impoundments	4

TSF Documentation	
Date of last DSI	10 to 12 September 2019
Date of last DSR	September 2019 (site visit)
Date of next DSR	2024
Date of OMS update	February 2020
Date of EPRP update	May 2019, in draft
Date of EPRP test	26 November 2019
Date of dam breach and inundation study	28 November 2014
Tailings Management system (name)	FRO Tailings Management System
Tailings management system (last audit)	Legal compliance audit June 2019
TSF risk assessment last reviewed	November 2017
Water balance and water management plan (last update)	2018 (new update end of 2020)
Date of last as-built	2012 & 2013

TSF Information	
TSF name	**South Tailings Pond**
TSF operating status	Active, in use
Year facility was last used (if closed)	Currently in use
Number of dams	2
Engineer of record	John Cunning (Golder Associates Ltd.)
TSF qualified person	Adam Langer
Spillway present	No, spillway construction scheduled for 2020
Spillway date of last maintenance	n/a
Quantitative Performance Objectives (QPOs)	Yes
Volume of impoundment	12.1 million m^3

Dam Information	
Dam name	**Main Dam**
Height of dam	35 m
Consequence classification	Very High
Slope	1.5 to 1.75H : 1V
minimum factor of safety (long term steady state)	1.5
minimum factor of safety (pseudo-static)	1.2
Permitted elevation	1,637.85 m
Current elevation	1,637.85 m
Seismic design (AEP)	1/2 between 1/2,475 and 1/10,000 or Maximum Credible Earthquake
Flood design (AEP)	2/3 between 1/1,000 and PMF event
Type of dam construction (upstream, downstream, centre)	downstream
Type of dam core (till core, rock fill, cyclone sand, etc.)	till core

Dam Information	
Dam name	**West Dam**
Height of dam	24 m
Consequence classification	Very High
Slope	1.5 to 1.75H : 1V
minimum factor of safety (long term steady state)	1.6
minimum factor of safety (pseudo-static)	1.0
Permitted elevation	1,637.85 m to 1640 m
Current elevation	1,637.85 m to 1640 m
Seismic design (AEP)	1/2 between 1/2,475 and 1/10,000 or Maximum Credible Earthquake
Flood design (AEP)	2/3 between 1/1,000 and PMF event
Type of dam construction (upstream, downstream, centre)	downstream
Type of dam core (till core, rock fill, cyclone sand, etc.)	till core

TSF Information	
TSF name	**North Tailings Pond**
TSF operating status	Inactive
Year facility was last used (if closed)	2006
Number of dams	1
Engineer of record	John Cunning (Golder Associates Ltd.)
TSF qualified person	Adam Langer
Spillway present	no
Spillway date of last maintenance	n/a
Quantitative Performance Objectives (QPOs)	yes
Volume of impoundment	3.8 million m^3

Dam Information	
Dam name	**North Tailings Pond Dam**
Height of dam	24 m
Consequence classification	Very High
Slope	1.5 to 1.75H : 1V
minimum factor of safety (long term steady state)	1.5
minimum factor of safety (pseudo-static)	1.2
Permitted elevation	1653.09 m
Current elevation	1,652.6 m
Seismic design (AEP)	1/2 between 1/2,475 and 1/10,000 or Maximum Credible Earthquake
Flood design (AEP)	2/3 between 1/1,000 and PMF event
Type of dam construction (upstream, downstream, centre)	downstream
Type of dam core (till core, rock fill, cyclone sand, etc.)	till core

Notes: Elevations reported in the Elk Valley Elevation Datum.

Sources: 2019 Dam Safety Inspection for South Tailings Pond and North Tailings Pond (Golder, March 2020)
C-3 Permit Amendments

General Mine Information	
Owner/company	
Nearest community	name of closest community
Region	mining region name - Southcoast, Northwest, Northeast, Kootenays, Okanagan
Ore(s) mined	
Mine operational status	Operating, Closed or Care and Maintenance
Number of tailings impoundments	

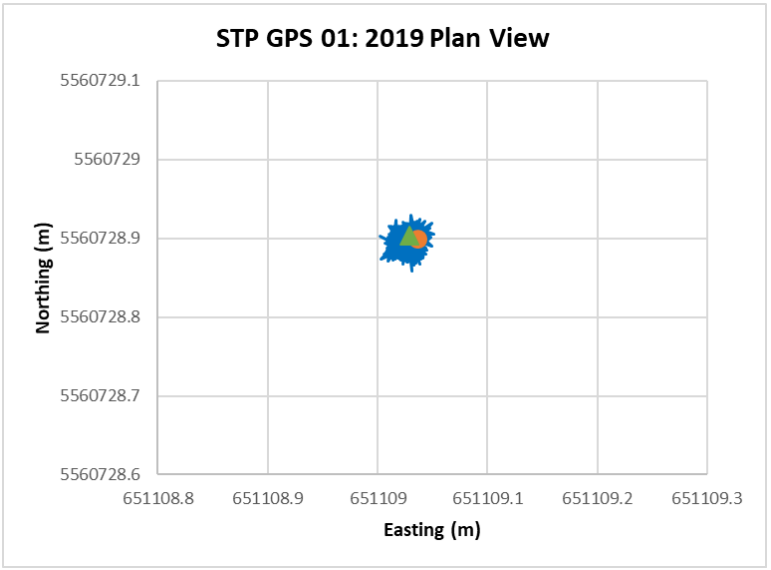
TSF Documentation	
Date of last DSI	dd/mm/yyyy of last inspection performed
Date of last DSR	dd/mm/yyyy of last inspection performed
Date of next DSR	yyyy of next DSR. NOTE DSRs now due every 5 years as per Code requirements
Date of OMS update	dd/mm/yyyy when OMS last updated
Date of EPRP update	dd/mm/yyyy when EPRP last updated
Date of EPRP test	dd/mm/yyyy when last EPRP test
Date of dam breach and inundation study	dd/mm/yyyy
Tailings management system (name)	name of system used (TSM, ISO, etc)
Tailings management system (last audit)	when last audit completed
TSF risk assessment last reviewed	dd/mm/yyyy when last risk assessment completed
Water balance and water management plan (last update)	dd/mm/yyyy last update
Date of last as-built	dd/mm/yyyy when as-built completed for TSF

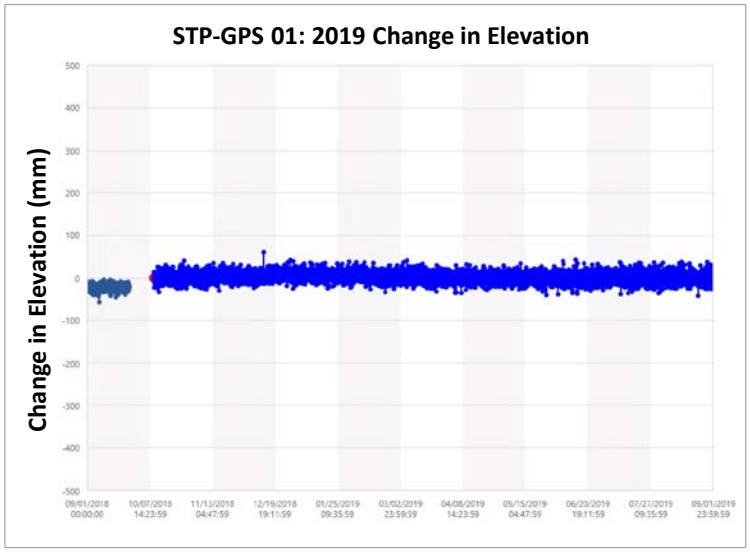
TSF Information	
TSF name	name of TSF please fill in one box per TSF on site
TSF operating status	current status of TSF - operating or closed. If intention is to use facility in future, please include projected date of re-start
Year facility was last used (if closed)	yyyy that TSF last received tailings
Number of dams	provide number of dams associated with the TSF
Engineer of record	name of Engineer of Record for the TSF
TSF qualified person	name of TSF qualified person
Spillway present	yes or no
Spillway date of last maintenance	dd/mm/yyyy of last maintenance
Quantitative Performance Objectives (QPOs)	yes or no (included in OMS manual and DSI)
Volume of impoundment	volume of impoundment in cubic meters

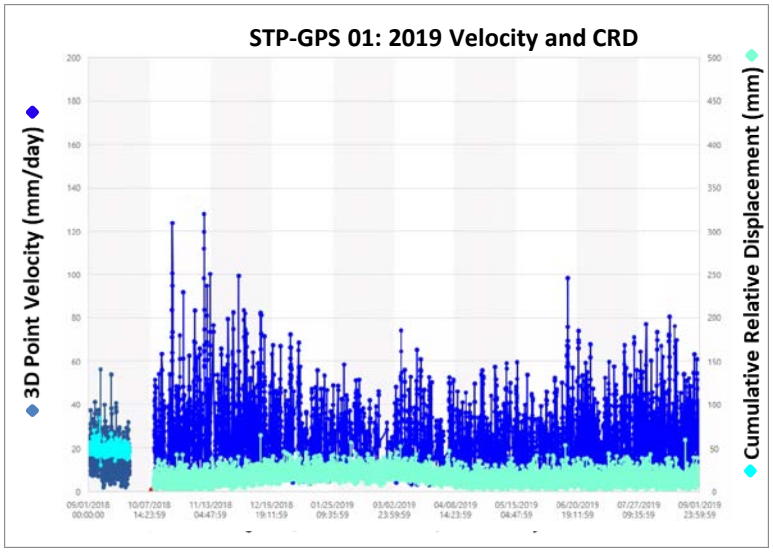
Dam Information	
Dam name	provide dam name if applicable - please fill in one box per dam on mine site
Height of dam	current height of dam in m (measured toe of slope to crest of dam)
Consequence classification	consequence classification of the dam
Slope	Maximum slope angle (ex. 2H:1V)
minimum factor of safety (long-term steady state)	Minimum FOS (long term steady state analyses)
minimum factor of safety (pseudo-static)	Minimum FOS (pseudo-static analyses)
Permitted elevation	provide highest permitted elevation of the dam in m
Current elevation	provide current elevation of the dam in m
Seismic design (AEP)	Annual Exceedance Probability (Seismic design)
Flood design (AEP)	Annual Exceedance Probability (Flood design)
Type of dam construction (upstream, downstream, centre)	upstream, downstream or centre
Type of dam core (till core, rock fill, cyclone sand, etc.)	till core, rock fill, cyclone same or other

APPENDIX H

GPS Plots







LEGEND

- INITIAL READING (SEPTEMBER 2018)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

NOTES

1. DATA DOWNLOADED FROM GEOEXPLORER IN SEPTEMBER 2019.
2. THIS GPS UNIT WAS REPLACED AND THE BASE STATION SWITCHED IN OCTOBER 2018. CHANGE IN ELEVATION VS. TIME IS PLOTTED FOR COMPARISON WITH DATA OF OLD GPS, WHICH REFERENCED A DIFFERENT BASE STATION.

CLIENT
TECK COAL LIMITED
FORDING RIVER OPERATIONS
ELKFORD, B.C.

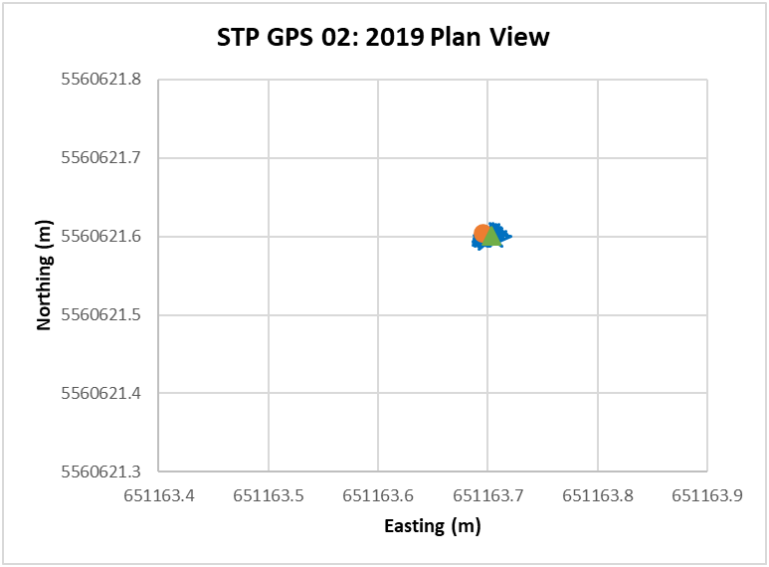
CONSULTANT
GOLDER

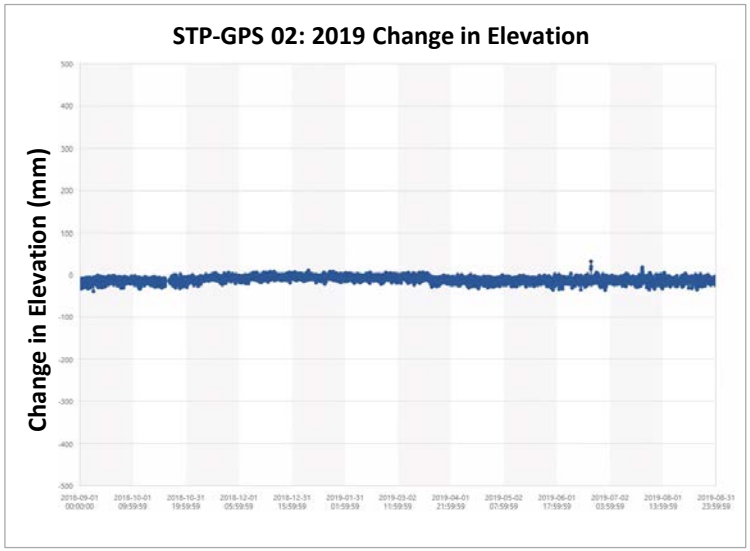
YYYY-MM-DD	2020-03-04
PREPARED	TF / NEC
DESIGN	TF / NEC
REVIEW	CYL
APPROVED	JCC

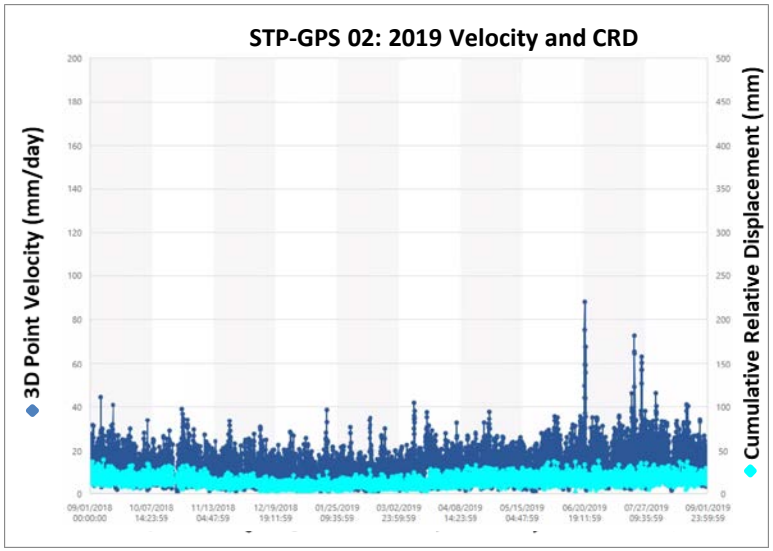
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND - GPS MONITORING DATA AT STP-GPS 01

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-1**







LEGEND

- INITIAL READING (SEPTEMBER 2018)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

NOTES

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ELKFORD, B.C.

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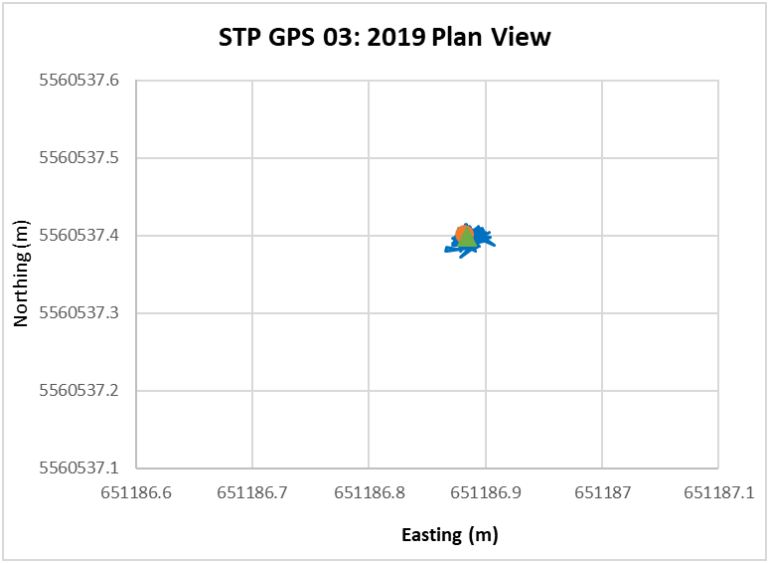
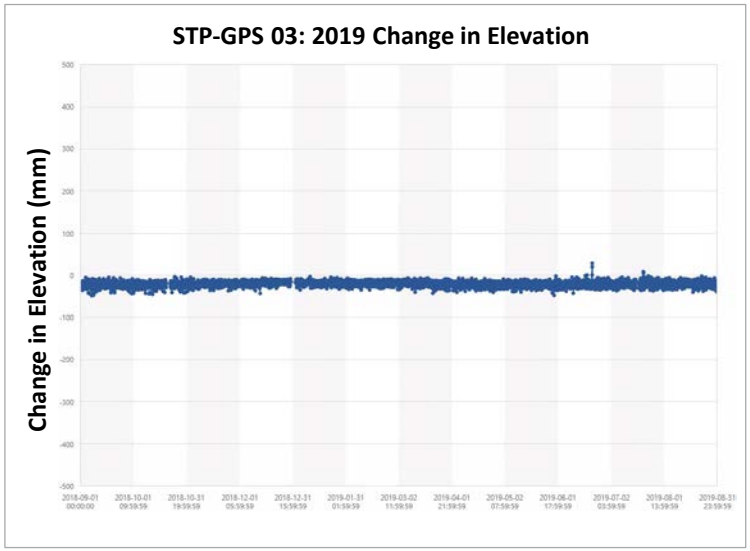
DESIGN	TF / NEC
REVIEW	CYL
APPROVED	JCC

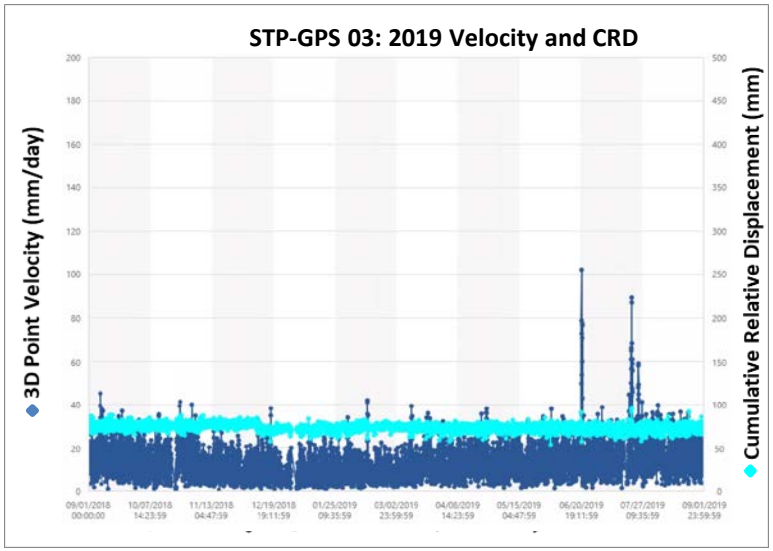
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND - GPS MONITORING DATA AT STP-GPS 02

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	1000/1006/2019-159	0	H-2







LEGEND

- INITIAL READING (SEPTEMBER 2018)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

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ELKFORD, B.C.

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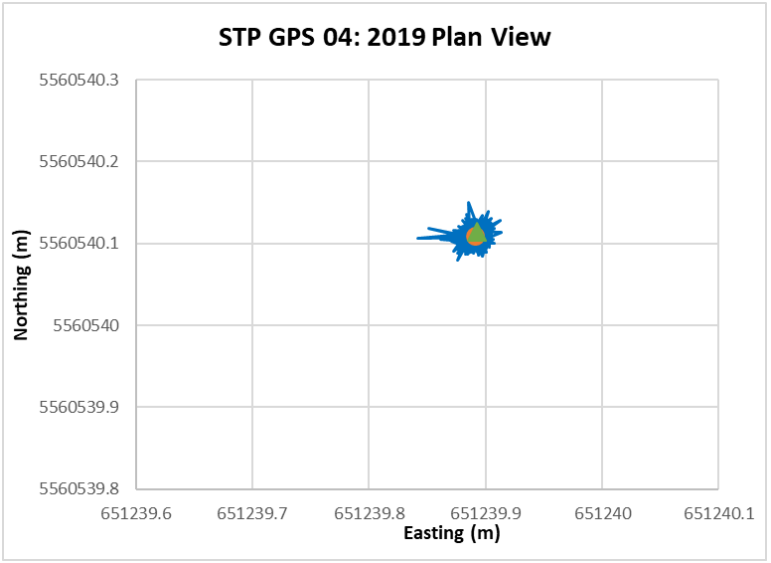
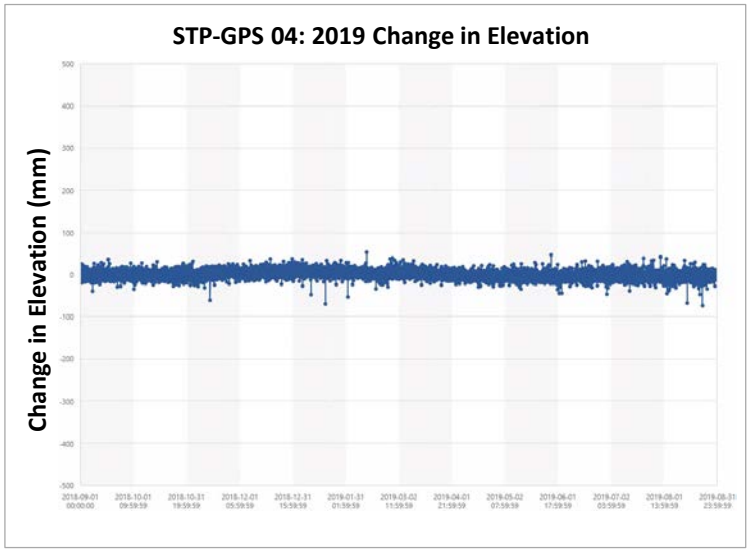
DESIGN	TF / NEC
REVIEW	CYL
APPROVED	JCC

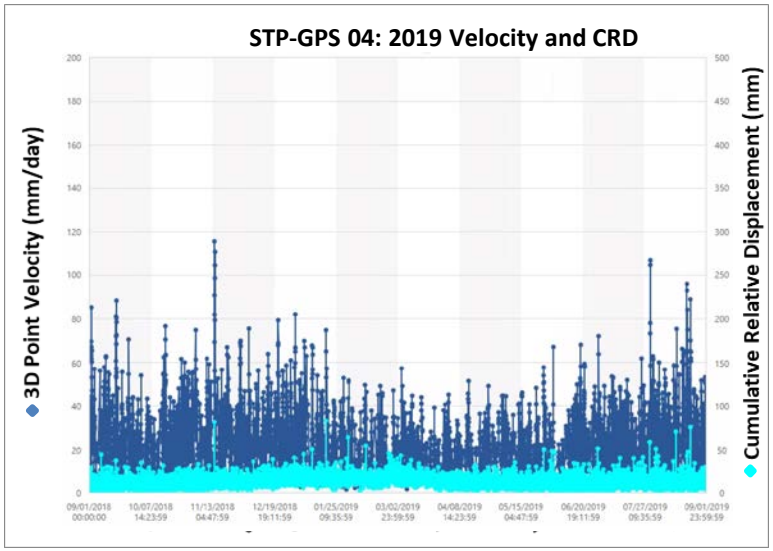
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND - GPS MONITORING DATA AT STP-GPS 03

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-3**







LEGEND

- INITIAL READING (SEPTEMBER 2019)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

NOTES

1. DATA DOWNLOADED FROM GEOEXPLORER IN SEPTEMBER 2019.
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FORDING RIVER OPERATIONS
ELKFORD, B.C.

CONSULTANT
GOLDER

YYYY-MM-DD	2020-03-04
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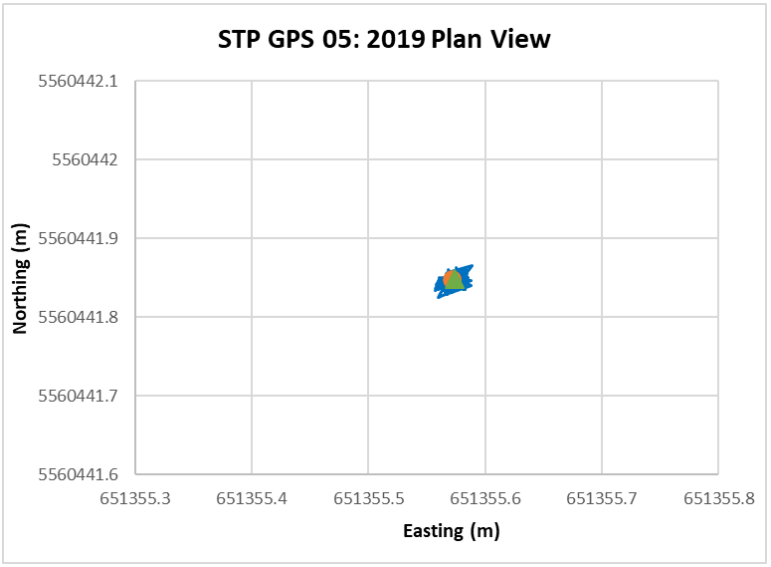
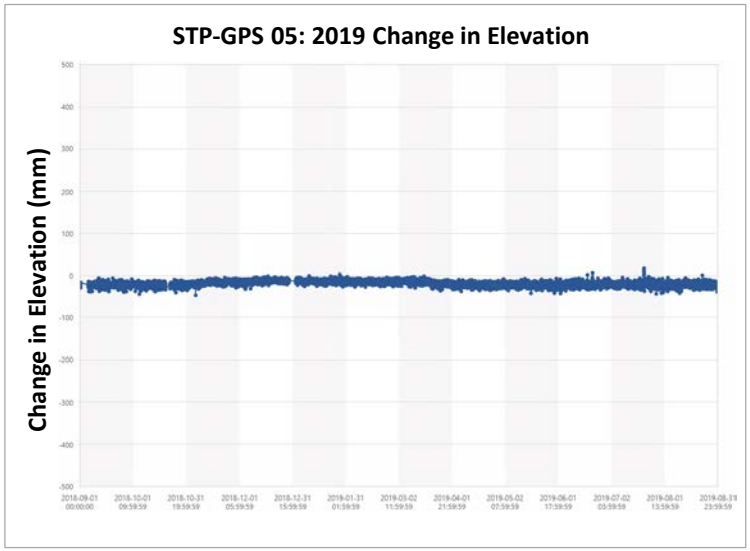
DESIGN	TF / NEC
REVIEW	CYL
APPROVED	JCC

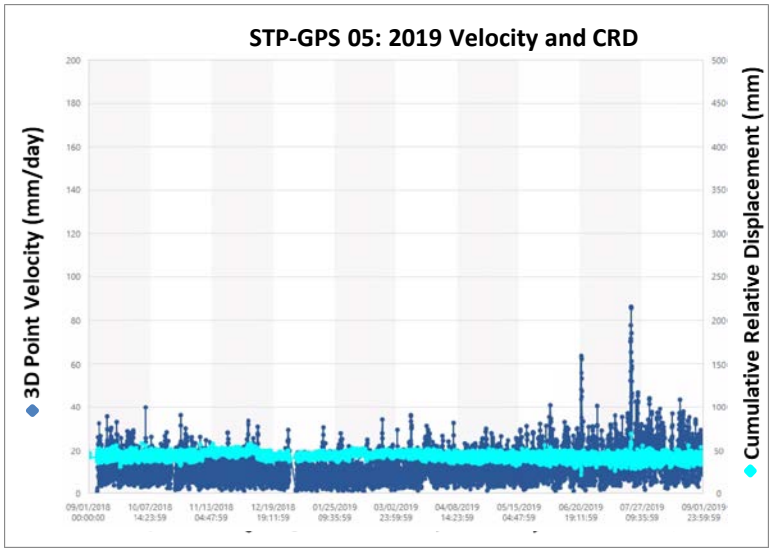
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND - GPS MONITORING DATA AT STP-GPS 04

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-4**







LEGEND

- INITIAL READING (SEPTEMBER 2018)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

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ELKFORD, B.C.

CONSULTANT
GOLDER

YYYY-MM-DD	2020-03-04
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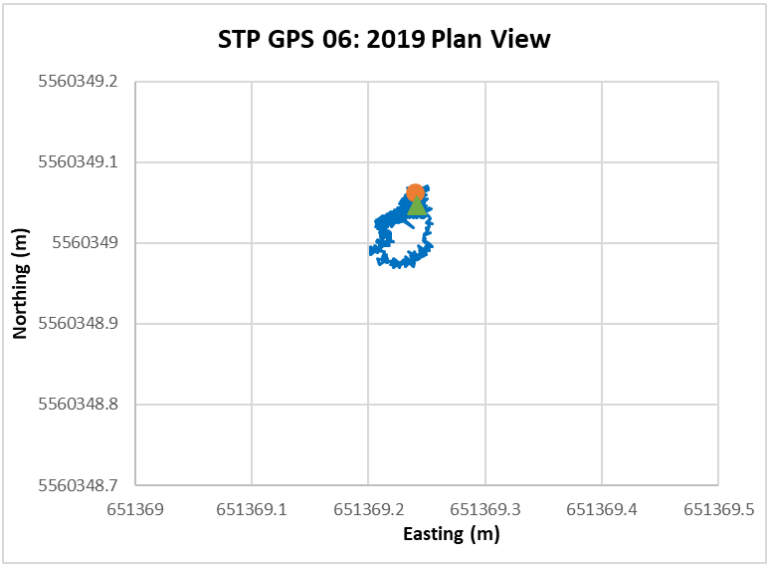
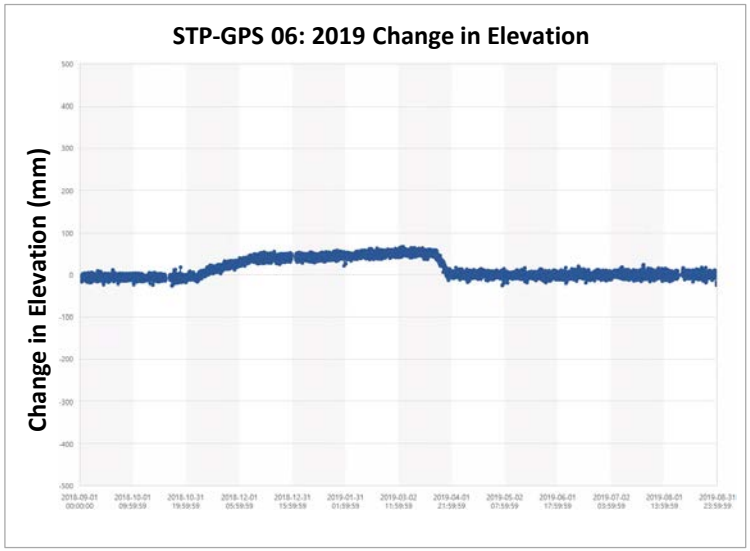
DESIGN	TF / NEC
REVIEW	CYL
APPROVED	JCC

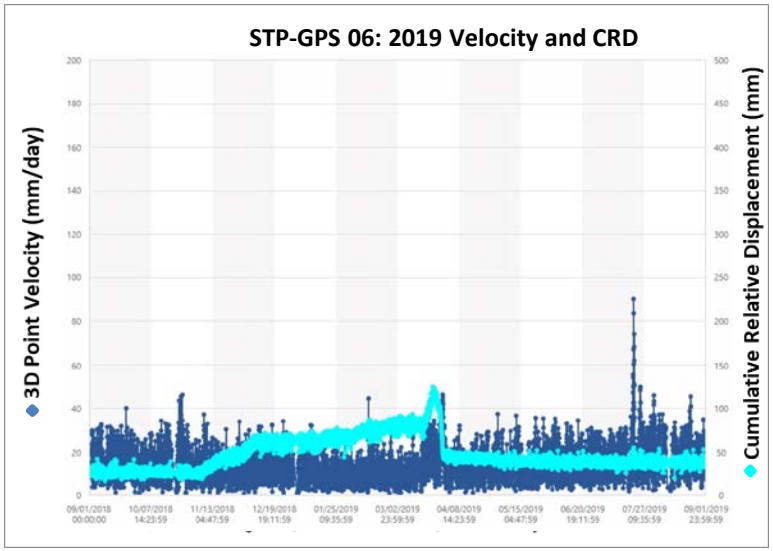
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND - GPS MONITORING DATA AT STP-GPS 05

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-5**







LEGEND

- INITIAL READING (SEPTEMBER 2018)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

NOTES

1. DATA DOWNLOADED FROM GEOEXPLORER IN SEPTEMBER 2019.
2. DUE TO THE MANNER IN WHICH GPS DATA IS REFERENCED AT FRO, CHANGE IN ELEVATION VS. TIME IS PLOTTED FOR REVIEW.

CLIENT
TECK COAL LIMITED
FORDING RIVER OPERATIONS
ELKFORD, B.C.

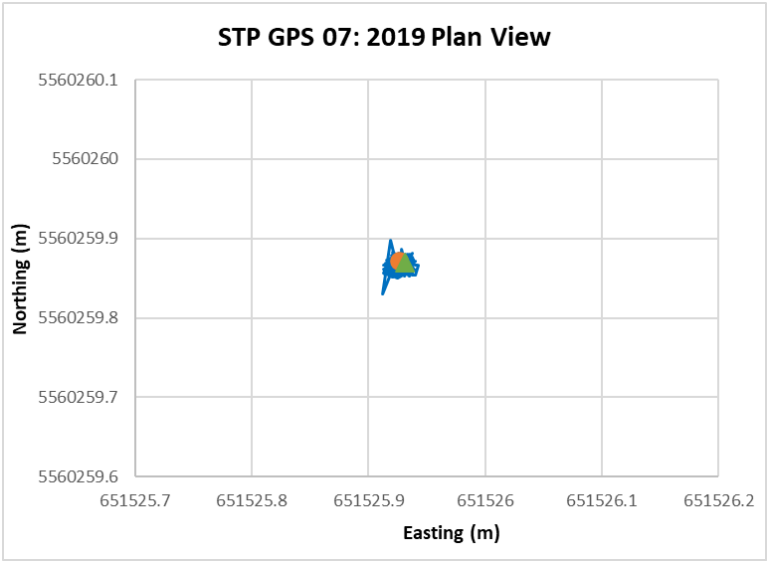
CONSULTANT
GOLDER

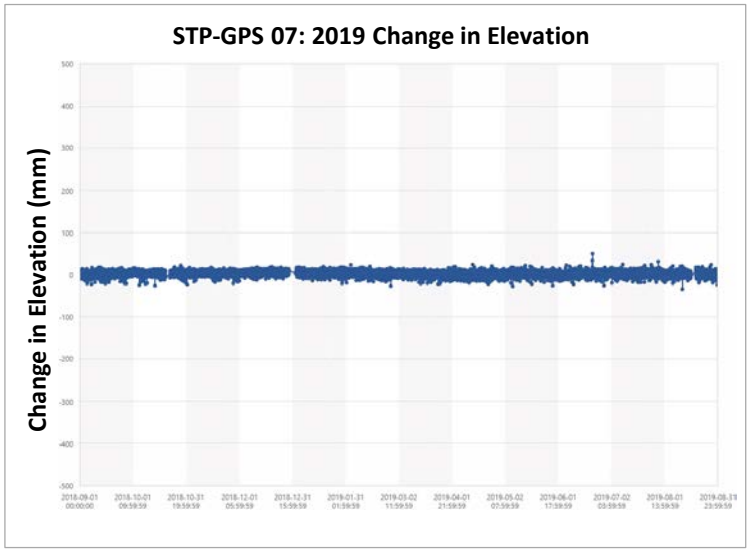
YYYY-MM-DD	2020-03-04
PREPARED	TF / NEC
DESIGN	TF / NEC
REVIEW	CYL
APPROVED	JCC

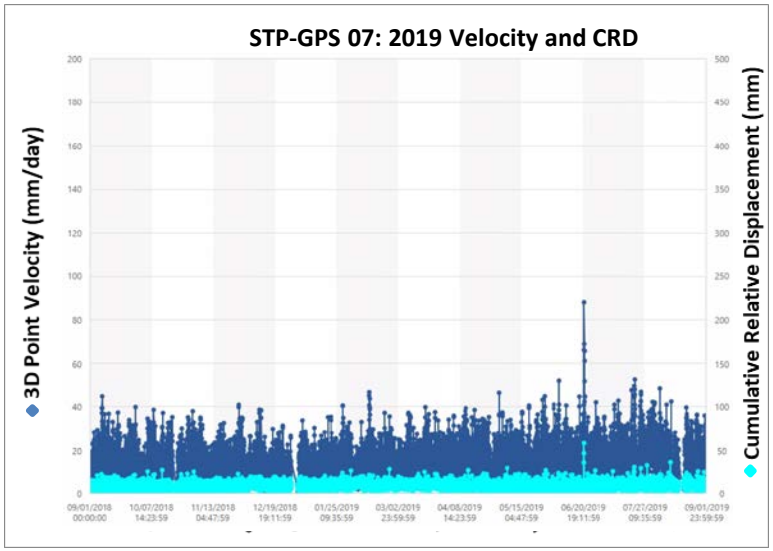
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND - GPS MONITORING DATA AT STP-GPS 06

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-6**







LEGEND

- INITIAL READING (SEPTEMBER 2018)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

NOTES

1. DATA DOWNLOADED FROM GEOEXPLORER IN SEPTEMBER 2019.
2. DUE TO THE MANNER IN WHICH GPS DATA IS REFERENCED AT FRO, CHANGE IN ELEVATION VS. TIME IS PLOTTED FOR REVIEW.

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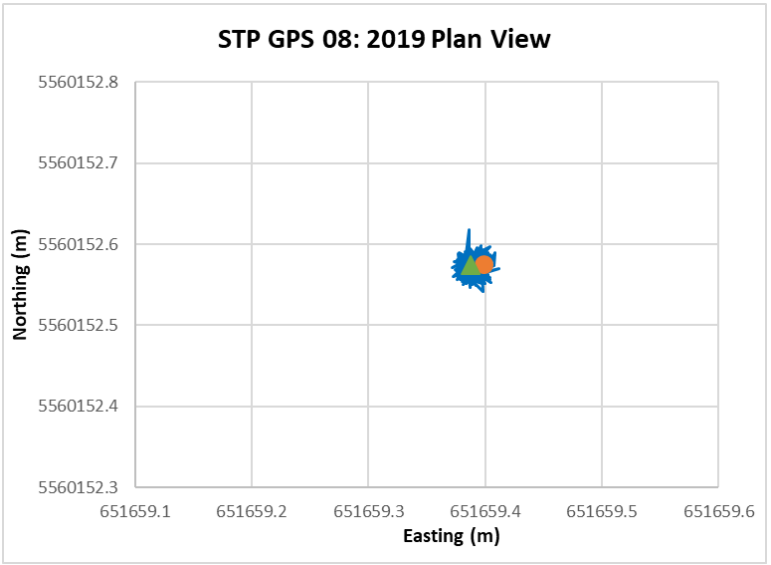
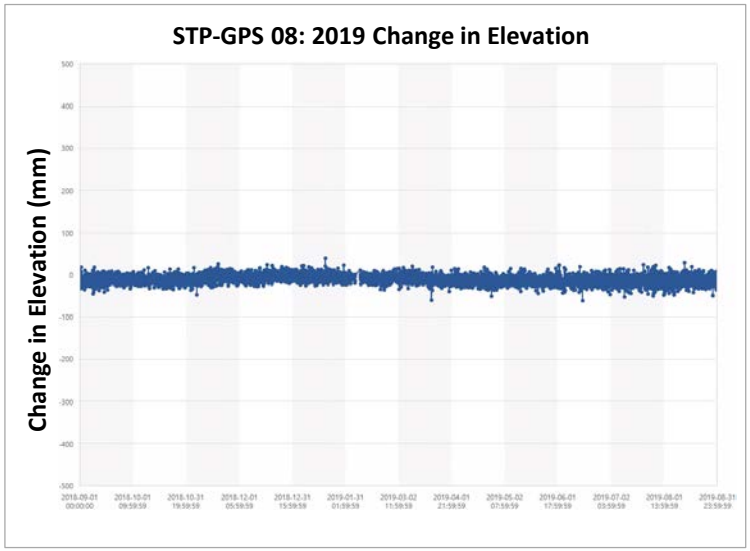
DESIGN	TF / NEC
REVIEW	CYL
APPROVED	JCC

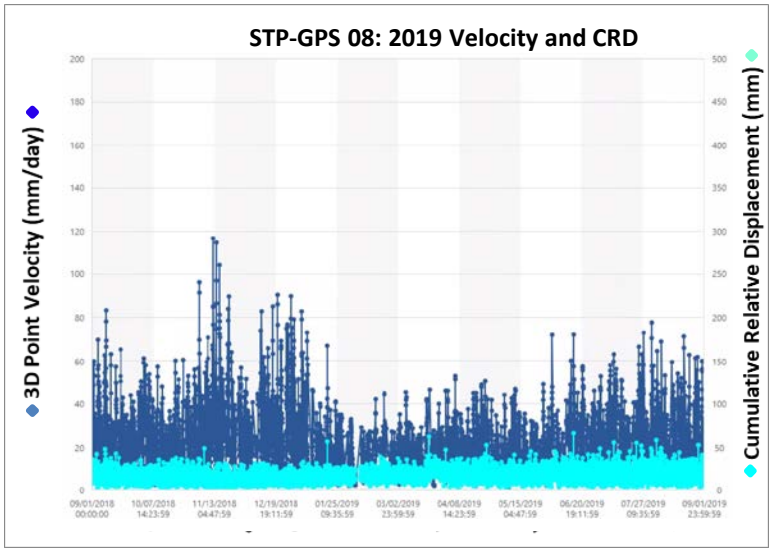
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND - GPS MONITORING DATA AT STP-GPS 07

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-7**







LEGEND

- INITIAL READING (SEPTEMBER 2019)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

NOTES

1. DATA DOWNLOADED FROM GEOEXPLORER IN SEPTEMBER 2019.
2. THIS GPS UNIT WAS REPLACED AND THE BASE STATION SWITCHED IN MAY 2018. CHANGE IN ELEVATION VS. TIME IS PLOTTED FOR COMPARISON WITH DATA OF OLD GPS, WHICH REFERENCED A DIFFERENT BASE STATION.

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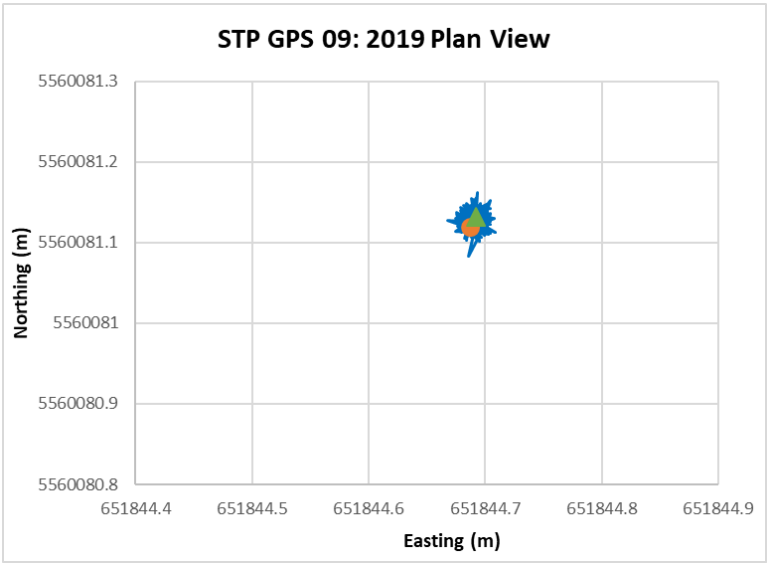
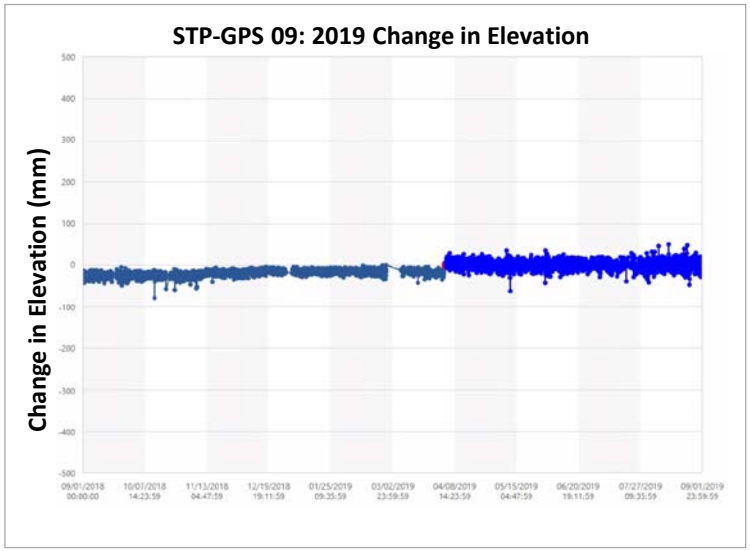
DESIGN	TF / NEC
REVIEW	CYL
APPROVED	JCC

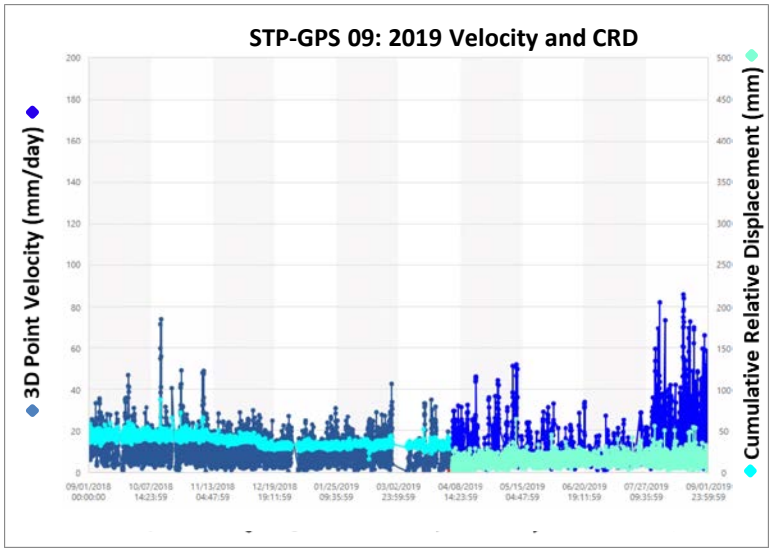
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND - GPS MONITORING DATA AT STP-GPS 08

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-8**







LEGEND

- INITIAL READING (SEPTEMBER 2019)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

NOTES

1. DATA DOWNLOADED FROM GEOEXPLORER IN SEPTEMBER 2019.
2. THIS GPS UNIT WAS REPLACED AND THE BASE STATION SWITCHED IN APRIL 2019. CHANGE IN ELEVATION VS. TIME IS PLOTTED FOR COMPARISON WITH DATA OF OLD GPS, WHICH REFERENCED A DIFFERENT BASE STATION.

CLIENT
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CONSULTANT
GOLDER

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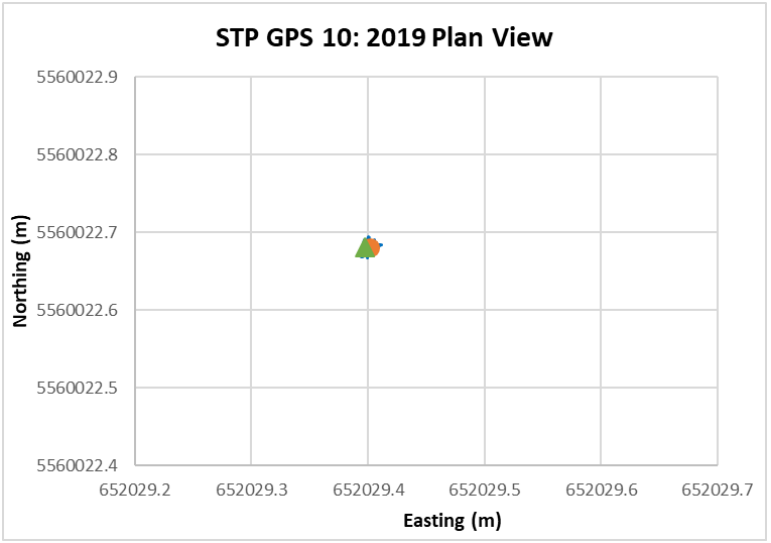
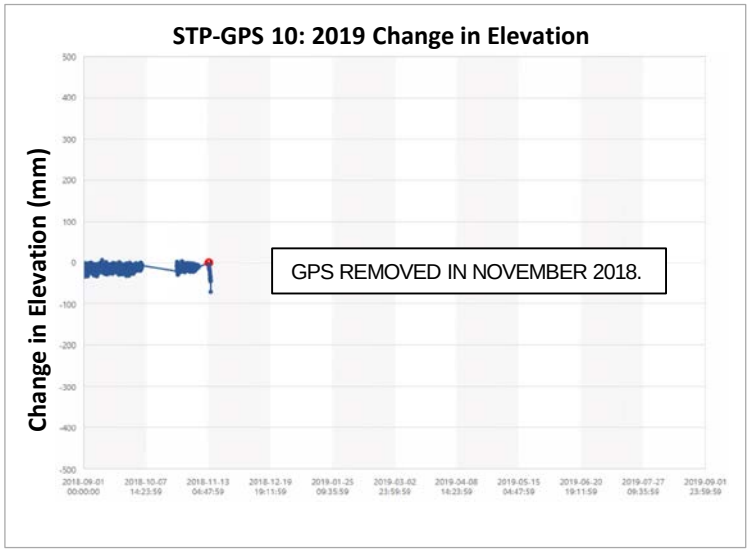
DESIGN	TF / NEC
REVIEW	CYL
APPROVED	JCC

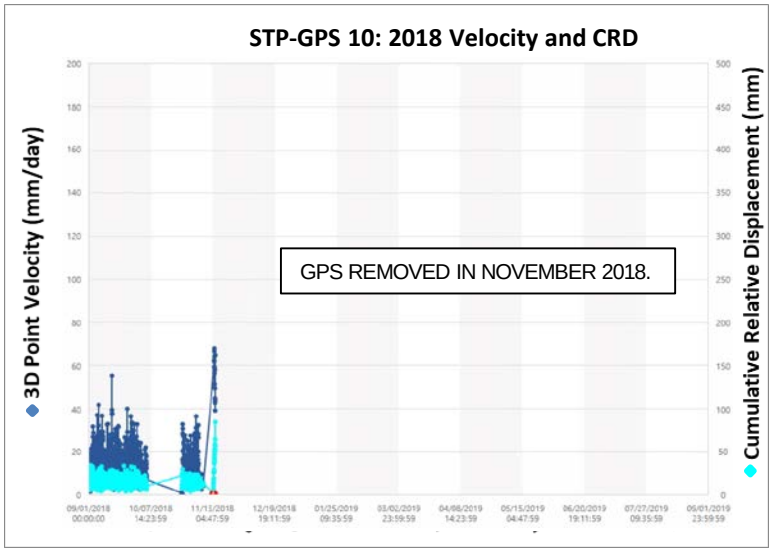
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND - GPS MONITORING DATA AT STP-GPS 09

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-9**







LEGEND

- INITIAL READING (SEPTEMBER 2018)
- 2018 READINGS
- LAST READING (NOVEMBER 2018)

NOTES

1. DATA DOWNLOADED FROM GEOEXPLORER IN SEPTEMBER 2019.
2. DUE TO THE MANNER IN WHICH GPS DATA IS REFERENCED AT FRO, CHANGE IN ELEVATION VS. TIME IS PLOTTED FOR REVIEW.

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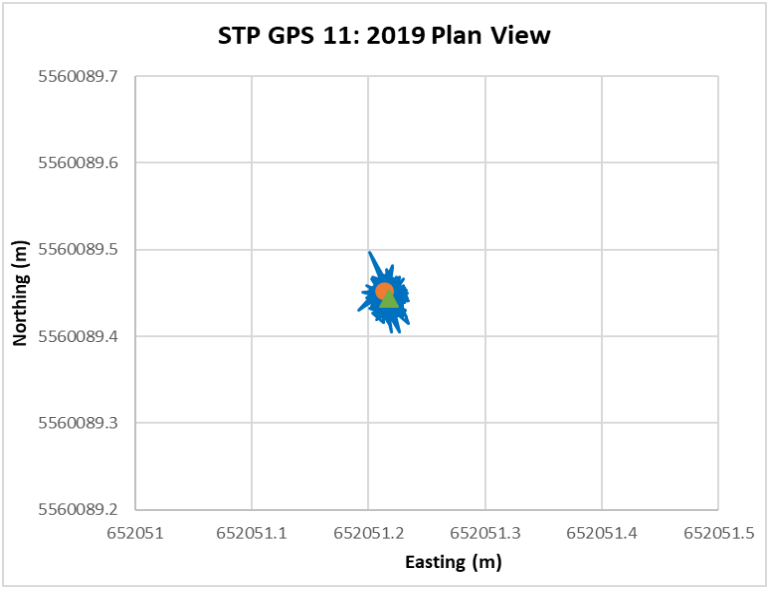
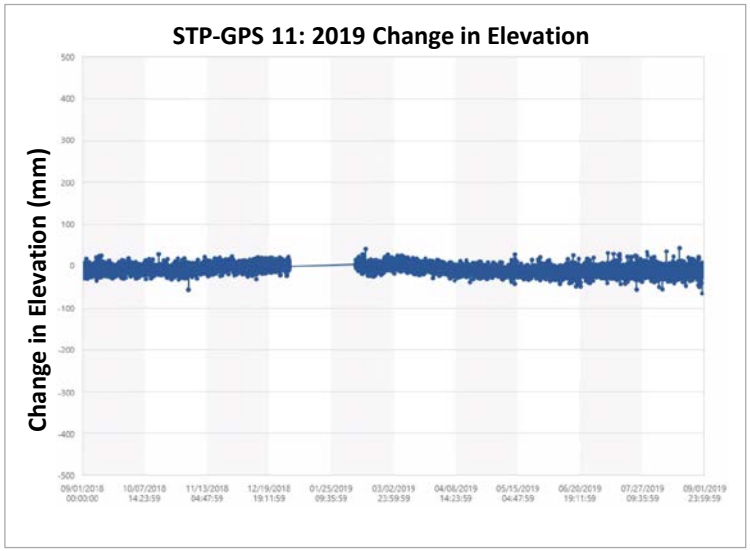
DESIGN	TF / NEC
REVIEW	CYL
APPROVED	JCC

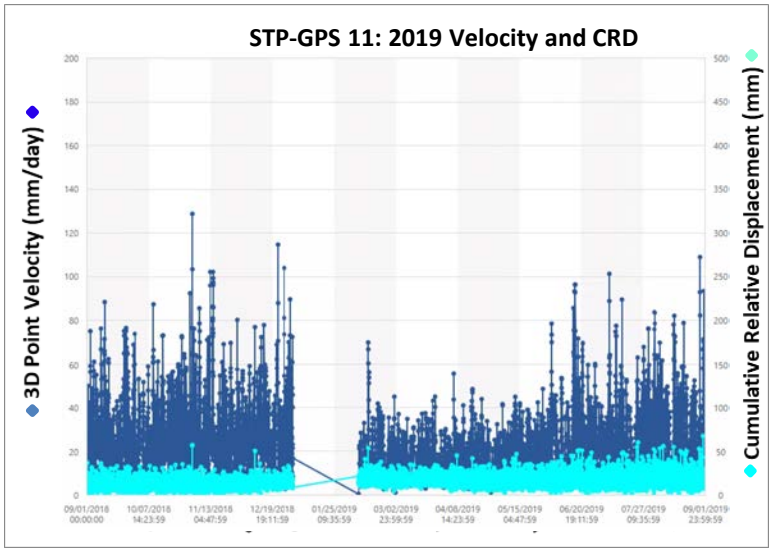
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND - GPS MONITORING DATA AT STP-GPS 10

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-10**







LEGEND

- INITIAL READING (SEPTEMBER 2019)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

NOTES

1. DATA DOWNLOADED FROM GEOEXPLORER IN SEPTEMBER 2019.
2. THIS GPS UNIT WAS REPLACED AND THE BASE STATION SWITCHED IN JULY 2018. CHANGE IN ELEVATION VS. TIME IS PLOTTED FOR COMPARISON WITH DATA OF OLD GPS, WHICH REFERENCED A DIFFERENT BASE STATION.

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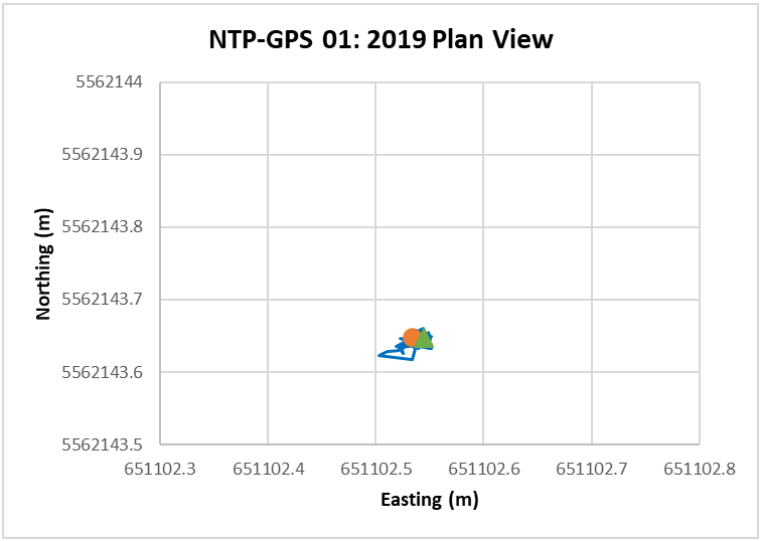
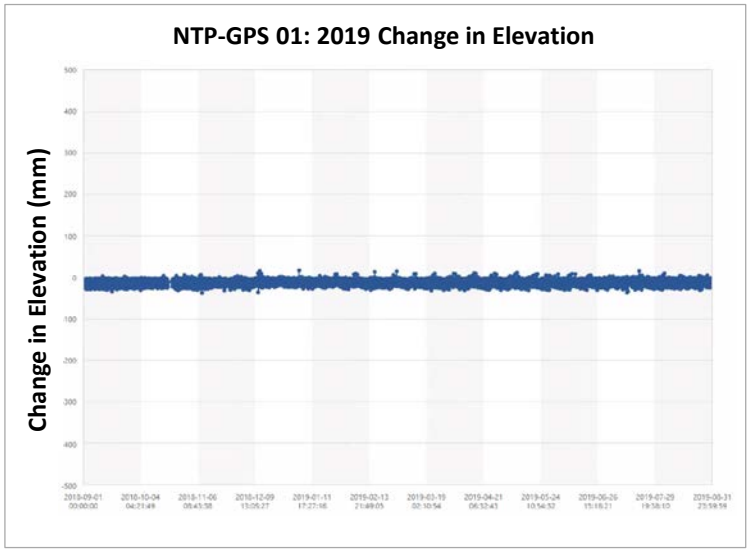
APPROVED	JCC

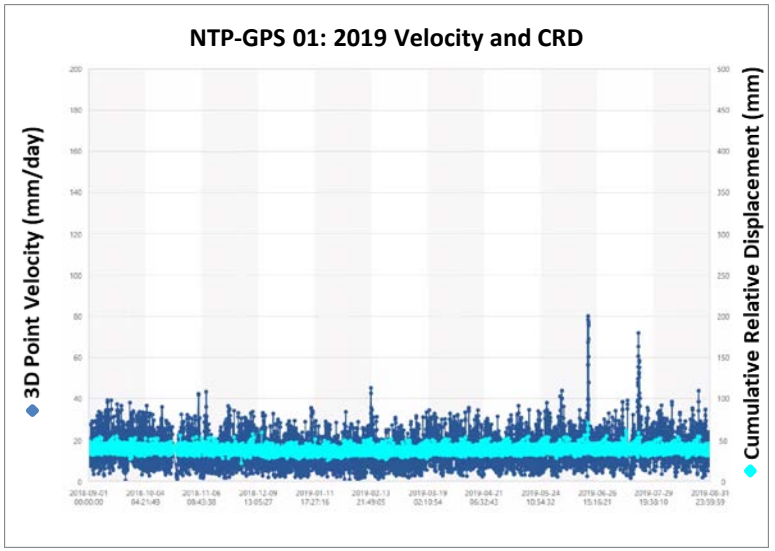
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND - GPS MONITORING DATA AT STP-GPS 11

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-11**







LEGEND

- INITIAL READING (SEPTEMBER 2018)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

NOTES

1. DATA DOWNLOADED FROM GEOEXPLORER IN JANUARY 2020.
2. DUE TO THE MANNER IN WHICH GPS DATA IS REFERENCED AT FRO, CHANGE IN ELEVATION VS. TIME IS PLOTTED FOR REVIEW.

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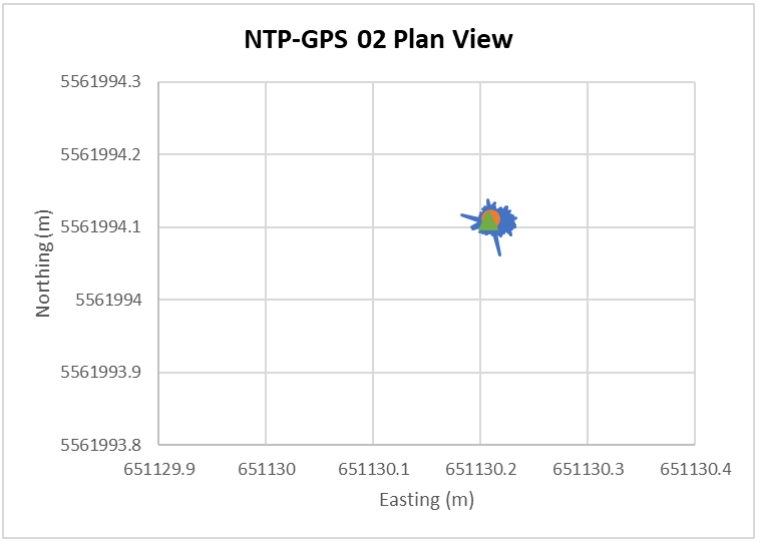
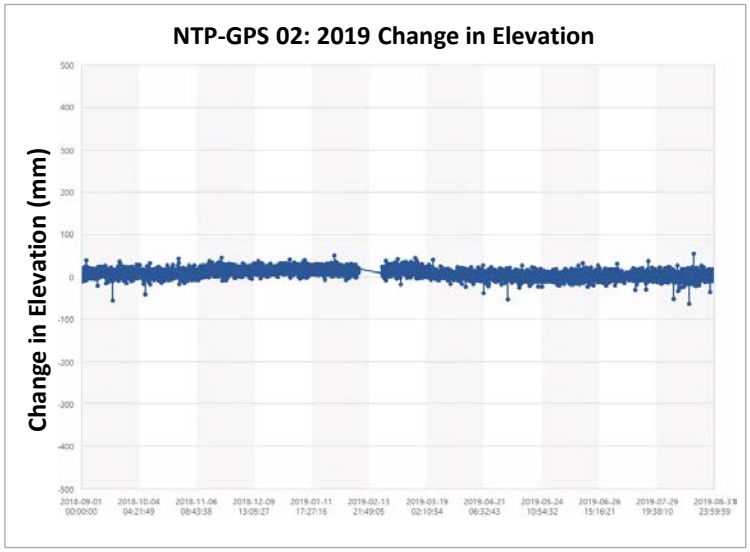
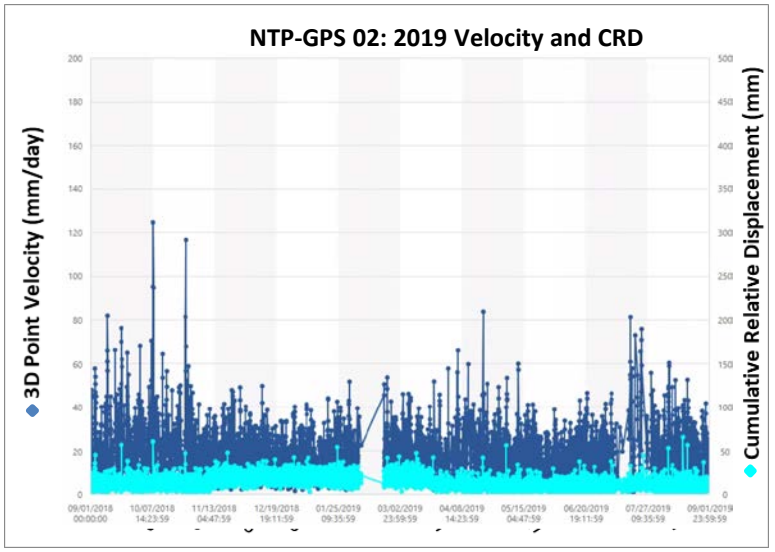
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
NORTH TAILINGS POND - GPS MONITORING DATA AT NTP-GPS 01

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-12**







LEGEND

- INITIAL READING (SEPTEMBER 2018)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

NOTES

1. DATA DOWNLOADED FROM GEOEXPLORER IN SEPTEMBER 2019.
2. DUE TO THE MANNER IN WHICH GPS DATA IS REFERENCED AT FRO, CHANGE IN ELEVATION VS. TIME IS PLOTTED FOR REVIEW.

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ELKFORD, B.C.

CONSULTANT
GOLDER

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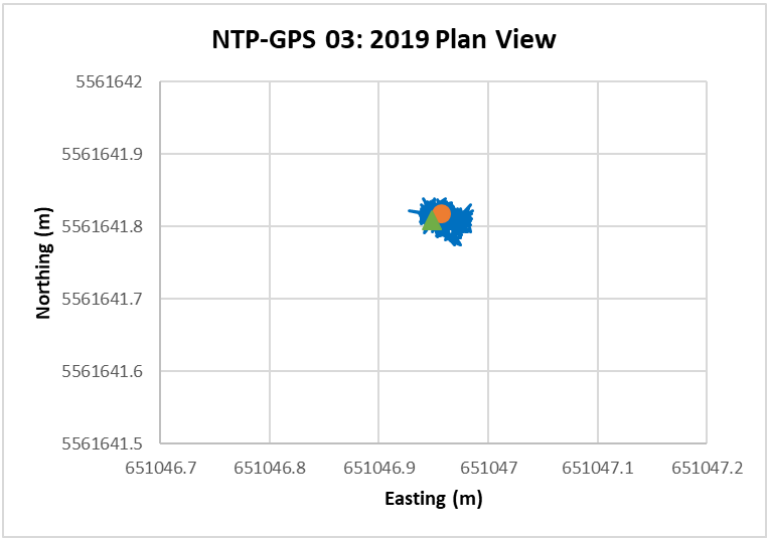
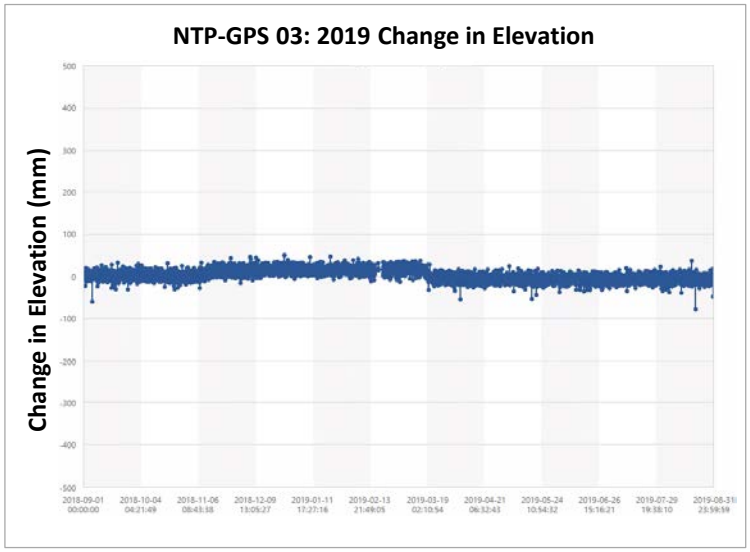
REVIEW	CYL
APPROVED	JCC

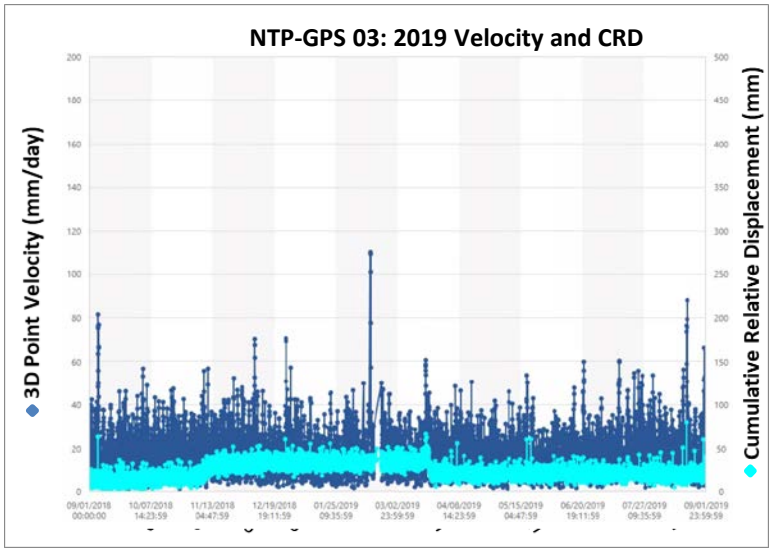
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
NORTH TAILINGS POND - GPS MONITORING DATA AT NTP-GPS 02

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-13**







LEGEND

- INITIAL READING (SEPTEMBER 2018)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

NOTES

1. DATA DOWNLOADED FROM GEOEXPLORER IN SEPTEMBER 2019.
2. DUE TO THE MANNER IN WHICH GPS DATA IS REFERENCED AT FRO, CHANGE IN ELEVATION VS. TIME IS PLOTTED FOR REVIEW.

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ELKFORD, B.C.

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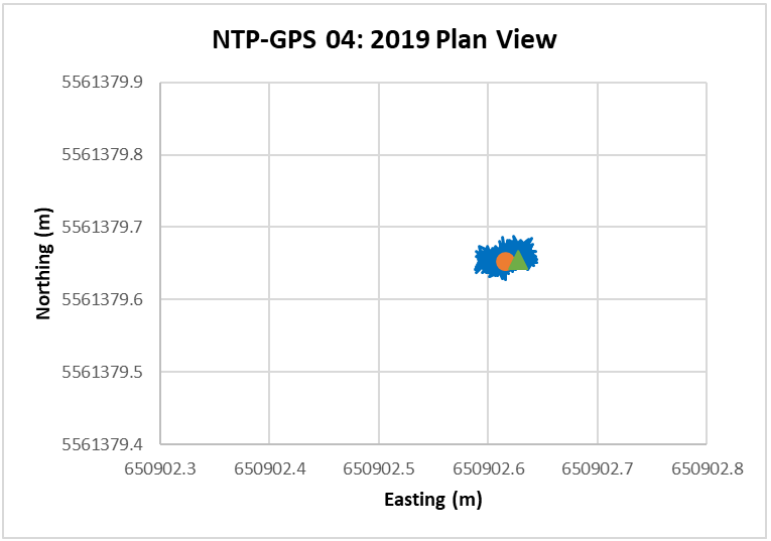
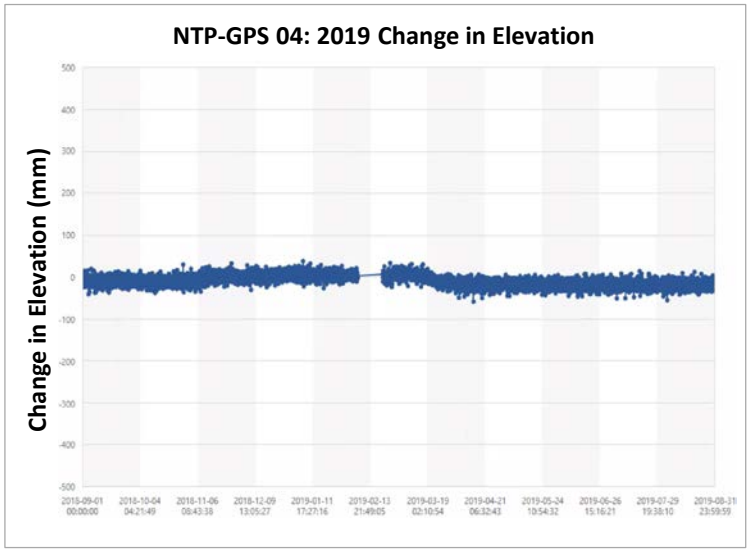
DESIGN	TF / NEC
REVIEW	CYL
APPROVED	JCC

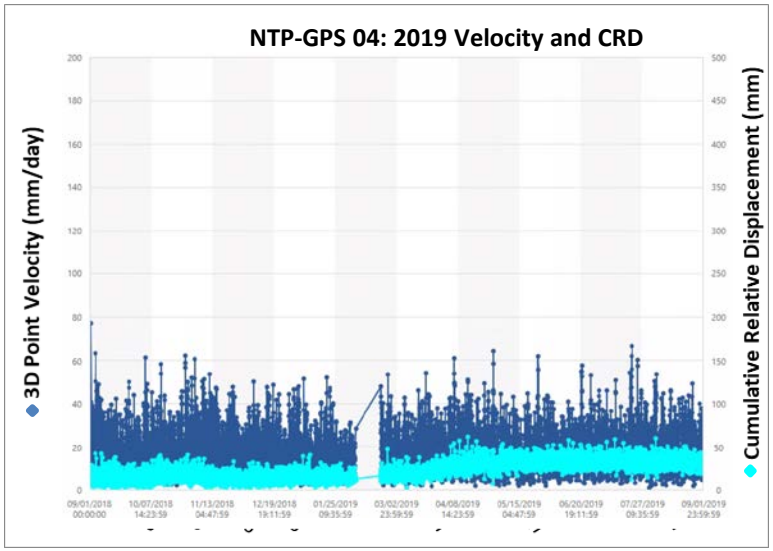
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
NORTH TAILINGS POND - GPS MONITORING DATA AT NTP-GPS 03

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-14**







LEGEND

- INITIAL READING (SEPTEMBER 2018)
- 2018/2019 READINGS
- LAST READING (AUGUST 2019)

NOTES

1. DATA DOWNLOADED FROM GEOEXPLORER IN SEPTEMBER 2019.
2. DUE TO THE MANNER IN WHICH GPS DATA IS REFERENCED AT FRO, CHANGE IN ELEVATION VS. TIME IS PLOTTED FOR REVIEW.

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ELKFORD, B.C.

CONSULTANT
GOLDER

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DESIGN	TF / NEC
REVIEW	CYL
APPROVED	JCC

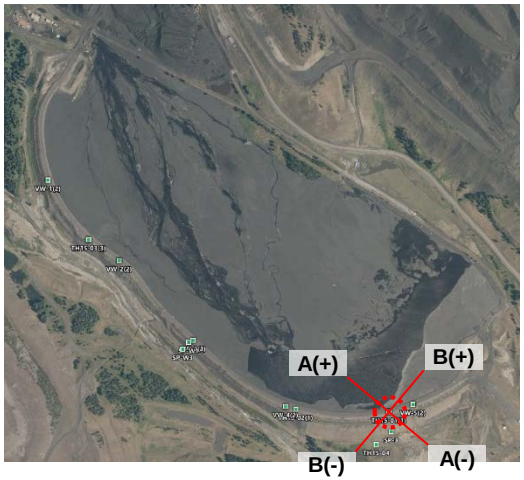
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

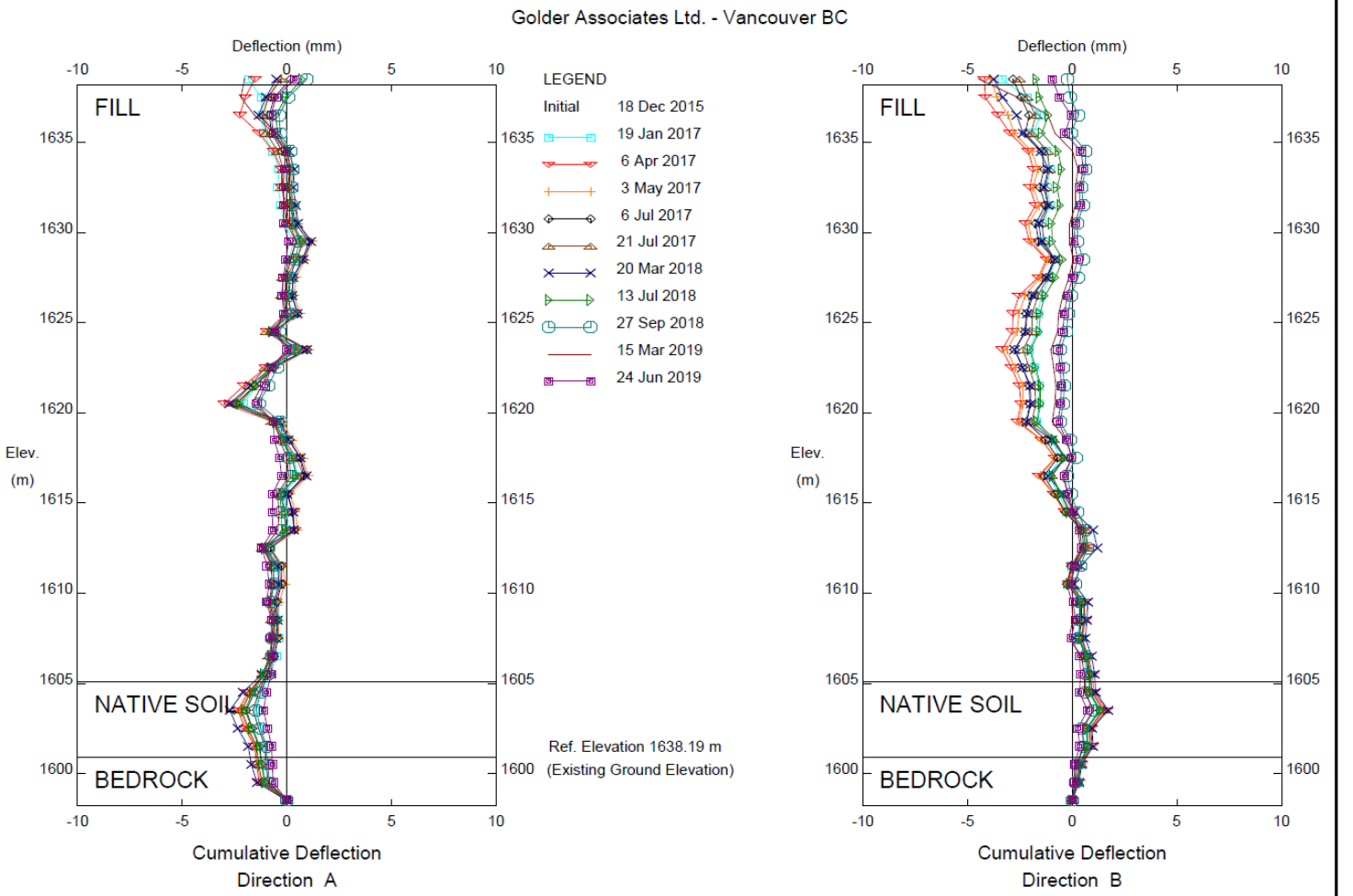
TITLE
NORTH TAILINGS POND - GPS MONITORING DATA AT NTP-GPS 04

PROJECT No.	Phase/Task/Doc.	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**H-15**

APPENDIX I

Slope Inclinometer Data





South Tailings Pond Main Dam, Inclinometer TH15-01

Fording River Operations

REFERENCES

1. DATA PROVIDED BY FORDING RIVER OPERATIONS JULY 2019.
2. LOCATIONS FROM GEOEXPLORER.
3. A-A AXIS AZIMUTH PROVIDED BY FORDING RIVER OPERATIONS 15 NOVEMBER 2017.
4. ELEVATIONS ARE IN ELK VALLEY ELEVATION DATUM.
5. SOIL STRATIGRAPHY SHOWN FROM TEST HOLE AND INSTALLATION LOGS PROVIDED BY FORDING RIVER OPERATIONS (2016).

CLIENT
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ELKFORD, B.C.

CONSULTANT
GOLDER

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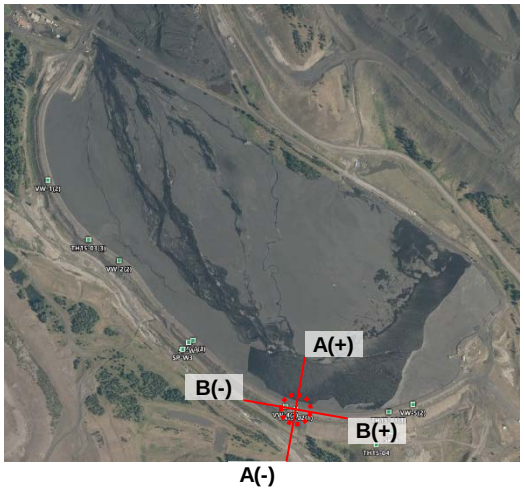
DESIGN	AVE
REVIEW	NEC
APPROVED	JCC

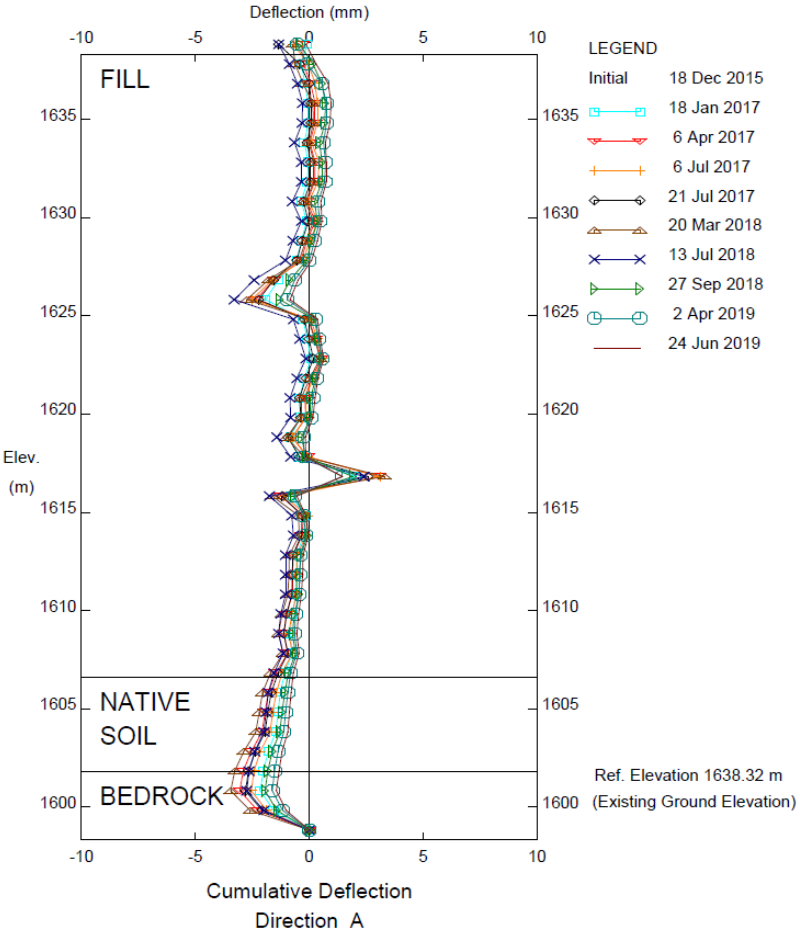
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

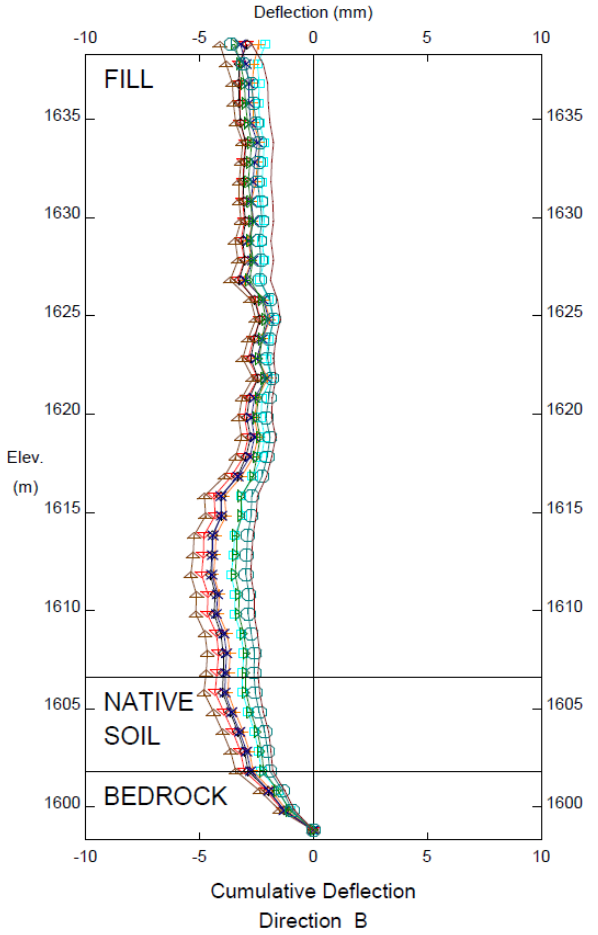
TITLE
SOUTH TAILINGS POND - SLOPE INCLINOMETER DATA AT TH15-01

PROJECT No.	Phase	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**I-1**

Golder Associates Ltd. - Vancouver BC







South Tailings Pond Main Dam, Inclinometer TH15-02

Fording River Operations

REFERENCES

1. DATA PROVIDED BY FORDING RIVER OPERATIONS JULY 2019.
2. LOCATIONS FROM GEOEXPLORER.
3. A-A AXIS AZIMUTH PROVIDED BY FORDING RIVER OPERATIONS 15 NOVEMBER 2017.
4. ELEVATIONS ARE IN ELK VALLEY ELEVATION DATUM.
5. SOIL STRATIGRAPHY SHOWN FROM TEST HOLE AND INSTALLATION LOGS PROVIDED BY FORDING RIVER OPERATIONS (2016).

CLIENT

TECK COAL LIMITED
FORDING RIVER OPERATIONS
ELKFORD, B.C.

CONSULTANT

GOLDER

YYYY-MM-DD	2020-03-04
PREPARED	AVE
DESIGN	AVE
REVIEW	NEC
APPROVED	JCC

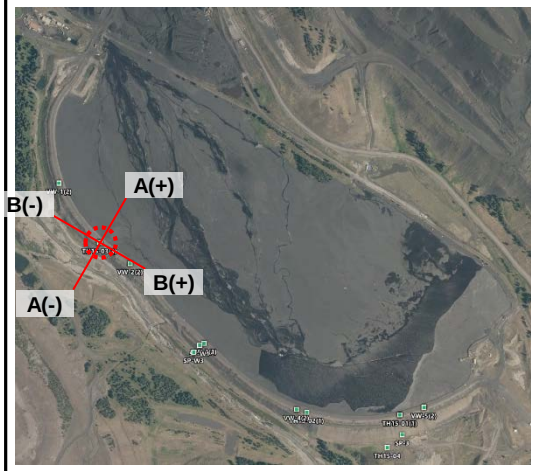
PROJECT

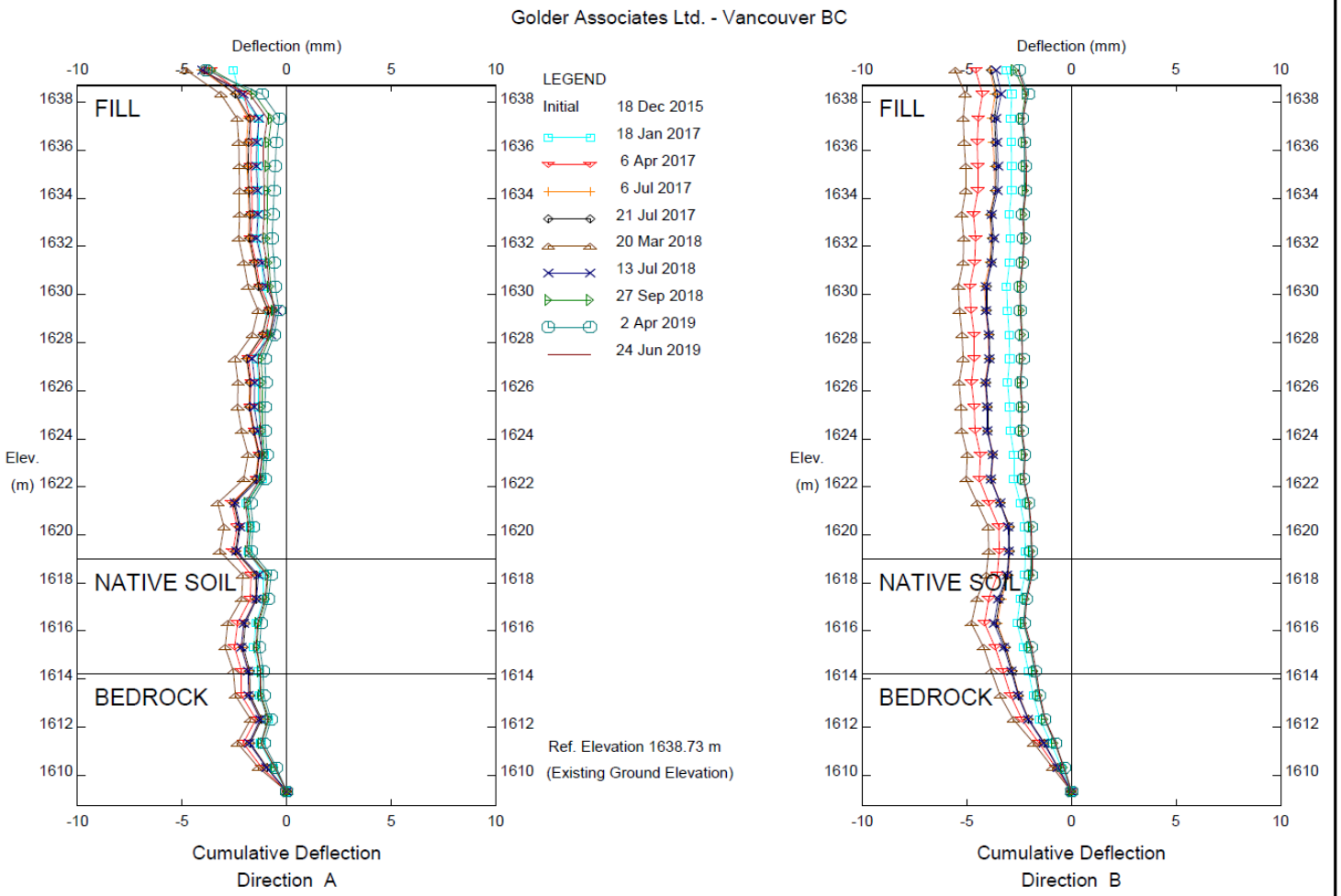
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE

SOUTH TAILINGS POND - SLOPE INCLINOMETER DATA AT TH15-02

PROJECT No.	Phase	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**I-2**





South Tailings Pond West Dam, Inclinometer TH15-03

Fording River Operations

REFERENCES

1. DATA PROVIDED BY FORDING RIVER OPERATIONS JULY 2019.
2. LOCATIONS FROM GEOEXPLORER.
3. A-A AXIS AZIMUTH PROVIDED BY FORDING RIVER OPERATIONS 15 NOVEMBER 2017.
4. ELEVATIONS ARE IN ELK VALLEY ELEVATION DATUM.
5. SOIL STRATIGRAPHY SHOWN FROM TEST HOLE AND INSTALLATION LOGS PROVIDED BY FORDING RIVER OPERATIONS (2016).

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YYYY-MM-DD	2020-03-04
PREPARED	AVE
DESIGN	AVE
REVIEW	NEC
APPROVED	JCC

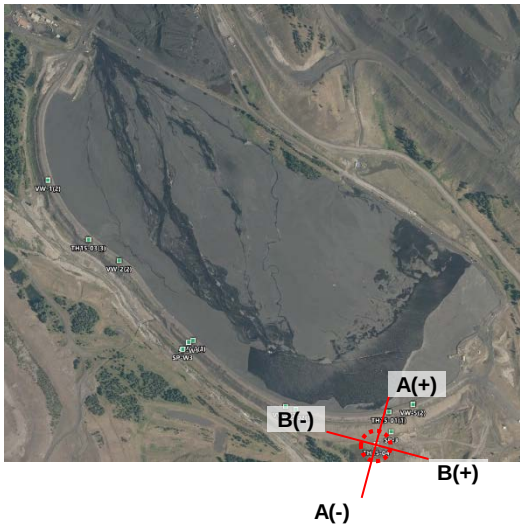
PROJECT

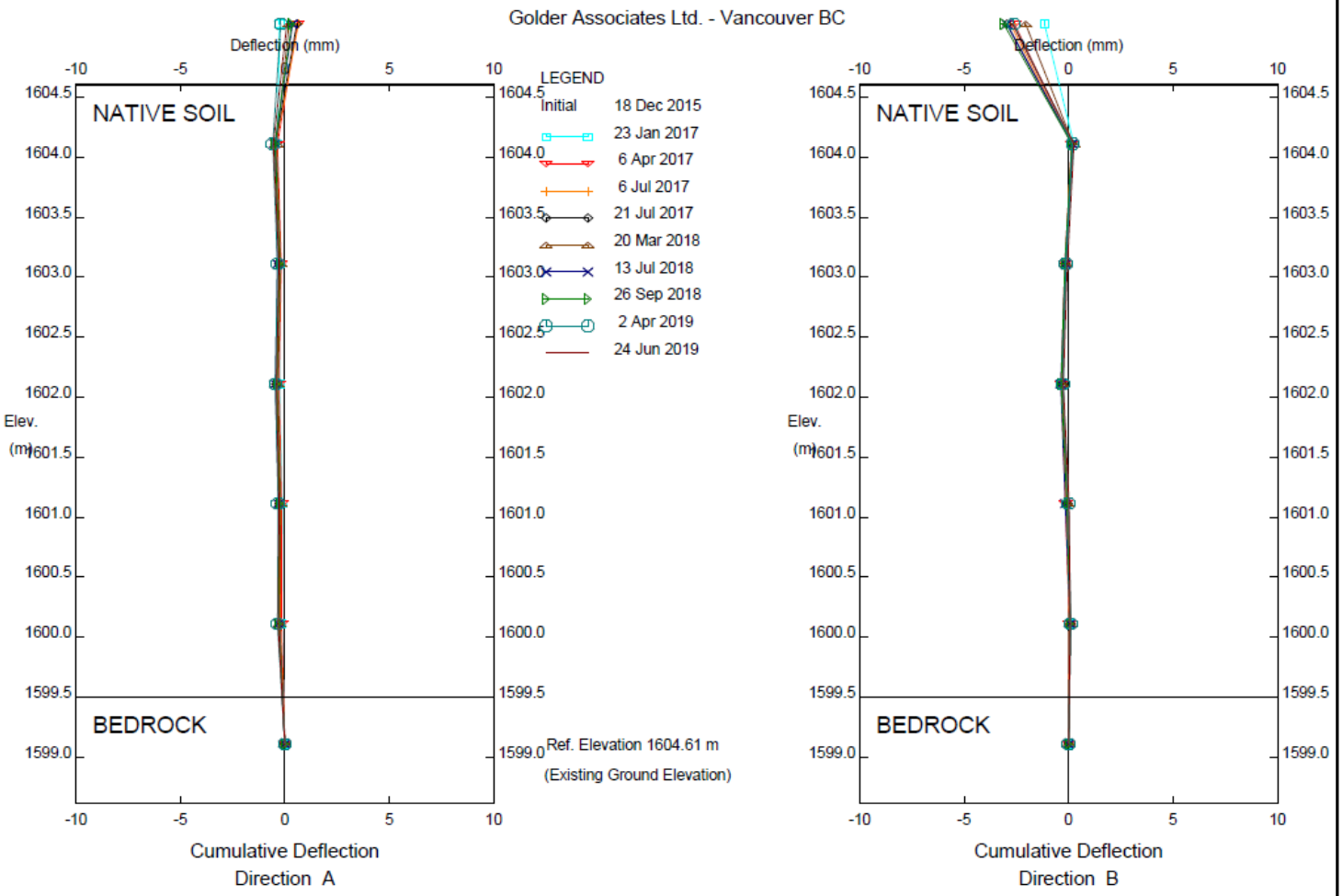
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE

SOUTH TAILINGS POND - SLOPE INCLINOMETER DATA AT TH15-03

PROJECT No.	Phase	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**I-3**





South Tailings Pond Main Dam, Inclinometer TH15-04

Fording River Operations

REFERENCES

1. DATA PROVIDED BY FORDING RIVER OPERATIONS JULY 2019.
2. LOCATIONS FROM GEOEXPLORER.
3. A-A AXIS AZIMUTH PROVIDED BY FORDING RIVER OPERATIONS 15 NOVEMBER 2017.
4. ELEVATIONS ARE IN ELK VALLEY ELEVATION DATUM.
5. SOIL STRATIGRAPHY SHOWN FROM TEST HOLE AND INSTALLATION LOGS PROVIDED BY FORDING RIVER OPERATIONS (2016).

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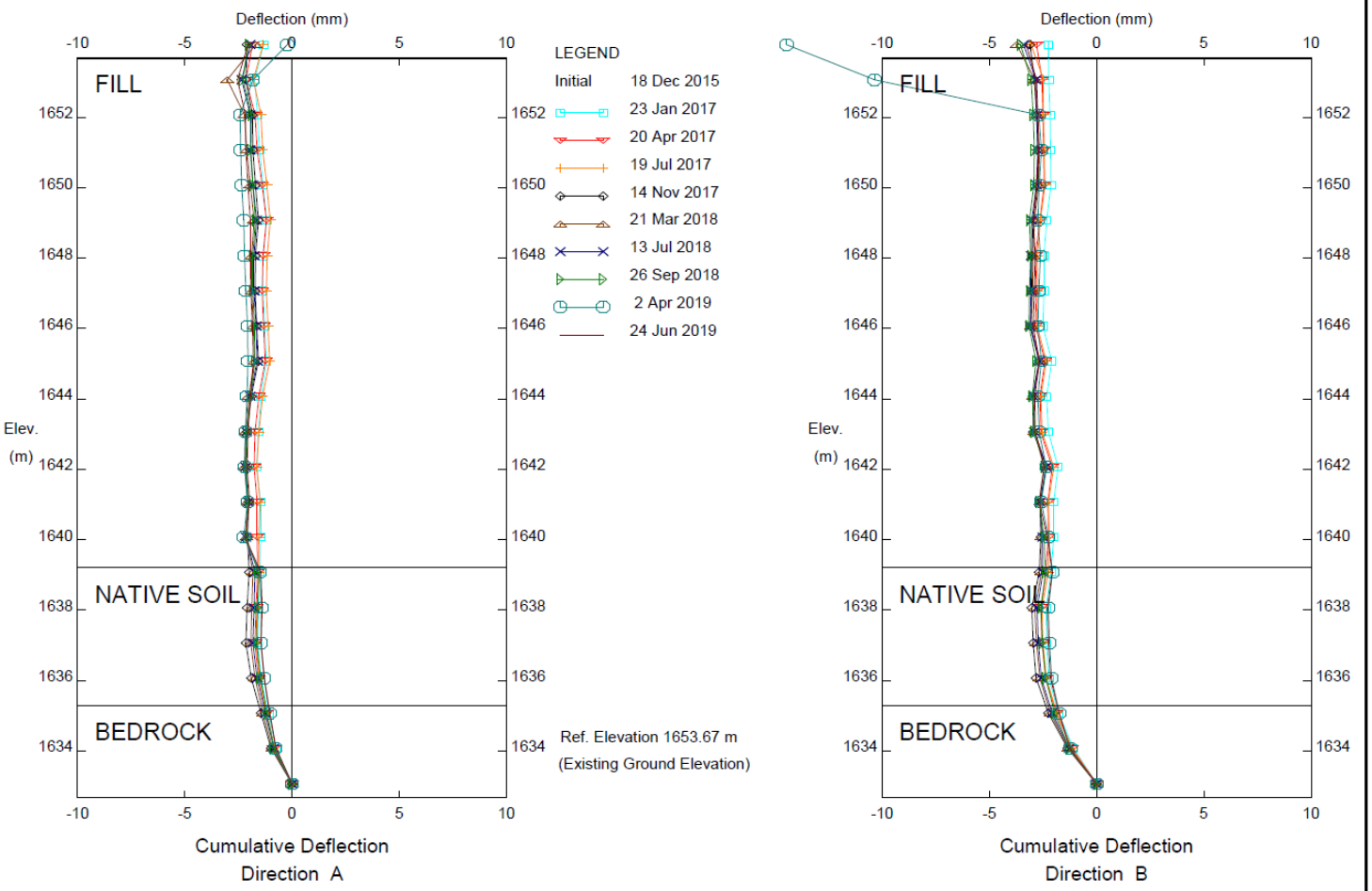
PREPARED	AVE
DESIGN	AVE
REVIEW	NEC
APPROVED	JCC

PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
SOUTH TAILINGS POND - SLOPE INCLINOMETER DATA AT TH15-04

PROJECT No.	Phase	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**I-4**

Golder Associates Ltd. - Vancouver BC



North Tailings Pond, Inclinometer TH15-05

Fording River Operations

REFERENCES

1. DATA PROVIDED BY FORDING RIVER OPERATIONS JULY 2019.
2. LOCATIONS FROM GEOEXPLORER.
3. A-A AXIS AZIMUTH PROVIDED BY FORDING RIVER OPERATIONS 15 NOVEMBER 2017.
4. ELEVATIONS ARE IN ELK VALLEY ELEVATION DATUM.
5. SOIL STRATIGRAPHY SHOWN FROM TEST HOLE AND INSTALLATION LOGS PROVIDED BY FORDING RIVER OPERATIONS (2016).

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GOLDER

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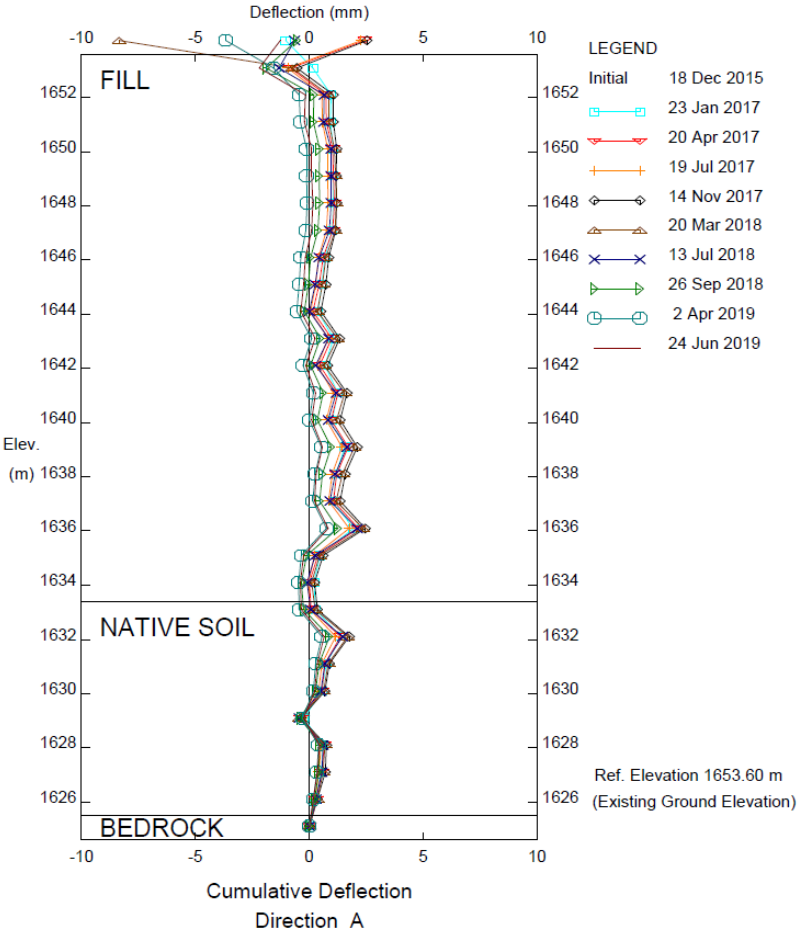
PREPARED	AVE
DESIGN	AVE
REVIEW	NEC
APPROVED	JCC

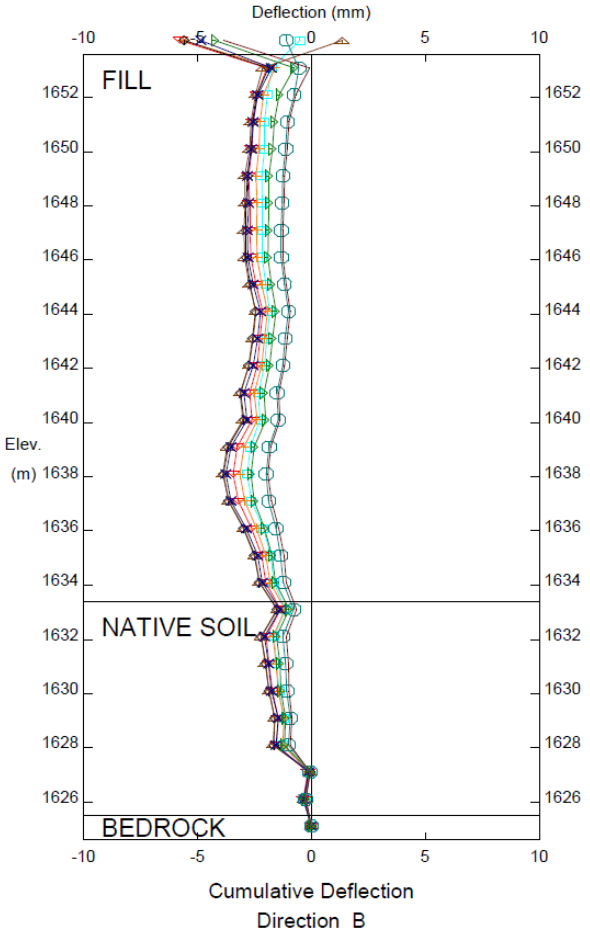
PROJECT
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE
NORTH TAILINGS POND - SLOPE INCLINOMETER DATA AT TH15-05

PROJECT No.	Phase	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**I-5**

Golder Associates Ltd. - Vancouver BC





North Tailings Pond, Inclinometer TH15-06

Fording River Operations

REFERENCES

1. DATA PROVIDED BY FORDING RIVER OPERATIONS JULY 2019.
2. LOCATIONS FROM GEOEXPLORER.
3. A-A AXIS AZIMUTH PROVIDED BY FORDING RIVER OPERATIONS 15 NOVEMBER 2017.
4. ELEVATIONS ARE IN ELK VALLEY ELEVATION DATUM.
5. SOIL STRATIGRAPHY SHOWN FROM TEST HOLE AND INSTALLATION LOGS PROVIDED BY FORDING RIVER OPERATIONS (2016).

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PREPARED	AVE
DESIGN	AVE
REVIEW	NEC
APPROVED	JCC

PROJECT

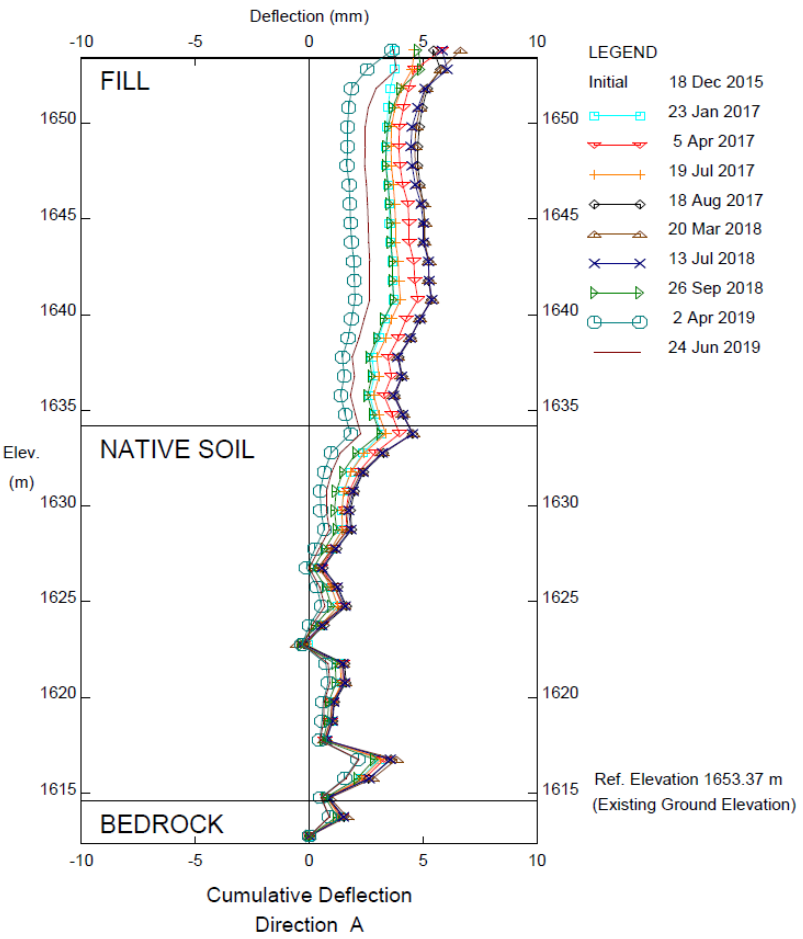
SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

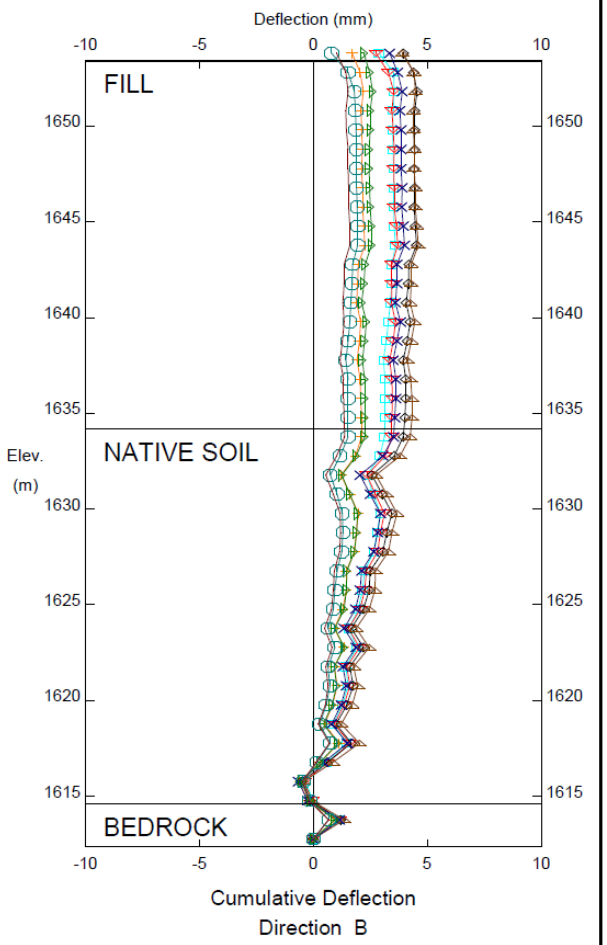
TITLE

NORTH TAILINGS POND - SLOPE INCLINOMETER DATA AT TH15-06

PROJECT No.	Phase	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**I-6**

Golder Associates Ltd. - Vancouver BC





North Tailings Pond, Inclinometer TH15-07

Fording River Operations

REFERENCES

1. DATA PROVIDED BY FORDING RIVER OPERATIONS JULY 2019.
2. LOCATIONS FROM GEOEXPLORER.
3. A-A AXIS AZIMUTH PROVIDED BY FORDING RIVER OPERATIONS 15 NOVEMBER 2017.
4. ELEVATIONS ARE IN ELK VALLEY ELEVATION DATUM.
5. SOIL STRATIGRAPHY SHOWN FROM TEST HOLE AND INSTALLATION LOGS PROVIDED BY FORDING RIVER OPERATIONS (2016).

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PREPARED	AVE
DESIGN	AVE
REVIEW	NEC
APPROVED	JCC

PROJECT

SOUTH AND NORTH TAILINGS PONDS
2019 ANNUAL DAM SAFETY INSPECTION

TITLE

NORTH TAILINGS POND - SLOPE INCLINOMETER DATA AT TH15-07

PROJECT No.	Phase	Rev.	FIGURE
18110785	**1000/1006/2019-159**	**0**	**I-7**

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