



## REPORT

# 2020 Annual Inspection Report

## *Greenhills Operations Tailings Storage Facility*

Submitted to:

**Teck Coal Limited**

Greenhills Operations  
PO Box 5000  
Elkford BC V0B 1H0

Attention: Mr. Andrew Knight, P.Eng.

Submitted by:

**Golder Associates Ltd.**

Suite 200 - 2920 Virtual Way, Vancouver, British Columbia, V5M 0C4, Canada

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## Executive Summary

This report presents the 2020 annual inspection report (previously described as Annual Dam Safety Inspection; DSI) for the Tailings Storage Facility (TSF) at the Teck Coal Limited, Greenhills Operations (GHO) mine site. The site visit was carried out during the week of 1 September 2020. Available instrumentation data were reviewed for a period between 1 August 2019 and 31 August 2020 (the reporting period).

### Summary of Facility Description

The GHO site is an active open pit steelmaking coal mine located 14 km from Elkford, British Columbia. Tailings and process water in the GHO TSF are impounded on the southeast side by the Main Tailings Dam and on the west side by the West Tailings Dam. Both the Main and West Tailings Dams were at an elevation of approximately 1,731 m during the reporting period and are designed and permitted to be raised to an ultimate crest elevation of 1,735 m. Construction of a dam raise to elevation 1,732.5 m was completed in October 2020. The dams are constructed on dense till or bedrock foundation materials and are raised using the downstream method.

The Main Tailings Dam is a zoned earthfill embankment, approximately 50 m high. The downstream shell is constructed from compacted coarse refuse (CR), also known as coarse coal rejects/refuse (CCR), material and supports a 6 to 7 m wide zone of compacted clay till (clay blanket) on the upstream face. The dam has a design upstream slope of 2 horizontal to 1 vertical (2H:1V) and a design downstream slope of 2.5H:1V. CR Site C and D storage facilities are located immediately downstream of the Main Tailings Dam. These storage facilities provide a buttressing effect that is favourable to dam stability but is not required by design. The Main Tailings Dam was designed to meet stability criteria without the buttress.

The West Tailings Dam is a zoned earthfill dam, approximately 25 m high. The West Tailings Dam acts as a saddle dam in a topographic low spot at the northwest end of the TSF and has a similar design and construction to the Main Tailings Dam.

### Summary of Activities

The following activities were completed during the reporting period:

- monthly facility inspections by Teck
- monthly Tailings Management Committee meetings
- monthly instrumentation and data reviews by the EoR including discussion and action planning with Teck, as required
- EPRP tabletop exercise on 27 August 2019
  - an additional tabletop exercise was completed in December 2020, outside of the monitoring period
- Site C seepage collection channel improvements in October 2019
- Independent Tailings Review Board meetings in January and September 2020
- development and implementation of Water Reduction Plan to reduce pond volume (Teck 2020b)

- development of TWRS Management Plan (Golder 2020d)
- update to the TSF and Settling Pond Closure Plan in July 2020
- construction of dam raise to elevation 1,732.5 m was completed in September and October 2020
  - details will be reported in the 2021 annual inspection report

## Summary of Key Hazards

A required component of the annual inspection report is a review of key hazards associated with similar structures in the mine waste industry, after excluding failure modes that are not relevant or not possible for the facility.

The performance is assessed by comparing the design basis against observed dam performance and available data during the monitoring period for each identified failure mode / hazard. The following three hazards/potential failure modes have been identified in the design of the Greenhills TSF and are considered in the assessment of performance compared to the design expectations:

- **Instability**— a mechanism involving movement of a part of the dam (either entirely within the dam or including portions of the foundation materials), as a result of imbalanced forces, with possible loss of integrity of the dam.
  - Investigations have confirmed foundation materials. Analysis and design based on investigated materials indicate factors of safety that exceed the design criteria., including design loads relevant to Extreme consequence structures.
  - Instrumentation data did not indicate conditions likely to present a stability concern such as elevated piezometric levels or increase in displacement rates.
  - No conditions, such as cracks, settling, or bulging of the dams, were observed during the 2020 site visit or monthly inspections that would indicate instability.
- **Overtopping**— a mechanism where the pond level rises above the dam crest level, resulting in flow over the dam that may cause progressive erosion of the dam and uncontrolled release of the pond.
  - The GHO TSF can store storm events up to and including the 72-hour probable maximum flood.
  - Minimum freeboard requirements, from dam crest to the main pond, were established based on Canadian Dam Association Guidelines (CDA 2013).
  - The water level in the pond was within CDA (2013) and HSRC (Ministry of Energy and Mines 2017) requirements for freeboard criteria for the reporting period.
- **Internal erosion** — the formation of voids within a soil caused by the removal of material by hydraulic action from dam seepage.
  - No conditions were observed during the 2020 site visit or monthly inspections that would indicate piping, such as change in seepage rates, presence of fines in seepage, changes in piezometric readings within dam fill or foundations or depressions/sinkholes that would be indicative of internal erosion.

## HSRC Dam Consequence Classification

The Main and West Tailings Dams are classified as High consequence dams, in accordance with CDA (2013). The consequence classifications for the dams have not changed based on this annual inspection report.

## Summary of Significant Changes

There were no significant changes in the operation and performance of the TSF during the reporting period. The performance of the dams during the reporting period was as expected for normal operating conditions. The volume of free water early in the year was larger than the target volume. A water reduction plan was implemented which has returned the pond volume to within the target range in August 2020.

The GHO TSF was observed to be in good condition at the time of the 2020 site inspection. Records indicate that the discharge of tailings into the GHO TSF was consistent with the normal operating conditions.

## Significant Changes in Instrumentation or Visual Monitoring Records

No significant changes were noted during the 2020 site inspection or monthly visual inspections. Some minor erosion of the upstream slope and crest of the Main and West Tailings Dams were observed which require routine maintenance, completed as part of dam raise construction. This minor erosion does not present a dam safety concern.

Reported instrumentation values were assessed by Teck and the EoR on a routine basis during the reporting period or following the occurrence of an alert. Data were assessed for dam safety implications and action plans implanted as required. No instrumentation was observed which suggested a dam safety concern during the reporting period.

## Significant Changes to Stability and/or Surface Water Control

There were no significant changes to dam stability or integrity during the reporting period.

The volume of free water early in the year was larger than the target volume. A water reduction plan was implemented in March 2020 which returned the pond volume to within the target range in August 2020.

The facility achieved the HSRC (Ministry of Energy and Mines 2017) regulatory requirement to have capacity to manage the inflow design storm for a High consequence facility for the entire monitoring period. The facility is typically operated such that it can manage the Probable Maximum Flood (PMF) which is a larger volume than the regulatory requirements. The facility had insufficient capacity to store the PMF from 16 April 2020 to 9 August 2020.

## Operation, Maintenance, and Surveillance Manual and Emergency Preparedness Plan

The current OMS manual was last updated in June 2019 (GHO 2019b). An update of the OMS manual was in progress at the time of this Annual Inspection Report to comply with the guidelines provided by the Mining Association of Canada (MAC 2019), and Teck Resources Limited's revised *Tailings and Water Retaining Structures Guidelines* (Teck Resources 2019).

The emergency preparedness and response plan (EPRP) for the TSF was last updated in 2018 (Standard Practices and Procedures No. 1583, GHO 2019a). An EPRP tabletop exercise was performed in August 2019. From this test, action items were identified that are being included in updated versions of the EPRP

and Trigger Action Response Plan (TARP). Updates to these documents were in progress at the time of this annual inspection report. An EPRP tabletop exercise was also performed in December 2020.

A Risk Register review was completed in two sessions during July and August 2020. No significant changes were made to any TSF failure modes relative to the previous risk assessment.

A draft Tailings and Water Retaining Structures (TWRS) Management Plan was developed in May 2020 (Golder 2020d) to meet the requirements of Teck guidelines for TWRS and the MAC Towards Sustainable Mining (TSM) guidelines for tailings management (MAC 2019).

## Recommendations

Previous deficiencies and recommendations from the 2019 DSI (Golder 2019c) and new deficiencies and recommendations from the 2020 annual facility inspection are presented in Table E-1. Completed items are shown with grey shading.

Table E-1: Previous and New Recommended Actions

ID Number	Deficiency	Potential Dam Safety Hazard	Priority Level	Recommended Action	Target Date	Status as of October 2020
2019-01	Volume of water in TSF is greater than that needed for plant operation.	Increased zone of inundation if failure were to occur	3	Reduce pond volume to less than 350,000 m³	Q4 2020	<b>Complete</b> – Water reduction strategy implemented to reduce pond volume in 2020 freshet.
2020-01 (2019-02)	Seepage weirs: <ul style="list-style-type: none"><li>■ Weir automation equipment is on site and pending installation.</li></ul>	Potentially unstable condition not measured.	3	Install weir automation equipment.	Q3 2020	<b>In progress</b> – Upgrades progressing, completion aimed before winter 2020
2020-02 (2019-03)	Pond against upstream slope of Main Tailings Dam. <ul style="list-style-type: none"><li>■ The pond against the upstream slope of the Main Tailings Dam is consistent with design basis and not a dam safety concern, but there is an opportunity to improve towards best applicable practice by moving the pond away from the upstream slope of the Main Tailings Dam.</li></ul>	Increased potential for piping, and potential increased zone of influence if dam integrity is compromised.	4	Develop and implement strategy to move pond away from upstream slope of the Main Tailings Dam.	Q3 2021	<b>In Progress</b> – Tailings discharge outlet to be relocated along the Main Tailings Dam. Deposition planned in fall/winter 2020.
2020-03 (2019-04)	Ponded water on downstream crest of Site C storage facilities at east abutment of Main Tailings Dam (Photograph 10, Appendix A).	Erosion of downstream shell of CCR storage facilities leading to instability	3	Revise drainage to prevent long-term ponding of surface water.	n/a	<b>In Progress</b> – Area filled with CCR during 2020 construction, surface water currently ponding on Site E access road. Water currently pumped back to TSF, long term drainage plan in development.
2019-05	Closure plan does not meet HSRC requirements.	Operational procedures do not align with closure design; long-term environmental hazards become difficult and costly to mitigate.	3	Develop the current concept level closure plan to align with the current life of mine strategy and HSRC requirements.	n/a	<b>Completed</b> – Updated closure plan issued 17 July 2020 (Golder 2020h).
2020-04 (2019-06)	Golder has recommended additional inundation study modelling of the downstream area, up to Lake Koocanusa.	n/a	3	Update inundation study with additional modelling at the confluence of the Elk River and Fording River, and at Lake Koocanusa.	n/a	<b>In Progress</b> – Draft inundation study issued in April 2020 (Golder 2020f)  Finalization placed on hold pending issuance of the Global International Standards on Tailings Management (GISTM 2020) guidance document.
2020-05 (2019-07)	<ul style="list-style-type: none"><li>■ OMS manual does not reflect:<ul style="list-style-type: none"><li>■ current geotechnical instrumentation details including revised QPOs</li><li>■ revised MAC and Teck guidance documents</li></ul></li><li>■ Multiple coordinate grid systems appear to be used in the OMS manual.</li></ul>	Potential to ineffectively respond to alerts and warnings from geotechnical instrumentation.	3	Update OMS manual to: <ul style="list-style-type: none"><li>■ 2020-05a: remove non-functioning geotechnical instrumentation and update QPOs.</li><li>■ 2020-05b: update based on MAC (2019) and Teck (2019)</li><li>■ 2020-05c: use a single coordinate grid system</li></ul>	Q1 2021	<b>In progress</b>
2020-06	QPO actions are not fully aligned with Teck corporate Emergency Preparedness and Response Plan categories.	Potential to ineffectively respond to alerts and warnings and take required action.	4	Update QPO categories to align with Teck ERP categories	Q1 2021	<b>In progress</b>

Priority Level	Description
1	A high probability or actual 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 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 safety issues.
4	Best Management Practice – Further improvements are necessary to meet industry best practices or reduce potential risks.

## Abbreviations

Abbreviation	Definition
CDA	Canadian Dam Association
CRD	cumulative relative displacement
CR	Coarse Refuse (also known as Coarse Coal Refuse/Rejects; CCR)
DSR	dam safety review
EoR	Engineer of Record
EPRP	Emergency Preparedness and Response Plan
FRO	Fording River Operations
GHO	Greenhills Operations
Golder	Golder Associates Ltd.
HSRC	Health, Safety and Reclamation Code
IDF	inflow design flood
ITRB	Independent Tailings Review Board
MAC	Mining Association of Canada
Ministry of Energy and Mines	British Columbia Ministry of Energy and Mines. Now known as the British Columbia Ministry of Energy, Mines and Low Carbon Innovation (EMLI)
PMF	Probable Maximum Flood
OMS	Operation, Maintenance and Surveillance
QPO	Quantifiable Performance Objective
TSF	Tailings Storage Facility
Teck	Teck Coal Limited
TWRS	Tailings and Water Retaining Structures
VWP	Vibrating Wire Piezometer



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**APPENDICES****APPENDIX A**

2020 Site Inspection Photos

**APPENDIX B**

September 2020 Annual Golder Inspection Reports

**APPENDIX C**

TSF Registry

**APPENDIX D**

GPS &amp; Prism Plots

**APPENDIX E**

Vibrating Wire Piezometer Data

## 1.0 INTRODUCTION

### 1.1 Purpose, Scope of Work, Method

At the request of Teck Coal Limited (Teck), Greenhills Operations (GHO), Golder Associates Ltd. (Golder) has completed the 2020 annual inspection report for the GHO tailings storage facility (TSF), which includes the Main Tailings Dam and West Tailings Dam.

This report is based on a site visit carried out by the Engineer of Record (EoR) during the week of 1 September 2020, which included a walkover of the TSF area with GHO staff involved in the maintenance, operation, and surveillance of the facility, as well as a review of site data, including available instrumentation data from 1 August 2019 through 31 August 2020 (the reporting period).

This report consists of the following:

- a summary of site conditions and background information
- a summary of construction, operating, and/or maintenance activities for the reporting period
- site photographs and records of dam inspection
- review of:
  - available instrumentation data
  - dam consequence classification
  - required operational documents
  - climate data
  - water balance
  - dam safety relative to potential failure modes
- findings and recommended actions

Photographs of the TSF are presented in Appendix A. A summary of observations made during the September site visit is included in Appendix B.

This report is to be read in conjunction with the Study Limitations, which follows the text.

### 1.2 Regulatory Requirements

#### 1.2.1 BC Health, Safety and Reclamation Code

The GHO TSF is regulated under the Health, Safety, and Reclamation Code (HSRC) for Mines in British Columbia (Ministry of Energy and Mines 2017). It is noted that the 2021 release of the HSRC will apply to the 2021 monitoring period.

This annual inspection report has been prepared in accordance with the requirements of the HSRC (Ministry of Energy and Mines 2017) and in consideration of the guidelines for annual reports provided in the HSRC Guidance Document (Ministry of Energy and Mines 2016) and Teck Resources Limited's *Guideline for Tailings and Water Retaining Structures* (Teck Resources 2019). It is understood that this report will be submitted by Teck to the Chief Inspector of Mines for British Columbia.

## 1.2.2 Permits and Licences

Specific permits, including amendments, and licences that apply to the TSF, include:

- C-137 Permit (issued by Ministry of Energy and Mines 1993 and 2010)
- C-137 Permit Amendment of 15 September 2014, Approving Main and West Tailings Dam Raises and Boundary Amendment
- Environmental Management Act Permit PE-6248, 16 October 2017 (BC Ministry of Environment)



## 2.0 BACKGROUND

The GHO site is an active open pit steelmaking coal mine located 14 km north of Elkford, BC. The GHO site plan including the location of the TSF is shown in Figure 1.

The mine was started by Westar Mining Ltd. with production between 1982 and 1992, after which the site was temporarily inactive. In December 1993, mine ownership changed to a joint venture between Fording Coal Limited (Fording) and Pohang Steel Canada Ltd., and the mine was operated by Fording. The operating company changed from Fording to Elk Valley Coal Corporation in 2003 and then to Teck Coal Limited in 2008.

### 2.1 Overview of Operations

Raw coal from the open pit is processed at the wash plant to produce marketable steelmaking coal with by-product streams of coarse refuse (CR), also known as coarse coal rejects/refuse (CCR), and fine refuse tailings. The CCR is unsaturated and comprises 50 mm minus gravel- to sand-sized rock and coal particles. CR is transported, dumped, and stored near the wash plant in stockpiles (Sites A to E, Figure 2). The fine refuse stream consists of a slurry of coal and rock particles (tailings). The tailings are silt sized with a  $D_{50}$  (diameter of the particle that 50% of a material by mass is smaller than) of around 0.2 mm. Tailings are discharged from the wash plant on the west side from where they are transported, by gravity, to the TSF discharge point, located on the north side of the TSF (Figure 2). Tailings in the 2019/2020 monitoring period were discharged at an approximate solids content of between 2 and 39% by mass (Teck 2020a), but typically around 20% solids content, resulting in an approximate dry density of 1.13 t/m<sup>3</sup> (GHO 2019b).

Approximately 500,000 m<sup>3</sup> of tailings solids are deposited annually (Golder 2018). Slurry water is collected in a pond and, following a period of time to allow solid particle settlement, the clarified water is re-circulated by barge pumps to the wash plant for reuse.

### 2.2 Greenhills Tailings Storage Facility

Tailings and process water in the GHO TSF are impounded on the southeast side by the Main Tailings Dam and on the west side by the West Tailings Dam as shown in Figure 2. Both the Main and West Tailings Dams were at an elevation of approximately 1,731.1 m during the reporting period and are designed and permitted to be raised to an ultimate crest elevation of 1,735 m. Construction of a dam raise to an elevation of 1,732.5 m was completed in October 2020.

The 2020 bathymetric survey indicates that the deepest point of the impoundment area is approximately 40 m south of the barge at an elevation of approximately 1,722.8 m, which corresponded to a pond depth of about 6.5 m at the time of the survey. This is an operational consideration and does not impact dam safety.

### 2.3 Subsurface Conditions

Details of subsurface conditions prior to the construction of the Main and West Tailings Dams are provided in the following sections.

#### Main Tailings Dam

A geotechnical investigation was conducted by Hardy Associates (1978) Ltd. (Hardy) during 1980 (Hardy 1980) to assess the subsurface conditions within the footprint of the Main Tailings Dam foundation. Dam foundation materials generally comprise a surficial layer of colluvium overlying glacial till which overlies shale bedrock. The colluvium layer beneath the starter dam was approximately 1.5 m thick, although it was assumed that up to 8 m of colluvium may be encountered on steep slopes. The colluvium comprises a mixture of clay, sand,

and gravel. The consistency of colluvium comprising primarily clay materials was described as soft to stiff. The consistency of colluvium comprising primarily gravel or sand was described as very dense.

At the west end of the dam footprint, muskeg was found overlying the colluvium. The muskeg was observed to be soft, highly compressible, and up to 3 m thick.

Hard subsoil (glacial till) was found to underlie the colluvium, and shale bedrock was encountered in two boreholes at depths of 12.5 and 12.2 m. The remaining 14 boreholes were terminated within the glacial till. Stability analyses indicated that soft colluvial clay with an undrained shear strength ( $s_u$ ) less than 35 kPa was to be stripped from the foundation during preparation (Hardy 1980).

A geotechnical drilling program was conducted by Golder from October to December 2016 (Golder 2017e) to assess foundation conditions at the Main Tailings Dam and Site C with the objective of estimating the extent of any remaining unsuitable or soft materials. This investigation did not encounter soft colluvial clays, and anecdotal discussions confirm that weak materials were removed during construction.

Subsurface conditions generally consisted of a 3.1 to 56.8 m thick layer of cohesive glacial till underlain by fine-grained sedimentary rock. The fines content, by mass, of recovered glacial till samples ranged from 31% to 74%, with an average of 54%. The gravimetric water content of recovered glacial till samples ranged from 5.3% to 29.9%, with an average of 14%. Large capacity direct shear tests were performed on combined samples of glacial till. Results indicated a drained peak friction angle of 22° and a drained peak apparent cohesion intercept of 142 kPa. One multistage triaxial test, conducted on a Shelby tube sample of glacial till, resulted in an approximate drained peak friction angle of 32° and apparent peak cohesion intercept of 50 kPa.

## West Tailings Dam

Initial foundation investigations were carried out by Golder in March 1992 and July 1993 (Golder 1993). Prior to construction, a mine access road was present within what would become the West Tailings Dam footprint. The road embankment fill material was up to 8.8 m thick and comprised dense sand and gravel, with zones of loose to compact clayey silt. It was assumed that the embankment was initially constructed with locally excavated colluvium and till, and later raised with sand and gravel. During investigations, boreholes were drilled to the east of the access road and encountered moist to wet, soft to firm clayey silt with zones of rootlets and wooded debris up to 1.8 and 4.9 m below surface. Dense to very dense glacial till consisting of a clayey silt with gravel and cobbles was found underlying the colluvium. Three of the investigation locations terminated in siltstone bedrock at depths of between 0.6 m (at the south abutment) and 11.3 m (at the road embankment).

Additional site investigations were carried out in 2013 (Golder 2014a) as part of designs for raising the West Tailings Dam to an elevation of 1,735 m. Topsoil was encountered in some locations with thickness between 0.2 m and 0.5 m, and consisted of organic root materials, and organic silt or fine sand. Colluvial deposits were of variable thickness and included sandy silty clays and gravelly silty sands with gravimetric water contents ranging from 1% to 26%. Glacial till was also encountered in varying thicknesses between 0.8 and 2.8 m below ground surface. The glacial till was highly variable, ranging from silty clay to gravelly sand and sandy silty clay; the consistency was described as hard with gravimetric water content ranging from 9% to 21%. Weathered claystone and siltstone were encountered below the glacial till.

The West Tailings Dam is located in a topographic low area, and peat and buried wood debris was excavated as part of initial dam construction to expose the stiff clay till and bedrock. These excavation areas were backfilled with 1.0 to 1.5 m of selected reject rock to promote drainage, as shown in cross-section in Figure 5 (Golder 1999).

Early dam construction data indicates that surfaces receiving dam fill were stripped of deleterious materials, and that the upstream clay blanket was keyed into natural ground. Reports also indicate dam abutments were prepared by excavating to dense till at the north abutment and to weathered siltstone at the south abutment. Unsuitable materials were removed from the footprint of the downstream shell of the dam during dam raise construction in 2014 to expose dense till.

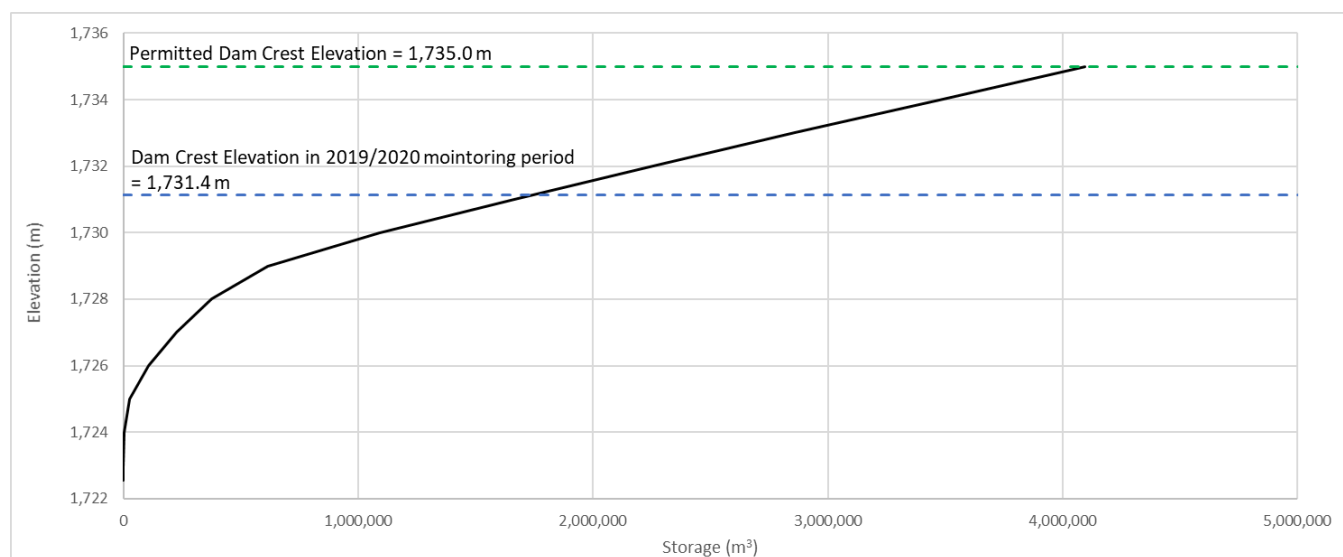
## 2.4 Overview of Design and Construction

The construction of the Main Tailings Dam began in 1982, and deposition of slurry tailings into the TSF began in 1983. The original design of the Main Tailings Dam, to crest elevation 1,706 m, was provided by Hardy for the former mine owner Westar Mining Ltd. (Hardy 1980).

A design for the West Tailings Dam was completed by Golder (Golder 1993) and construction of the dam began the same year.

A design to raise the crest of the Main and West Tailings Dams to an elevation of 1,725 m was completed in January 1994 (Golder 1994). A further design to raise the Main and West Tailings Dams to an elevation of 1,735 m (current permitted elevation) were completed by Golder in 2005 and 2014, respectively (Golder 2005, 2014a).

The TSF embankments are routinely raised during the development of the mine. During the 2019/2020 reporting period the minimum crest elevation was approximately 1,731.1 m. The facility is currently permitted to a maximum crest elevation of 1,735 m. Based on the 2020 bathymetric survey, it is estimated that a total struck level storage volume, without allowance for freeboard or beach angles, of approximately 4.1 million m<sup>3</sup> is available to elevation 1,735 m (as shown in Illustration 1).



**Illustration 1: Storage Capacity Curve for Elevations above Surface Surveyed in 2020 Bathymetry Survey**

## Main Tailings Dam

The Main Tailings Dam is a zoned earthfill embankment with an approximate height of 50 m above original ground surface. The dam shell is composed of compacted CR material, with a 6 to 7 m wide zone of compacted clay till (clay blanket) on the upstream face. The CR is filter compatible with the clay blanket. The design geometry of the Main Tailings Dam is outlined in the 2005 design report (Golder 2005) and the dam was designed with an upstream slope of 2H:1V and downstream slope of 2.5H:1V; cross-sections are provided in Figure 4. The ultimate crest width, at an elevation of 1,735 m, is 12 m. CR storage facilities Site C and D are located adjacent to the Main Tailings Dam. These storage facilities provide a buttressing effect that is favourable to dam stability but is not required by design. The Main Tailings Dam was designed to meet stability criteria without the buttress. The Main Tailings Dam has been raised in stages since 1983, as summarized in Table 1.

**Table 1: Main Tailings Dam Construction Summary**

Year	Construction	Dam Crest Elevation (m)	References
1982–1983	Starter dam, piezometers installed	1,687	Hardy 1980, 1984
1984–1985	Raise	1,695	No documentation
1986	Raise, piezometers damage, 10 pneumatic piezometers installed	1,699	Hardy 1987
1987	Coarse refuse shell raised, French drains installed beneath shell	1,700.00	Hardy 1988
1988	Rock drains (French drain) below CR	No change	Westar 1988
1989	Raise	1,702.00	Golder 1989
1990	Raise	1,704.00	Golder 1990
1991	Raise	1,707.00	Golder 1992
1994	Coarse refuse shell raised	1,710.00	Golder 1995
1995	Raise, 3 standpipe piezometers installed	1,712.00	Golder 1996
1996	Coarse refuse shell raised	1,718.00	Golder 1997
1997	Blanket to elevation 1,718 m, CCR shell raise, rock drains extended beneath Site C and Site D CR storage facilities	1,720.00	Golder 1998
2003	Raise	1,720.10	Golder 2004
2009	Raise	1,723.00	Golder 2010a
2010	Raise	1,724.60	Golder 2010b
2011	5 vibrating wire piezometer locations (2 sensors in each location)	No change	Golder 2012a
2014	Raise	1,727.45	Golder 2015
2015	Raise	1,727.58	Golder 2016a
2017	Raise	1,728.85	Golder 2017e
2018	Raise; additional instrumentation installed	1,731.14	Golder 2019a
2020	Raise	1,732.50	Golder 2020e

Geotechnical instrumentation installed to monitor the Main Tailings Dam that was operational during the 2019/2020 reporting period, is summarized in Table 2. Locations are shown in Figure 3.

**Table 2: Summary of Main Tailings Dam Instrumentation**

Instrumentation Type	Number	Comments
Vibrating Wire Piezometers (VWPs)	21	<ul style="list-style-type: none"> <li>Each VWP location (Figure 3), has two VWPs, except for SD-16-04, which has one.</li> </ul>
GPS units <sup>(a)</sup>	7	Two GPS units (319 and 320) are located along the downstream slope of Site C. Five units are positioned along the crest of Main Tailings Dam (MD_ROVER series).
Survey prisms	8	Prisms A to H are located on the centreline of Main Tailings Dam crest.
V-notch weir	1	One V-notch weir is located at the toe of Site C.
Inclinometer casing	2	Two boreholes were established during 2016, and inclinometer casing is installed at two locations downstream of the Main Tailings Dam on Sites C and D. The bottom of each casing is anchored in bedrock.

(a) An additional GPS (313) is located on the pond reclaim barge to record tailings pond elevation.

Monitoring of VWP VW11-MD-2B was discontinued in October 2019, after malfunctioning (not reporting data). The need for a replacement will be evaluated for dam raises above 1,735 m.

## West Tailings Dam

The West Tailings Dam is a zoned earthfill embankment similar in design to the Main Tailings Dam. The downstream shell is constructed from CCR and has a 6 m wide clay blanket on the upstream face. The West Tailings Dam has a maximum height of approximately 25 m above original ground. The main mine access road is located to the west of the West Tailings Dam.

The West Tailings Dam has an upstream slope of 2H:1V and a downstream slope of 2.5H:1V; cross-sections are provided in Figure 5. The original design had included a relatively wide 40 m crest width, to provide access for haul trucks to the adjacent CR storage facilities. This criterion was revised as part of the 2020 dam raise construction (Golder 2020e) to reduce the minimum width to 12 m.

Design drawings to raise the Main and West Tailings Dams to a crest elevation of 1,728 m were completed in May and June of 2014. The design included an enlarged West Tailings Dam footprint to support a future raise of the dam to an ultimate crest elevation of 1,735 m (Golder 2014b,c). The construction history of the West Tailings Dam is summarized in Table 3.

**Table 3: West Tailings Dam Construction Summary**

Year	Construction	Elevation (m)	References
1993	Raise as blanket on mine road	1,711.00	Golder 1993
1996	Raise as blanket on mine road	1,714.30	Golder 1997
1998	Foundation preparation of till and bedrock for dam footprint to elev. 1,725 m	No change	Golder 1999
1999	Raise, mine road relocated to west	1,719.10	Golder 2000
2004	Raise	1,721.60	No documentation
2010	Raise	1,724.80	Golder 2010a
2011	5 vibrating wire piezometers (2 sensors in each of 3 locations) installed	No change	Golder 2012a
2014	Raise, mine road relocated to west, foundation materials stripped to the footprint of the elev. 1,735 m shell	1,726.60	Golder 2015
2015	Raise	1,728.07	Golder 2016a
2016	Extension of the downstream portion of the West Tailings Dam	No change	Golder 2017b
2017	Raise	1,728.73	Golder 2017e
2018	Raise; additional instrumentation installed	1,731.14	Golder 2019a
2020	Raise	1,732.50	Golder 2020e

Geotechnical instrumentation, installed to monitor the West Tailings Dam and operational during the 2019/2020 monitoring period, is summarized in Table 4. Locations are shown in Figure 3.

**Table 4: Summary of West Tailings Dam Instrumentation**

Instrumentation Type	Number	Comments
Vibrating Wire Piezometers (VWPs)	6	Each location has two VWPs (Figure 3).
GPS units	3	Three GPS monitoring units are located on the crest of the West Tailings Dam (WD_ROVER series).
Survey prisms	5	Prisms I to M are located on the centreline of the West Tailings Dam crest.
V-Notch Weir	1	One V-notch weir is located at the toe of West Tailings Dam.



## 2.5 Material Properties

The material properties are provided in Table 5. These properties are based on geotechnical investigations of the Main Tailings Dam (Golder 2017e) and West Tailings Dam (Golder 2014a).

**Table 5: Design Material Properties**

Material	Unit Weight (kN/m <sup>3</sup> )	Peak Drained Apparent Cohesion Intercept (kPa)	Peak Drained Friction Angle (degrees)
Colluvial silty clay (West Tailings Dam)	17.3	0	26
Glacial till (West Tailings Dam)	21.2	0	32.5
Glacial till (Main Tailings Dam)	19.0	50	32
Clay blanket	21.5	50	n/a
Compacted coarse refuse	18.0	0	40
Uncompacted coarse refuse	17.0	0	37
Weathered bedrock	25.0	300	n/a

kN/m<sup>3</sup> = kilonewtons per cubic metre; kPa = kilopascal; n/a = not applicable.

## 2.6 Site Seismicity

GHO is located in an area of low seismic risk. Golder has developed a seismic hazard model for GHO based on historical seismicity and a review of geologic and paleoseismological features (Golder 2016b). The model incorporates data from the 5<sup>th</sup> Generation Seismic Hazard Model, including nine faults and fault segments mapped in northwest Montana. The 5<sup>th</sup> Generation Seismic Hazard Model was developed by Natural Resources Canada for use in the 2015 National Building Code of Canada (NRCC 2015).

Based on Golder's understanding of foundation conditions and using the 2015 National Building Code of Canada seismic hazard calculator (NRC 2015) a peak ground acceleration for GHO was estimated for various event return periods assuming Class C soil in the dam foundations. The results of seismic probabilistic analysis from the site hazard model are presented in Table 6.

**Table 6: 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 2015 National Building Code of Canada (NRCC 2015).

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

The Canadian Dam Association (CDA 2013) recommends a seismic event with a return period of 1 in 2,475 years be adopted for High consequence structures such as the GHO TSF dams, which corresponds to a peak ground acceleration of 0.158 g.

## 2.7 Key Operational Components

Key operational components of the GHO TSF are:

- visual inspections
- geotechnical instrumentation, including NavStar GeoExplorer software program
- process water reclaim and circulation
- dam raise construction

Geotechnical instrumentation is routinely monitored and assessed using the NavStar GeoExplorer software. Instruments are either read manually and uploaded to the software, or data are transmitted remotely to the software in real time. GHO and EoR staff receive email alerts when thresholds are triggered.

Visual inspections are carried out monthly by GHO, and observations are recorded and communicated to the EoR team. The EoR and GHO teams review the observations and instrumentation data monthly and collaboratively identify deficiencies and determine action plans.

The GHO team monitors the pond water elevation using a GPS unit located on the process water reclaim pump as well as a pan, tilt, zoom camera located at the process plant which can view the visual pond level indicator. The elevation of the tailings pond is recorded remotely and monitored in real time using GeoExplorer.

Dam raises are carried out following the development of construction drawings and specifications. Full-time quality control and assurance is maintained throughout the construction works.

## 2.8 Key Personnel

Key personnel associated with the GHO TSF during the 2019/2020 operating period are:

- the TSF Qualified Person: Andrew Knight, P.Eng., an employee of GHO
- the GHO Tailings Engineer in Training: David Walker, E.I.T., an employee of GHO
- the EoR: Andy Haynes, P.Eng., an employee of Golder

## 2.9 HSRC Facility 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 CDA (2013) *Dam Safety Guidelines*. As noted earlier, the design criteria for this facility exceed those derived from the HSRC classification.

Dam consequence classification is based on incremental losses that a hypothetical failure of the dam may inflict on downstream or upstream areas, or at the dam location itself irrespective of the potential for such an event to occur. 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 hypothetical dam failure are ranked as Low, Significant, High, Very High, or Extreme for each of four loss categories. The classification assigned to a dam is the highest rank determined among the four loss categories, as shown in Table 7 (GHO TSF classification is shaded grey).

**Table 7: Dam Consequence Classification Criteria Summary**

Dam Class	Population at Risk <sup>(a)</sup>	Incremental Losses		
		Loss of Life <sup>(b)</sup>	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	Minimal short-term loss or no long-term loss.	Low economic losses; area contains limited infrastructure or service.
Significant	Temporary Only	The appropriate level of safety required depends on the number of people, the exposure time, the nature of their activity, 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	10 or fewer	<ul style="list-style-type: none"> <li>Significant loss or deterioration of important fish or wildlife habitat.</li> <li>Restoration or compensation in kind highly possible.</li> </ul>	High economic losses affecting infrastructure, public transport, and commercial facilities.
Very High	Permanent	100 or fewer	<ul style="list-style-type: none"> <li>Significant loss or deterioration of critical fish or wildlife habitat.</li> <li>Restoration or compensation in kind possible but impractical.</li> </ul>	Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances).
Extreme	Permanent	More than 100	<ul style="list-style-type: none"> <li>Major loss of critical fish or wildlife habitat.</li> <li>Restoration or compensation in kind impossible.</li> </ul>	Extreme losses affecting critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances).

Based on the current facility risk assessment (Wood 2018), the GHO TSF is classified as a High consequence structure based on the following rationale:

- **Population at risk (High consequence)**—There is a permanent population in the towns of the Elk River valley, which are within the inundation zone.
- **Loss of life (High consequence)**—The loss of life is expected to be less than 10 if failure of the dams were to occur.
- **Environmental and cultural values (High consequence)**—Significant impact to the environment is possible should the containment fail, resulting in a release of tailings from the facility. This has the potential to impact important fish or wildlife habitat. Restoration or compensation in species is considered possible.

- **Infrastructure and economics (High consequence)**—High infrastructure and economic losses considering the impact to third parties including communities beyond the limit of the mine. Economics losses could be high for the mine due to loss of infrastructure including access road.

An inundation study for a hypothetical breach of the TSF was completed by Golder in 2012 (Golder 2012b) and updated in 2016 (Golder 2017c). The 2016 study included the assessment of overtopping or internal erosion of the Main Tailings Dam and assessed overtopping of the West Tailings Dam.

A Risk Register review was completed in two sessions during July and August 2020. No significant changes were made to any TSF failure modes.

## 2.10 Quantifiable Performance Objectives

A geotechnical instrumentation and monitoring program is in place to monitor the stability of the TSF, including survey prisms, GPS units, and inclinometer surveys to monitor for displacement and VWP to monitor piezometric levels within the dams and groundwater elevations in the foundations.

Quantifiable performance objectives (QPOs) have been developed and form part of Teck Resources Limited's risk management policy for tailings and water retaining structures (Teck Resources 2019). The intention of the QPOs is to provide early warning indications of changing conditions that may affect the safe and effective management of the TSF. QPOs were reviewed and, if required, updated in 2020 based on recommendations from the EoR (Golder 2020b). These revised QPOs were used as the basis for assessing performance in the 2019/2020 reporting period. Updated QPOs are planned for inclusion in an updated operation, maintenance, and surveillance (OMS) manual, currently in progress.

QPOs for the VWPs are set based on deviations from historic measurements that may be indicative of changing conditions within the dam or specified phreatic surface elevations assessed during stability analyses. QPOs for the survey prisms are set based on cumulative relative displacement (CRD), i.e., the total three-dimensional displacement from the initial location when the prism was first surveyed within the reporting period. QPOs for V-notch weirs are set deviations from historical data. Freeboard QPOs are set based on operational considerations, storage of the 72-hour Probable Maximum Flood (PMF), and Inflow Design Flood (IDF).

The QPOs are provided in Sections 2.10.1 to 2.10.3. A comparison between observed conditions during the reporting period and the QPOs are presented in the following sections:

- Section 5.5.1: instability—prisms and VWPs
- Section 5.5.2: overtopping—freeboard
- Section 5.5.3: internal erosion— V-notch weirs

## 2.10.1 Instability Monitoring

### Surface Displacement Monitoring

Surface displacement monitoring of the dams at the GHO TSF consists of GPS units and survey prisms. The locations of surface displacement instrumentation are presented in Figure 3. Data in this annual inspection report are focused on the comparison of long-term trends in data.

Survey prisms were installed during September 2015 to monitor for deformation and establish displacement trends. Prisms are spaced at approximately 100 m intervals along the centreline of the Main and West tailings dam crests and are relocated/reset following each dam raise. Prism QPOs were established in 2017 (Golder 2017a) and last updated in 2020 (Golder 2020b). QPOs for the survey prisms are summarized in Table 8.

**Table 8: Survey Prism Quantifiable Performance Objectives**

Measurement	Green Notification	Yellow Warning
Cumulative relative displacement (CRD) (m total annually)	0.1	0.2

GPS units on the Site C CCR spoil were installed in October 2012. During August 2017 additional GPS units were installed on the Main and West Tailings Dams. Data from the GPS units are recorded hourly and remotely uploaded to GeoExplorer software. QPOs for the GPS units were removed as part of the 2020 update due to high variability in short-term measurements. GPS units continue to be monitored for the purpose of establishing and comparing long-term trends in data for use in determining potential indicators of instability.

### Inclinometers

Inclinometer casings (SD-16-04 and SD-16-05) were installed in the Main Tailings Dam during the 2016 geotechnical investigation (Golder 2017d). Locations of inclinometer casings are presented in Figure 3.

Golder completed a review of inclinometer data, collected monthly, up to February 2020, with the aim of establishing a baseline data set. Based on this data review, the EoR recommended that the frequency of routine inclinometer surveys be revised to a minimum of one survey per year (Golder 2020c). Additional surveys were also recommended, as follows:

- Following yellow warning exceedance by survey prisms or vibrating wire piezometers.
- Before and after dam construction.
- If visual observations indicated signs of slope movement or deformation.

If a yellow warning is triggered in survey monuments, or deformation is visually observed, an inclinometer survey will be completed, and the data used as part of an assessment of potential conditions in the Main Tailings Dam.

### Vibrating Wire Piezometers

VWPs were installed during 2011 in the Main and West Tailings Dams (MD and WD series, respectively). Additional VWPs were installed in the Main Tailings Dam and Site C and D CCR storage facilities in 2016 (SD series). The locations of VWPs are presented in Figure 3.

Data from the MD, SD and WD series piezometers are automated and uploaded directly into GeoExplorer.

QPOs were updated for all the VWP in 2020 (Golder 2020b). The green notification levels are set based on deviations from historical averages. The yellow warning levels are set based on phreatic surfaces that would decrease the factor of safety below the minimum criteria (Golder 2017a). VWP QPOs are summarized in Table 9.

**Table 9: Vibrating Wire Piezometer Quantifiable Performance Objectives**

Dam	Vibrating Wire Piezometer	Green Notification		Yellow Warning
		Minimum Phreatic Surface Elevation (m)	Maximum Phreatic Surface Elevation (m)	Maximum Phreatic Surface Elevation (m)
Main Tailings Dam	VW11-MD-2A	1,691.0	1,695.0	1,724.0
	VW11-MD-3A	1,686.0	1,690.0	
	VW11-MD-3B	1,687.3	1,691.3	
	VW11-MD-4A	1,685.0	1,689.0	
	VW11-MD-5A	1,681.9	1,685.9	
	VW11-MD-5B	1,682.4	1,686.4	
	SD-16-01A	n/a <sup>(a)</sup>	1,693.3	1,713.5
	SD-16-02A	n/a <sup>(a)</sup>	1,695.6	1,708.0
	SD-16-03A	n/a <sup>(a)</sup>	1,693.4	1,713.5
	SD-16-04	1,674.1	1,678.1	1,710.0
	SD-16-05A	n/a <sup>(a)</sup>	1,690.2	1,710.5
	SD-16-06A	n/a <sup>(a)</sup>	n/a <sup>(b)</sup>	1,710.0
	SD-16-07A	n/a <sup>(a)</sup>	1,660.7	1,686.5
	SD-16-08A	n/a <sup>(a)</sup>	1,677.4	1,686.5
West Tailings Dam	VW11-WD-1A	1,711.3	1,714.8	n/a <sup>(c)</sup>
	VW11-WD-1B	n/a <sup>(a)</sup>	1,716.1	
	VW11-WD-2A	1,712.9	1,715.1	
	VW11-WD-2B	1,715.7	1,717.9	
	VW11-WD-3A	1,715.4	1,717.7	
	VW11-WD-3B	1,716.1	1,718.4	

(a) No lower QPO set – average phreatic surface was recorded as dry during the 2019 DSI reporting period.

(b) No QPO. Maximum phreatic surface elevation is defined by stability analysis not variation from tip elevation.

(c) No QPO set as no credible phreatic surface results in minimum factor of safety criterion for stability.



### 2.10.2 Tailings Pond Level

The elevation of the tailings pond is controlled by the reclaim barge which recirculates water from the facility to the wash plant for use in processing. The tailings pond elevation is monitored by GPS Unit 313, which is mounted on the reclaim barge, and by a visual indicator. Pond level QPOs are summarized in Table 10.

**Table 10: Freeboard Quantifiable Performance Objectives**

Measurement	Green Notification	Yellow Warning	Red Alarm
Freeboard (m)	2.0	1.3	0.5

QPOs were developed on the following basis:

- **Green notification**—adopted operational freeboard which enables the storage of the 72-hour probable maximum flood, which corresponds to Teck's typical operating freeboard criterion.
- **Yellow warning**—minimum freeboard as defined by CDA (2013) guidelines to contain the 72-hour inflow design flood (IDF) for a 1/3 between the 1-in-1,000-year event and the probable maximum flood, including allowance for wave-uprush, in accordance with HSRC (Ministry of Energy and Mines 2017) requirements for a high consequence classification facility.
- **Red alarm**—Approaching overtopping.

A visual indicator was installed in 2017 on the crest of the Main Tailings Dam to complement electronic monitoring and provide a basis for visual confirmation of facility freeboard (Photos 8 and 9 in Appendix A). This indicator is viewable from the crest of the Main Tailings Dam and a camera located on the process plant.

### 2.10.3 Seepage

V-notch weirs are located downstream of the Main Tailings Dam at the toe of Site C (Site C Weir), and downstream of the West Tailings Dam (West Dam Weir). Weir locations are shown in Figure 3. Manual measurements are taken monthly, when accessible, and data uploaded to GeoExplorer for notification and tracking.

Seepage from the Main Tailings Dam is collected by rock drains that were installed through the Site C and D CCR stockpile footprints in 1996. These rock drains consist of geotextile-wrapped crushed limestone (Golder 2019a). Seepage at the toe of the Site C is collected in a seepage collection channel, at the end of which the Site C Weir monitors discharge.

The West Dam Weir monitors discharge through a seepage ditch downstream from the dam toe.

QPOs for the weirs were updated in 2020 based on historical data (Golder 2020b) and are summarized in Table 11.

**Table 11: Seepage Weir Quantifiable Performance Objectives**

Instrument	Green Notification		Yellow Warning Flow (L/s)
	Minimum Flow (L/s)	Maximum Flow (L/s)	
Site C Weir	0.2	5.0	10.0
West Dam Weir	0.0	1.5	3.0

### **3.0 OPERATIONS, MAINTENANCE, AND CONSTRUCTION DURING 2019/2020**

During the reporting period GHO staff carried out monthly visual inspections of the TSF. Observations during the inspection were recorded and reviewed by GHO and the EoR team monthly.

#### **3.1 Tailings Storage Facility and Operations**

GHO tracks in-place tailings volume through bathymetric surveys. These bathymetric surveys, in conjunction with LiDAR surveys, are used to estimate the volume of tailings deposited in the TSF. Based on a comparison between the 2020 (21 July 2020) and 2019 (17 October 2019) bathymetric surveys approximately 500,000 m<sup>3</sup> of tailings were deposited in the 9-month period between 17 October 2019 and 21 July 2020.

#### **3.2 Maintenance**

Maintenance and repair of instrumentation during the reporting period was routine and consisted of rectifying minor deficiencies, which are typical for the normal operation of tailings dams.

#### **3.3 Construction**

Prior to the 2019/2020 reporting period the GHO TSF dams were raised in 2018 to an elevation of approximately 1,731 m as reported in the 2018 DSI (Golder 2019b) and the construction record (Golder 2019a). Construction of a dam raise to an elevation of 1,732.5 m was completed in September and October 2020. The construction is documented in the 2021 construction record report (Golder 2021), which was in draft at the time of this report. Maintenance of minor erosion on the upstream face and crest of the Main and West Tailings Dams was also completed during the 2020 construction program.

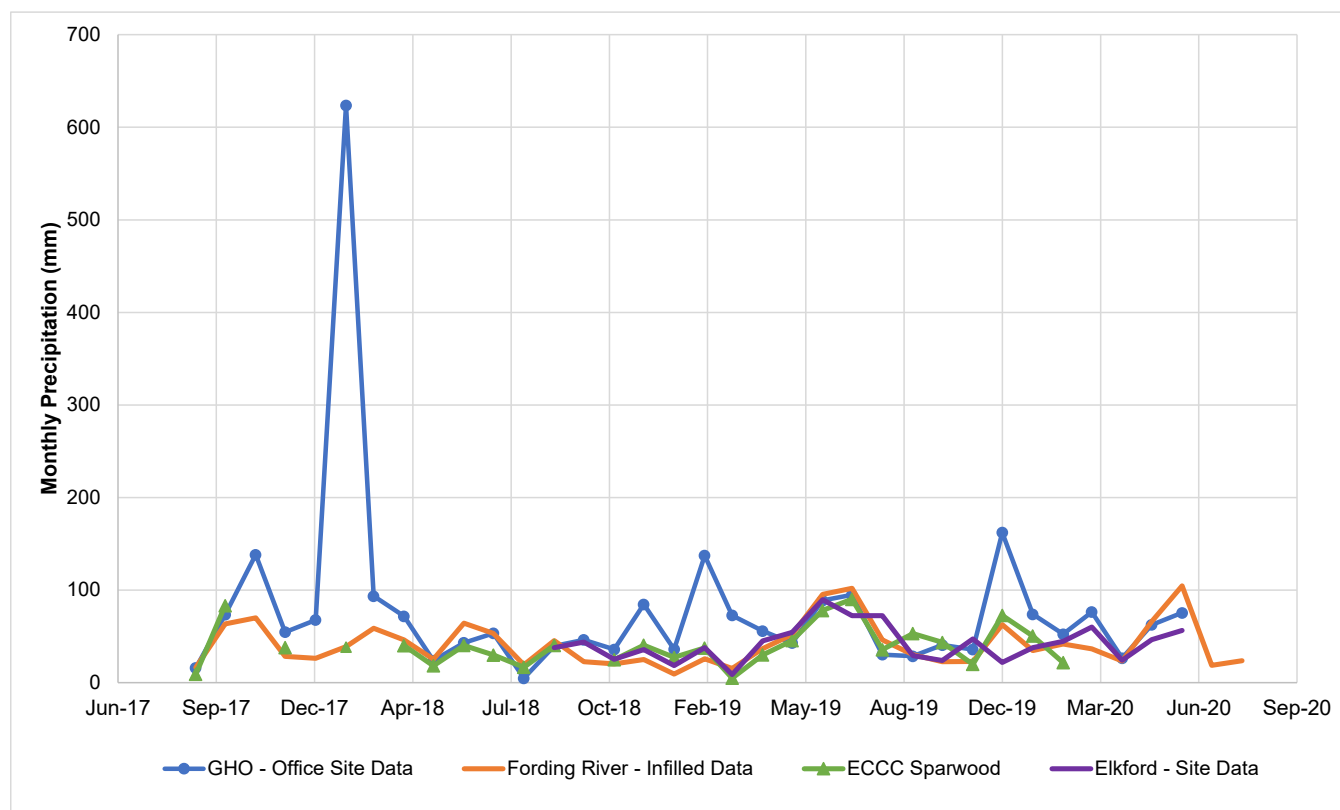
Repair of the SmartDitch seepage collection channel at the Site C toe was repaired in October 2019 (Teck 2019).

## 4.0 REVIEW OF CLIMATE DATA, WATER BALANCE, AND TAILINGS STORAGE FACILITY REGISTRY

### 4.1 Climatic Review

Precipitation data collected at the GHO Office climate station were provided by GHO. The data provided were reviewed and found to be unreliable when compared to nearby climate data (Teck Fording River synthetic dataset, known as Fording River Cominco, Environment and Climate Change Canada station at Sparwood [Climate #1157630], and measured site data at Elkford). Precipitation data from September 2017 to August 2020, from the various data sources, are compared in Illustration 2, and identified anomalies were:

- Monthly total precipitation at the GHO Office station shows a different trend to nearby climate data for the same period, especially during the winter season from October to April.
- Total recorded precipitation at the GHO Office station for December 2019, January 2020, and March 2020 was significantly higher than the values obtained from nearby climate stations for the reporting period.



Note: GHO Office data were provided to Golder up to the end of June 2020.

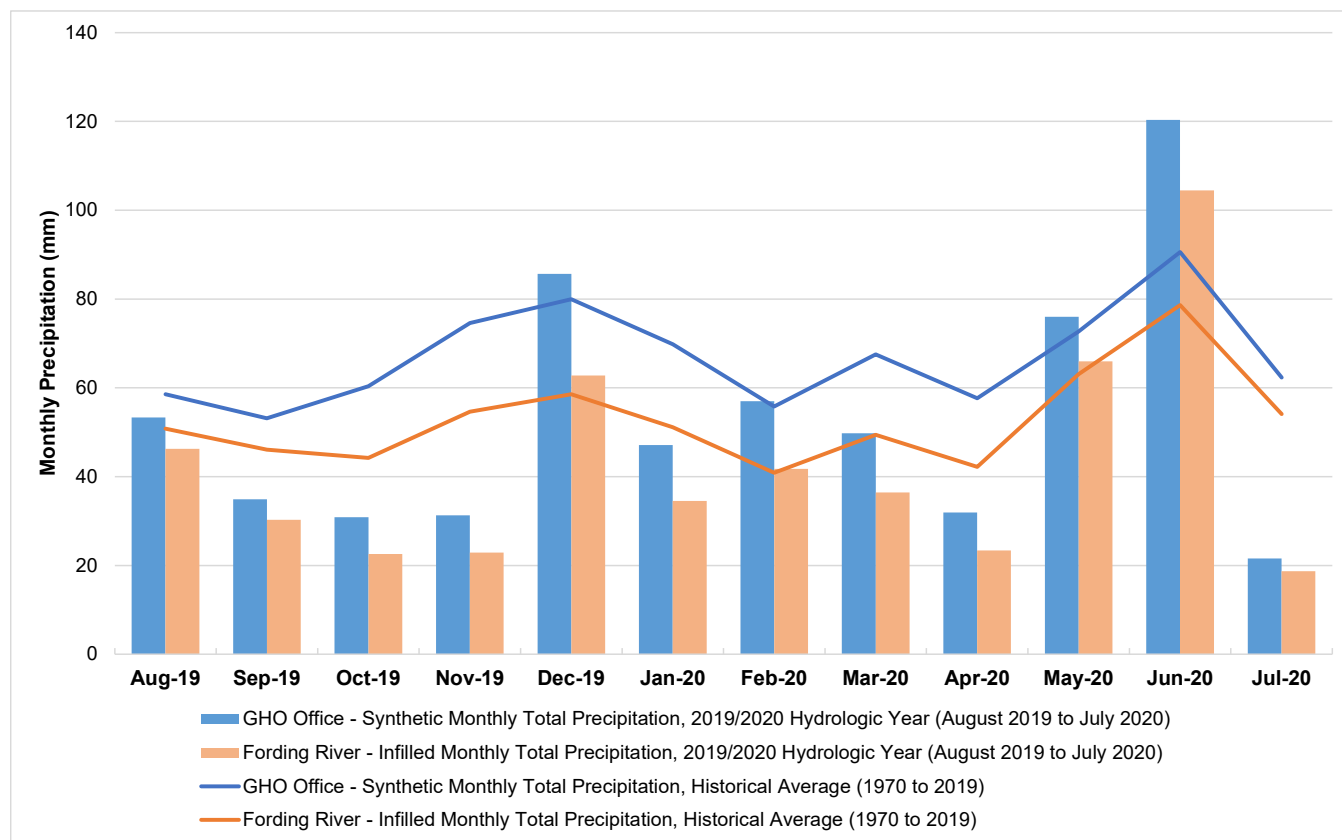
**Illustration 2: GHO Office Precipitation Data Compared to Nearby Climate Datasets**

Due to the identified anomalies, precipitation data from the GHO Office weather station for the 2019/2020 reporting period (August 2019 to July 2020) were replaced with precipitation data from the Fording River Cominco synthetic dataset, which for the 2019/2020 reporting period consisted of data from the Fording River Operations (FRO) waste water treatment (WWT) weather station with the exception of 7 to 9 July 2020, where data was infilled from the Sparwood CS station. The FRO WWT weather station is approximately 7 km northeast of the GHO Office station, and 390 m lower in elevation.

The FRO WWT data were adjusted to the GHO Office station location based on summer (May to September) and winter (October to April) elevation precipitation adjustment factors previously determined for the region (Teck 2017).

A long-term synthetic precipitation dataset was created for the GHO Office station to allow comparison of the precipitation data during the 2019/2020 reporting period with the established historical precipitation data. The synthetic precipitation dataset was created using precipitation data from the Fording River Cominco dataset from 1970 to 2020. The synthetic precipitation dataset was then adjusted to the elevation of the GHO Office station using the same summer and winter adjustment factors applied to the 2019/2020 reporting period data.

A summary of the recorded and synthetic monthly total precipitation for the reporting period (1 August 2019 to 31 July 2020), and the historical monthly averages at the GHO Office station location are presented in Illustration 3.



**Illustration 3: Comparison Between 2019/2020 Total Precipitation and Historical Average for Greenhills Operations**

Precipitation records from the Fording River Cominco climate station are presented for comparison purposes. The data indicate that:

- Total precipitation in the reporting period (1 August 2019 to 31 July 2020) was approximately 20% lower than the historical average for the same period (1 August to 31 July).
- Total monthly precipitation in the reporting period was lower, in comparison with the historical monthly averages, in every month except December 2019 and February, May, and June 2020.
  - Total monthly precipitation between August 2019 and November 2019 was approximately 38% lower than the historical average for the same period.
  - Total monthly precipitation in December 2019 was approximately 7% higher than the historical average for the same period.
  - Total monthly precipitation between January 2020 and April 2020 was approximately 25% lower than the historical average for the same period.
  - Total monthly precipitation between May 2020 and June 2020 was approximately 19% higher than the historical average for the same period.
  - Total monthly precipitation in July 2020 was approximately 65% lower than the historical average for the same period.

## 4.2 Water Balance and Reclaim Water

The water balance for the GHO TSF for the reporting period of 1 August 2019 to 31 July 2020 was completed using the 2020 GHO site wide water balance (SWWB) model (Golder 2020i), based on discharge measurements, and TSF inflow and outflow data provided by GHO. The SWWB model characterizes the conveyance and storage of water at the mine site and is intended to be used as a tool to support decision making on water management practices at the site. The SWWB model was updated with 2019/2020 infilled climate data (i.e., precipitation and temperature, Section 4.1), 2020 TSF bathymetry data and flow measurement data provided by GHO.

The following parameters of the SWWB model were calibrated for the reporting period:

- TSF water volumes (calibrated to measured water levels and converted to volumes based on the facility storage capacity curve, Section 2.4)
- 2019/2020 TSF inflow and outflow data (i.e., slurry and reclaimed water flows)
- 2019/2020 discharge measurements at GH FP1 and GH GH1.

Interpolated storage capacity curves were derived from bathymetry survey data from 24 October 2018, 17 October 2019, and 21 July 2020.

Table 12 summarizes the TSF water balance for the reporting period 1 August 2019 to 31 July 2020.

**Table 12: 1 August 2019 to 31 July 2020 Greenhills TSF Water Balance**

IN	Volume (m <sup>3</sup> )	OUT	Volume (m <sup>3</sup> )	Total Inventory Change (m <sup>3</sup> )
Direct Precipitation	160,410	Seepage	144,940	
Surface Runoff	328,980	Evaporation	172,850	
Water Discharge with Tailings	3,705,970	Reclaim water to Plant	4,334,420	
Transfers from Phase 3 and Phase 6 Pits	542,050	Water retained in tailings <sup>(a)</sup>	251,080	
<b>Sum</b>	<b>4,737,410</b>		<b>4,903,290</b>	<b>-165,880</b>

a) Water retained in the pore space of the tailings is estimated by multiplying the annual tailings dry tonnage by an estimated gravimetric water content of the consolidated tailings of 39% (Golder 2020i).

The TSF water balance results suggest that there was approximately 0.54 M m<sup>3</sup> of water transferred into the TSF from Phase 3 and Phase 6 Pits during the twelve-month reporting period. This volume is smaller than the estimated 1.2 M m<sup>3</sup> transferred into the TSF from Phase 3 and Phase 6 Pit during 2018/2019 reporting period (Golder 2020a), but greater than the estimated 0.28 Mm<sup>3</sup> during 2017/2018 reporting period (Golder 2019b). The simulated inflows to and outflows from the TSF result in a net loss of 165,880 m<sup>3</sup> in TSF total inventory (i.e. there was an overall decrease in the volume of water stored in the TSF during the reporting period).

The water balance results for the reporting period show an overall reduction in the total volume of water within the TSF, consistent with current Teck's water management objectives for the TSF. Due to gaps in some of the TSF inflows and outflows data, it is expected the water balance model underestimates the reduction in water inventory during the reporting period, especially during the period when the TSF Water Reduction Plan was implemented (see Section 4.3).

### 4.3 Water Discharge

Following recommendation 2019-01 (Golder 2020a), Teck developed a TSF Water Reduction Plan (Teck 2020b) as a response to tailings pond levels above the 2 m operational limit in spring 2020, as well as to reduce the overall volume of water stored within the TSF. The Water Reduction Plan was implemented 3 March 2020.

As part of this plan, water is removed from the TSF using the process plant reclaim water barge, and conveyed through the process plant to the thickener and then to the rail loop pond where it is discharged to the receiving environment at a rate within the discharge permit allowance.

Implementation of the Water Reduction Plan has resulted in a reduction of the pond volume when compared to the 2018/2019 reporting period (Golder 2020a). The pond volume at the time of the 2020 bathymetric survey (21 July 2020) was approximately 755,000 m<sup>3</sup>. On 1 January 2021 the pond level was estimated, based on the 2020 bathymetric survey data, to be approximately 492,000 m<sup>3</sup>.

### 4.4 Tailings Storage Facility Registry

A TSF registry for the Main and West Tailings Dams is presented in Appendix C.

## 5.0 GREENHILLS OPERATION TAILINGS STORAGE FACILITY SAFETY ASSESSMENT

This section presents an assessment of the safety of the dams based on a review of instrumentation data and an assessment of field observations and background information.

### 5.1 Site Visit

An inspection of the TSF was carried out during the week of 1 September 2020 by the EoR, Mr. Andy Haynes, P.Eng., and Mr. Martyn Willan, P.Eng., both of Golder. The visit was accompanied by Mr. David Walker, E.I.T., of GHO. A close-out meeting was also held and attended by the TSF Qualified Person Mr. Andrew Knight, P.Eng., of GHO.

Appendix A presents a summary of photographs taken during the September 2020 inspection. Photograph locations and directions are presented in Figure 2. A summary of observations made during the September 2020 visit are included in Appendix B. The GHO Main and West Tailings Dams were observed to be in satisfactory condition at the time of the 2020 site visit.

### 5.2 Review of Background Information

GHO provided the following information for this annual facility inspection

- survey data
  - GHO air photograph and site LiDAR survey data (flown July 2020)
  - tailings dam area survey data, completed following dam raise in 2018 (2 October 2018)
    - The 2020 raise was completed to elevation 1,732.5 m in September and October 2020, will be reported in the 2021 annual inspection report.
  - tailings pond bathymetric survey data (21 July 2020)
- site climate data recorded at the GHO Office station for the reporting period (Section 4.1)
- instrumentation data for the reporting period
  - Downloaded from GeoExplorer software:
    - VWP data
    - GPS unit data
    - survey prism data
    - seepage weir data
  - Provided directly by Teck:
    - inclinometer survey data
- monthly TSF inspection records, including photographs, visual observations, and instrument data

### 5.3 HSRC Facility Consequence Classification Review

The TSF remains a High consequence structure, in accordance with Section 3.4 from the HSRC Guidance Document (Ministry of Energy and Mines 2016).

### 5.4 Review Documentation

#### 5.4.1 Operation, Maintenance, and Surveillance Manual

The current OMS manual was last updated in June 2019 (GHO 2019b). An update of the OMS manual was in progress at the time of this annual inspection report to comply with the guidelines provided by the Mining Association of Canada (MAC 2019), and Teck Resources Limited's revised *Tailings and Water Retaining Structures Guidelines* (Teck Resources 2019). The updated OMS manual will also include revised QPOs.

#### 5.4.2 Emergency Preparedness and Response Plan

The emergency preparedness and response plan (EPRP) for the TSF was last updated in 2018 (GHO 2019a). An EPRP tabletop exercise was performed on 27 August 2019 and action items identified for incorporation in the updated versions of the EPRP and Trigger Action Response Plan (TARP). Updates to these documents were in progress at the time of this annual inspection report. An EPRP tabletop exercise was also performed in December 2020.

An inundation study for a hypothetical breach of the TSF was completed by Golder in 2012 (Golder 2012b) and updated in 2016 (Golder 2017c).

A Risk Register review was completed in two sessions during July and August 2020. No significant changes were made to any potential TSF failure modes. The risk assessment identified credible and non-credible potential failure modes.

#### 5.4.3 Tailings and Water Retaining Structures Management Plan

A draft Tailings and Water Retaining Structures (TWRS) Management Plan was developed in May 2020 (Golder 2020d) to meet the requirements of Teck guidelines for TWRS (Teck Resources 2019) and the MAC Towards Sustainable Mining (TSM) guidelines for tailings management (MAC 2019). This document is intended to provide an understanding of the TWRS management system and summarizes components of the TWRS management system for GHO. Finalization of this document was in progress at the time of this annual inspection report.

#### 5.4.4 Dam Safety Review

A dam safety review was completed by Klohn Crippen Berger Ltd. in 2017 (KCB 2017). The dam safety review concluded that the condition and integrity of the dams met current safety standards. The HSRC (Ministry of Energy and Mines 2017) specifies that a dam safety review is to be completed once every five years; the next dam safety review is therefore required by the end of 2022.



## 5.5 Assessment of Facility Safety Relative to Potential Failure Modes

A required component of the annual inspection report is a review of key hazards associated with similar structures in the mine waste industry, after excluding failure modes that are not relevant or not possible for the facility.

The performance is assessed by comparing the design basis against observed dam performance and available data during the monitoring period for each identified failure mode / hazard. The following three hazards/potential failure modes have been identified in the design of the Greenhills TSF and are considered in the assessment of performance compared to the design expectations:

The following three hazards/potential failure modes have been identified in the design of the Greenhills TSF and are considered in the assessment of performance compared to the design expectations:

- **Instability**— a mechanism involving movement of a part of the dam (either entirely within the dam or including portions of the foundation materials) as a result of imbalanced forces, with possible loss of integrity of the dam.
- **Overtopping**— a mechanism where the pond level rises above the dam crest level, resulting in flow over the dam that may cause progressive erosion of the dam and loss of the pond and tailings.
- **Internal erosion**—internal instability of a dam can be caused by materials migrating out of the dam via seepage and leaving voids within the dam. 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. Under such conditions, internal erosion (piping) can occur by regressive erosion of particles from within the dam forming a continuous pipe or void within the dam. Suffusion is the migration of soil particles through the soil matrix.

### 5.5.1 Instability

#### Design Basis

The Main and West Tailings Dams were designed to provide factors of safety in accordance with CDA (2013) guidelines for High consequence dams, as shown in Table 13.

**Table 13: Canadian Dam Association Recommended Minimum Factors of Safety for High Consequence Dams**

Operating Status	Stability Analysis	Minimum Factor of Safety
Normal operating conditions	Limit equilibrium	1.5
1-in-2,475-year design earthquake	Pseudo-static	1.0

Following the 2016 geotechnical investigation, Golder assessed the stability of the Main Tailings Dam for a crest elevation of 1,735 m (Golder 2017a). Results indicated:

- The development of excess pore pressures in the foundation materials is considered unlikely as soft clay colluvium was not encountered during the 2016 geotechnical investigation.
- Glacial till, present in the foundation, was dense to very dense with low liquidity index values.
- The stability of the Main Tailings Dam satisfies both CDA (2013) and HSRC (Ministry of Energy and Mines 2016) guidance for static and pseudo-static stability.

Following the 2013 geotechnical investigation, Golder assessed the stability of the West Tailings Dam for a crest elevation of 1,735 m (Golder 2014a). Results indicated:

- The upstream clay blanket is performing well in reducing seepage through the dam.
- The stability of West Tailings Dam satisfies both CDA (2013) and HSRC (Ministry of Energy and Mines 2016) guidance for static and pseudo-static stability.

In addition, an assessment of stability based on loading from a seismic event with an annual exceedance probability of 1-in-10,000-year event (0.3g), which exceeds the requirements of HSRC (Ministry of Energy and Mines 2017), has been completed and calculated factors of safety were above 1.0.

### Observed Performance

A review of the performance relative to the risk of instability is summarized below. Performance was within that expected of normal operating conditions.

Measured deformations (as recorded by GPS and prism surveys) were low and consistent with the expected performance.

Slope deformation was observed at Site C during 2011 and 2012 when visual inspections noted the development of a head scarp and a toe bulge. Scarp and toe bulge locations are shown in Figure 3. GPS units 319 and 320 were installed on the benches of Site C. Some potential fresh movement of the Site C head scarp was noted during the 2020 site visit, these movements were minor and do not pose a risk to dam safety at this time, but should continue to be monitored on a monthly basis.

General observations at the time of the 2020 site visit, in relation to instability, include:

- minor cracking and erosion along the upstream crest of the Main and West Tailings Dams at the upstream edge of the clay blanket
- some localized depressions on the upstream crest of the Main Tailings Dam
- minor erosion of riprap at the toe of the upstream face of the Main Tailings Dam

These features do not present a risk to dam safety, and routine maintenance occurred as part of dam raise construction in 2020.

### Survey Prisms

Survey prism data for the 2019/2020 reporting period are presented in Appendix D (Figures D-1 to D-26). Data analysis focuses on long-term data trends based on the average annual rate of CRD.

The survey pillar used for the prism survey was observed to be damaged and was changed on 26 February 2020, as such prism data was reset on this date, data in Appendix D is presented as two data series (September 2019 to January 2020 and February to August 2020). Following the identification of potentially erroneous readings for the period January to July 2020, the total station was sent for calibration, by Teck, on 8 July 2020. Levelling issues with the total station pillar were also observed in August 2020. As such, data for the period January to August 2020 is believed to be erroneous.

CRD was trending above the green notification level in prisms D, F, and H towards the end of the reporting period, this trend is the result of vertical heave (up to 200 mm) observed in all the prisms in the 2019/2020

reporting period. The dams and prisms were inspected during the 2020 site visit and during monthly inspections by Teck, no evidence of significant heave was observed. In addition, data from other instruments does not suggest a similar trend. In addition to CRD, prism data were plotted based on average 3D velocity over an approximately three-month period (Appendix D). No trends of increasing velocity were observed in the 2019/2020 reporting period. Observed trends in the exceedances of the green notification QPO are believed to be erroneous and are not a dam safety concern.

Measured deformations were low (less than 200 mm) in the reporting period, consistent with the expected performance and are not indicative of instability of the Main or West Tailings Dams. Movements, relative to maximum dam height were small (less than 0.4%) and within the expected range for earthfill embankments.

### GPS Units

GPS data for the 2019/2020 reporting period are summarized in Table 14 and presented in Appendix D (Figures D-27 to D-36). Data in this annual inspection report are focused on the comparison of long-term data trends.

**Table 14: Summary of GPS Unit Data 01 August 2019 to 31 August 2020**

Dam	Instrument	Cumulative Relative Displacement (CRD) Observations	Figure
Main	GPS 319 (Site C)	Data show an increasing trend in CRD related to settlement after February 2020	D-27
	GPS 320 (Site C)	Data show an increasing trend in CRD related to settlement after June 2020	D-28
	MD-1_ROVER	Data show general flat trend during the 2019/2020 reporting period	D-29
	MD-2_ROVER	Data show general flat trend during the 2019/2020 reporting period	D-30
	MD-3_ROVER	Data show general flat trend during the 2019/2020 reporting period	D-31
	MD-4_ROVER	Data show general flat trend during the 2019/2020 reporting period	D-32
	MD-5_ROVER	Data show general flat trend during the 2019/2020 reporting period	D-33
West	WD-1_ROVER	Data show general flat trend during the 2019/2020 reporting period	D-34
	WD-2_ROVER	Data show general flat trend during the 2019/2020 reporting period	D-35
	WD-3_ROVER	Data show general flat trend during the 2019/2020 reporting period	D-36

CRD = Cumulative relative displacement

The inherent error in the GPS units make them unsuitable for the measurement of short-term deformations, and therefore GPS data are not assessed against QPOs. The GPS units continue to be used to complement prism data in the assessment of long-term trends. Data obtained from GPS 319 and 320 at Site C show a trend of minor settlement (up to 50 mm) beginning in February 2020 in GPS 319 and June 2020 in GPS 320. No concurrent movement was observed from GPS units or survey prisms on the Main Dam. This settlement appears to be limited to the CR storage facility and does not present a dam safety concern.

No signs of instability which correlate to the observed variations in GPS data were observed during the 2020 site visit or monthly inspections completed by GHO.

GPS unit data for the 2019/2020 reporting period are not indicative of instability of the Main and West Tailings Dams.

## Inclinometer Surveys

Inclinometer survey data for the 2019/2020 reporting period are presented in Appendix D (Figures D-37 to D-38).

Results of the inclinometer surveys in the 2019/2020 reporting period indicate:

- Displacements of up to approximately 65 mm in both the negative (north, upstream) and positive (south, downstream) directions and up to approximately 35 mm in the positive B-axis (west, perpendicular to the downstream slope) were indicated in instrument SD-16-04. These data are not considered to be representative of movements within the dam and are likely a result of displacement in the inclinometer casing itself, i.e., separation of the casing at a connection. A downhole camera survey should be completed to check the integrity of the casing.
- Displacements were generally less than 4 mm in instrument SD-16-05

Inclinometer survey data for the 2019/2020 reporting period are not indicative of instability of the Main Tailings Dam.

## Vibrating Wire Piezometers

Maximum and minimum water elevations in the 2019/2020 reporting period for installed piezometers are presented in Table 15. The full data sets are presented Appendix E (Figures E-1 to E-4).

Negative pressure readings were recorded consistently in one piezometer (VW11-WD-1B) during the reporting period. Negative pressure readings indicate that the tip is dry. Piezometric levels cannot be determined from WVPs recording negative pressures. Water elevations calculated from negative pressure readings are not presented in the figures in Appendix E.

**Table 15: Maximum and Minimum Vibrating Wire Piezometer Readings**

Tailings Dam	Instrument	Range of Water Elevations in 2019/2020 Reporting Period		Exceeds QPO
		Minimum (m)	Maximum (m)	
Main	VW11-MD-2A	1,693.30	1,693.56	None
	VW11-MD-3A	1,687.97	1,688.62	None
	VW11-MD-3B	1,689.37	1,689.97	None
	VW11-MD-4A	1,687.65	1,688.18	None
	VW11-MD-5A	1,683.94	1,684.58	None
	VW11-MD-5B	1,684.43	1,685.10	None
	SD-16-01A	1,685.34	1,685.91	None
	SD-16-01B <sup>(b)</sup>	1,711.00	1,711.69	None
	SD-16-02A	1,685.37	1,685.58	None
	SD-16-02B <sup>(b)</sup>	1,693.77	1,694.33	None
	SD-16-03A	1,691.43	1,692.28	None
	SD-16-03B <sup>(b)</sup>	1,709.50	1,710.97	None
	SD-16-04	1,675.67	1,676.99	None
	SD-16-05A	1,682.75	1,683.61	None
	SD-16-05B <sup>(b)</sup>	1,697.62	1,698.87	None
	SD-16-06A	Dry at piezometer tip <sup>(c)</sup>	1,685.19	None
	SD-16-06B <sup>(b)</sup>	1,705.02	1,706.66	None
	SD-16-07A	1,651.36	1,651.83	None
	SD-16-07B <sup>(b)</sup>	1,650.41	1,650.86	None
	SD-16-08A	1,667.96	1,668.28	None
	SD-16-08B <sup>(b)</sup>	1,688.40	1,688.93	None

**Table 15: Maximum and Minimum Vibrating Wire Piezometer Readings**

Tailings Dam	Instrument	Range of Water Elevations in 2019/2020 Reporting Period		Exceeds QPO
		Minimum (m)	Maximum (m)	
West	VW11-WD-1A	1,712.79	1,712.99	None
	VW11-WD-1B	Dry at piezometer tip <sup>(c)</sup>		None
	VW11-WD-2A	1,713.00	1,713.23	None
	VW11-WD-2B	1,715.83	1,716.45	None
	VW11-WD-3A	1,715.50	1,715.76	None
	VW11-WD-3B	1,716.28	1,716.70	None

- (a) Piezometers no longer in operation will be removed in the 2021 annual inspection report.
- (b) The readings of the 2016 piezometers (SD-16-01B to SD-16-08B) that were installed in bedrock or deep till are on average higher than the shallow piezometers due to artesian conditions within an isolated groundwater flow which is not hydraulically linked to the upper groundwater system.
- (c) Negative pressure readings indicate that the tip is dry and piezometric levels cannot be determined from recorded negative pressures. Negative pressure readings not shown.

The elevation of the phreatic surfaces recorded in operational piezometers during the reporting period were within normal operating conditions and did not exceed the QPOs. The phreatic surface within the Main Tailings Dam was generally between 5 and 15 m above the glacial till foundation. The phreatic surface within the West Tailings Dam was generally within the glacial till foundation. VWPs showed an increase in phreatic surface coincident with the increase in pond level around April 2020.

## 5.5.2 Overtopping

### Design Basis

The TSF does not have an operational or emergency overflow structure (i.e., spillway) and is therefore required to contain the 72-hour IDF for a 1/3 between the 1-in-1,000-year event and the probable maximum flood, including allowance for freeboard, as per HSRC (Ministry of Energy and Mines 2017) requirements for a High consequence classification facility.

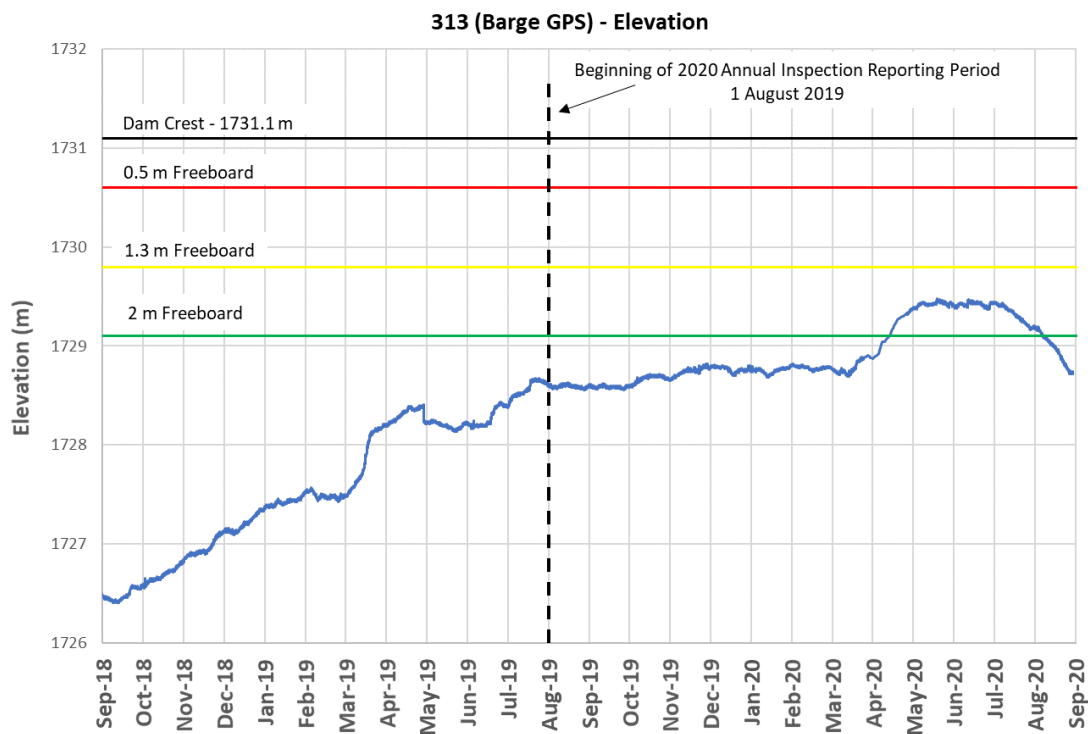
The GHQ TSF minimum freeboard (1.3 m) is calculated in accordance with the CDA (2013); however, GHQ currently adopts a minimum 2 m operational freeboard. Freeboard details are presented in Table 16.

**Table 16: Freeboard Details**

Item	Value (m)
Lowest crest elevation on Main or West Tailings Dam during 2019/2020 reporting period	1,731.14 (raised to 1732.5 in Oct 2020)
<b>HSRC (2017) Compliant Freeboard</b>	
Allowance for 72-hour IDF ( $\frac{1}{3}$ between 1:1,000-year flood and the probable maximum flood = 445,120 m <sup>3</sup> )	0.93
Allowance for wave run-up due to 1:2-year wind	0.35
Minimum required freeboard (per CDA 2013)	1.3
<b>GHO TSF Operational Freeboard</b>	
Allowance for 72-hour Probable Maximum Flood (621,670 m <sup>3</sup> )	1.65
Allowance for wave run-up due to 1:2-year wind <sup>(a)</sup>	0.35
Standard operating maximum pond level (distance below dam crest)	2.0

### Observed Performance

The pond elevation recorded from 1 September 2019 to 31 August 2020 is presented in Illustration 4.

**Illustration 4: Tailings Pond Elevation Relative to Freeboard Levels**

Data indicate that the pond elevation varied between 1,728.6 and 1,729.5 m during the 2019/2020 reporting period. The minimum freeboard during the reporting period was approximately 1.7 m and was therefore compliant with HSRC (Ministry of Energy and Mines 2017) requirements during the reporting period (minimum required freeboard of 1.3 m).

The standard operating level of 2.0 m was exceeded from 16 April to 9 August 2020. During this time the facility was unable to store the 72-hour probable maximum flood, a storm event which exceeds the requirements of the HSRC (Ministry of Energy and Mines 2017) for a high consequence facility but has been adopted to establish a normal operating freeboard.

Operational pond volumes were also developed in conjunction with the EoR and GHO staff to help support active water management at the facility. The following operational pond volume limits were established:

- Upper warning level - 600,000 m<sup>3</sup>
- Operating high level - 400,000 m<sup>3</sup>
- Operating low level - 200,000 m<sup>3</sup>
- Critical low level - 140,000 m<sup>3</sup>

To reduce the volume of stored water and increase facility freeboard, Teck implemented a Water Reduction Plan (Teck 2020b) in March 2020 as described in Section 4.3. The pond volume at the time of the 2020 bathymetric survey (21 July 2020) was approximately 755,000 m<sup>3</sup>. On 1 January 2021 the pond level was estimated, based on the 2020 bathymetric survey data, to be approximately 492,000 m<sup>3</sup>. This represents a 408,000 m<sup>3</sup> reduction in pond volume compared to a pond volume of 900,000 m<sup>3</sup>, based on the 2019 bathymetry survey on 17 October 2019 (Golder 2020a). This reduction is in line with recommendation 2019-01 (Golder 2020a) and Teck's long-term water management strategy (Section 2.10.2).

### 5.5.3 Internal Erosion

#### Design Basis

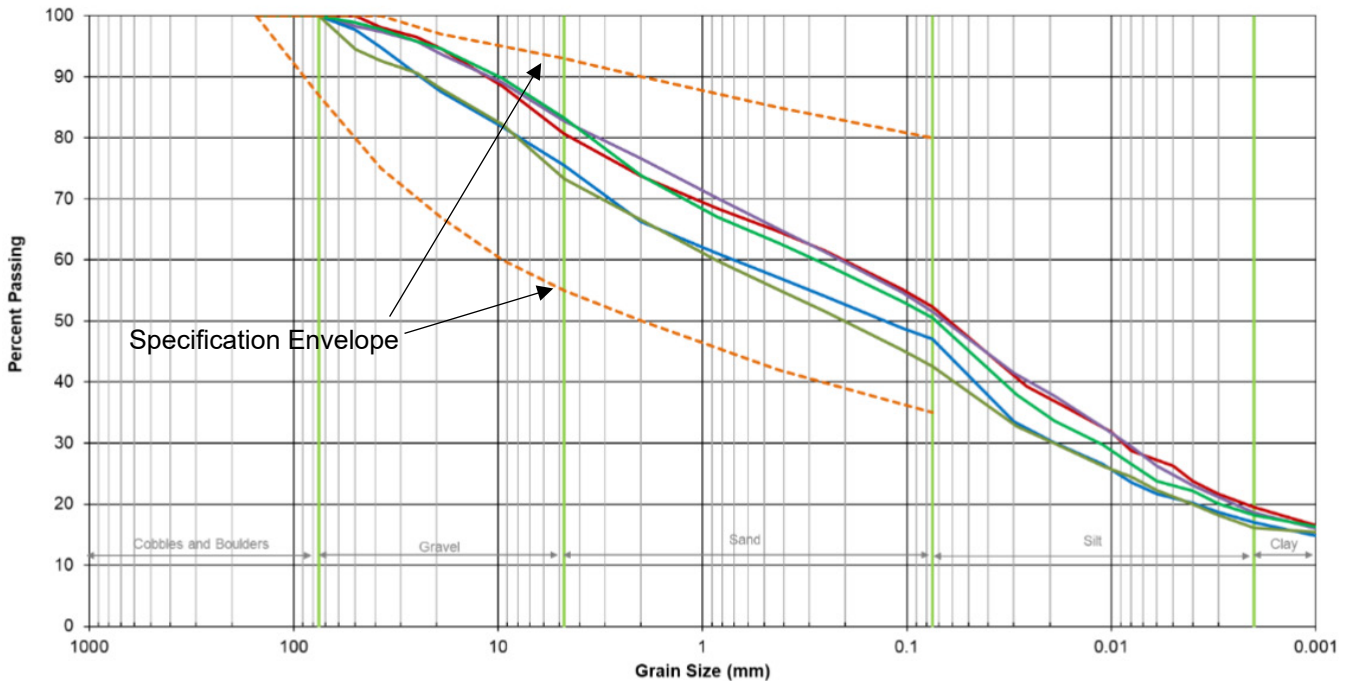
The till blanket on the upstream face of the dams and CR material specification have been designed to meet internal stability criteria (Li et al. 2009) and filter compatibility (Sherard et al. 1984; Sherard and Dunnigan 1989), as recommended by the CDA (2007).

Golder tested samples of tailings collected on 10 May 2016 at the tailings discharge. The particle size distribution of the tailings was determined using mechanical sieving (ASTM D6913) and a Fritsch laser particle size analyzer (ASTM D4464). The results are documented in Golder (2017c) and indicate that filter compatibility exists between the tested tailings and the clay blanket (till) samples. Recent testing of tailings (Weir 2020) confirmed that the gradation of the tailings remains valid.

The CR has been tested throughout construction of the dams, and with occasional exception, was found to meet filter criteria. Results from construction in 2020 were pending at the time of this annual inspection report and will be reported as part of the 2021 annual inspection report.

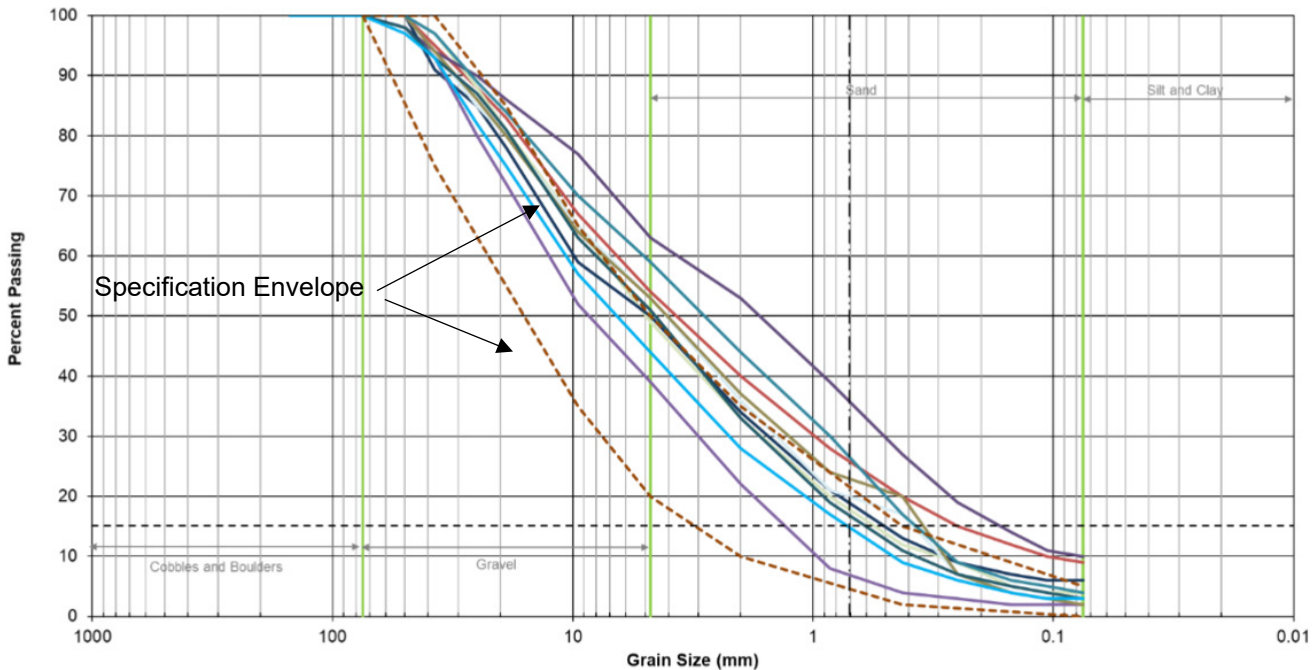
Grain size distribution tests were performed on 5 clay blanket (till) and 10 CR samples as part of the 2018 dam raise (Golder 2019a). Results are presented in Illustration 5 (till sample) and Illustration 6 (CR samples) along with the design specification envelopes. Tested till samples tested were within the specified envelope.





Source: Golder 2019a.

**Illustration 5: Grain Size Distribution and Specification Envelopes for Till**



Source: Golder 2019a.

**Illustration 6: Grain Size Distribution and Specification Envelopes for Coarse Refuse**



Four of the 10 CR samples were finer than the specification. CR material was assessed for filter compatibility, and all samples were found to meet the Li et al. (2009) internal stability criteria. Samples were also assessed against the Sherard et al. (1984) and Sherard and Dunnigan (1989) criteria, which recommends a filter  $D_{15}$  for glacial tills of less than or equal to 0.7 mm. Nine CR samples met this criterion. One sample was coarser ( $D_{15}=1.3$  mm).

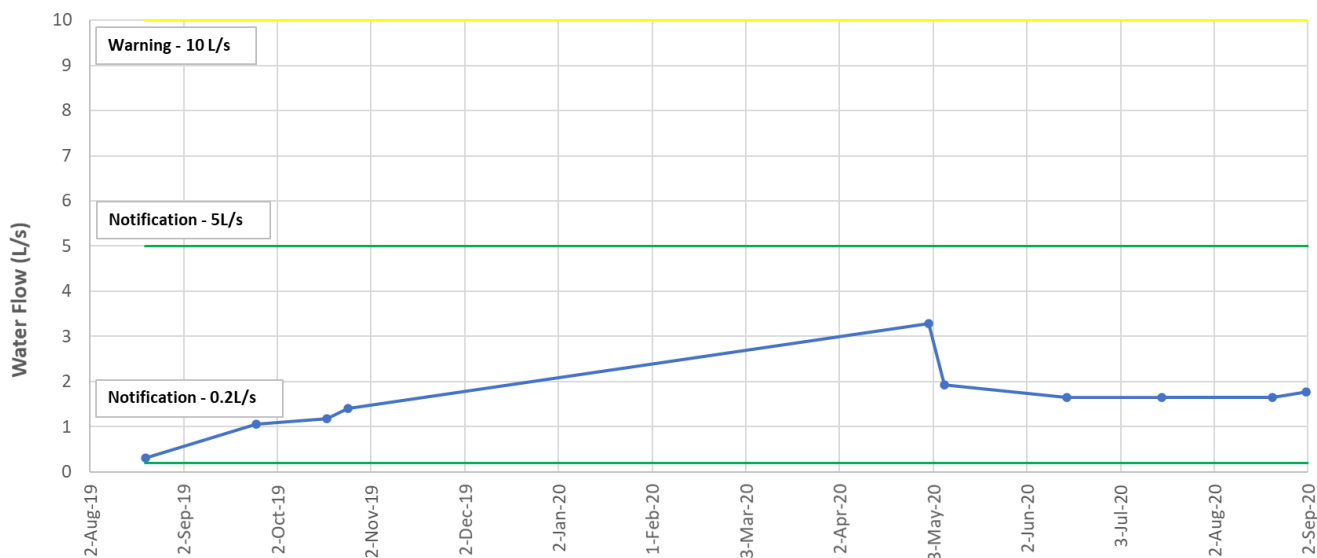
In summary, results indicate that piping criteria are generally met between the clay blanket (till) and the CR, and between the tailings and clay blanket (till). The constructed conditions are considered to be acceptable, and the GHO dams are unlikely to be prone to internal erosion.

### Observed Performance

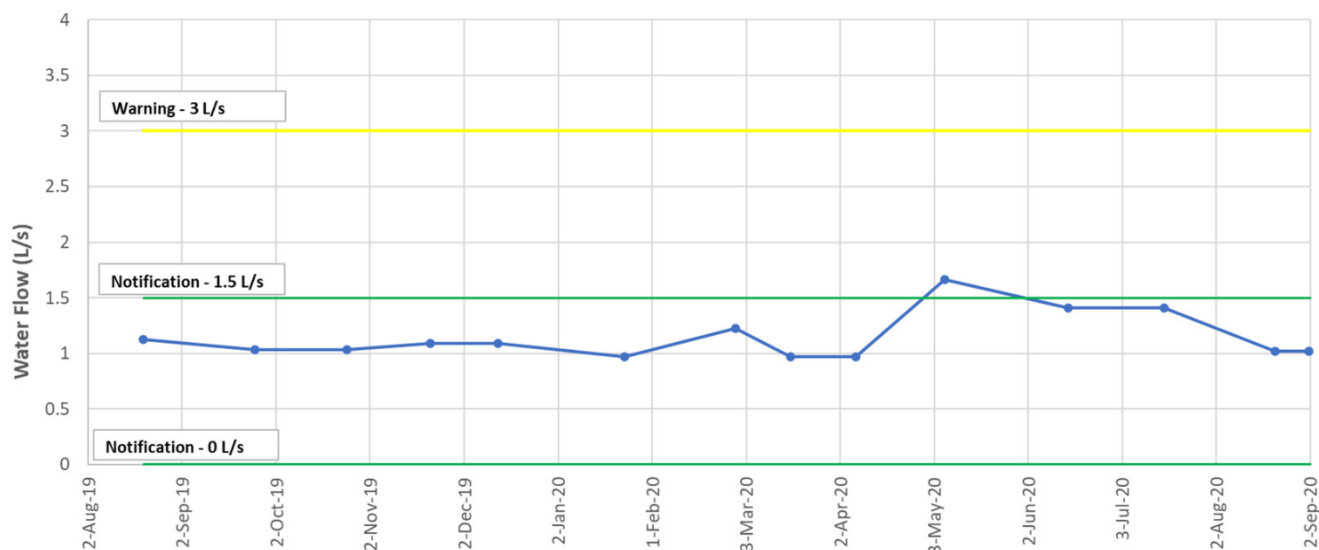
The GHO TSF commonly stores tailings pond water against the upstream slopes of the Main Dam, and occasionally against the upstream slopes of the West Dam.

Recorded flow rates at the Site C Weir and West Dam Weir in the 2019/2020 reporting period are presented in Illustration 7 and Illustration 8, respectively. Data were not recorded from the Main Dam Weir between 26 October 2019 and 30 April 2020 due to difficulties accessing the weir during winter.

The flows in both weirs were low and within the expected range for normal operation. The West Dam Weir exceeded the green notification level during the May inspection, during the 2020 freshet.



**Illustration 7: Site C Weir Discharge**



**Illustration 8: West Dam Weir Discharge**

During the 2020 site visit, it was observed that flow in the Main Tailings Dam and West Tailings Dam seepage collection channels was clear and free of visible suspended solids. Overall, seepage rates during the reporting period were within normal operating conditions, and visual observations were not indicative of conditions which would be attributed to internal erosion of earthfill dams.

Modifications to the Site C seepage collection channel were made in October 2019 to improve surface water collection and conveyance. These works were inspected during the 2020 site visit and were observed to be performing as intended including the interception of seepage previously observed to be flowing beneath the seepage collection channel.

An HDPE pipe, installed at the southwest corner of the wash plant, collects surface water from the plant yard, CR hopper and surface water run off and conveys this flow into a riprap lined channel and discharges to Greenhills Creek. Flow in this pipe is estimated during monthly inspections, no flow was observed during monthly inspections in the 2020 monitoring period. A second pipe collects surface water from the lower bench at site C and conveys the water to the seepage collection channel at the toe of the Site C CR stockpile. This flow reports to the Site C Weir and is not measured separately. It is therefore not possible to distinguish whether flow at the weir is due to increased seepage or surface water runoff from the wash plant area. The flow from the HDPE pipe into the seepage collection channel should be monitored separately.

## 5.6 Review of Previous Deficiencies and Non-conformances

An update of previous deficiencies, non-conformances, and recommendations from the 2019 DSI (Golder 2019c) are presented in Section 6.5.

## 6.0 SUMMARY AND RECOMMENDATIONS

### 6.1 Summary of Activities

The following activities were completed during the reporting period:

- monthly facility inspections by Teck
- monthly Tailings Management Committee meetings
- monthly instrumentation and data reviews by the EoR including discussion and action planning with Teck, as required
- EPRP tabletop exercise on 27 August 2019
  - an additional tabletop exercise was completed in December 2020
- Site C seepage collection channel improvements in October 2019
- Independent Tailings Review Board meetings in January and September 2020
- development and implementation of Water Reduction Plan to reduce pond volume (Teck 2020b)
- development of TWRS Management Plan (Golder 2020d)
- update to the TSF and Settling Pond Closure Plan in July 2020
- construction of dam raise to elevation 1,732.5 m was completed in September and October 2020
  - details will be reported in the 2021 annual inspection report

### 6.2 Summary of Climate and Water Balance

An update of the annual water balance will be completed for a future revision of this annual inspection report.

### 6.3 Summary of Performance and Changes

There were no significant changes in the operation and performance of the TSF during the reporting period. The performance of the dams during the reporting period was as expected for normal operating conditions.

The GHO TSF was observed to be in good condition at the time of the 2020 site inspection. Records indicate that the discharge of tailings into the GHO TSF was consistent with the normal operating conditions.

No significant changes were noted during the 2020 site visit or monthly visual inspections by GHO. Some minor erosion of the upstream slope and crest of the Main and West Tailings Dams was observed which required routine maintenance. This maintenance was completed during the 2020 dam raise construction.

### 6.4 HSRC Consequence Classification

The TSF remains a High consequence classified structure, in accordance with Section 3.4 of the HSRC Guidance Document (Ministry of Energy and Mines 2016).

### 6.5 Current Deficiencies and Non-conformances

Previous deficiencies and recommendations from the 2019 DSI (Golder 2019c) and new deficiencies and recommendations from the 2020 annual facility inspection are presented in Table 17. Completed items are shown with grey shading.

Table 17: 2020 Recommended Actions for Greenhills Tailings Storage Facility

ID Number	Deficiency	Potential Dam Safety Hazard	Priority Level	Recommended Action	Target Date	Status as of October 2020
2019-01	Volume of water in TSF is greater than that needed for plant operation.	Increased zone of inundation if failure were to occur	3	Reduce pond volume to less than 350,000 m³	Q4 2020	<b>Complete</b> – Water reduction strategy implemented to reduce pond volume in 2020 freshet.
2020-01 (2019-02)	Seepage weirs: ■ Weir automation equipment is on site and pending installation.	Potentially unstable condition not measured.	3	Install weir automation equipment.	Q3 2020	<b>In progress</b> – Upgrades progressing, completion aimed before winter 2020
2020-02 (2019-03)	Pond against upstream slope of Main Tailings Dam. ■ The pond against the upstream slope of the Main Tailings Dam is consistent with design basis and not a dam safety concern, but there is an opportunity to improve towards best applicable practice by moving the pond away from the upstream slope of the Main Tailings Dam.	Increased potential for piping, and potential increased zone of influence if dam integrity is compromised.	4	Develop and implement strategy to move pond away from upstream slope of the Main Tailings Dam.	Q3 2021	<b>In Progress</b> – Tailings discharge outlet to be relocated along the Main Tailings Dam. Deposition planed in fall/winter 2020.
2020-03 (2019-04)	Ponded water on downstream crest of Site C storage facilities at east abutment of Main Tailings Dam (Photograph 10, Appendix A).	Erosion of downstream shell of CR storage facilities leading to instability	3	Revise drainage to prevent long-term ponding of surface water.	n/a	<b>In Progress</b> – Area filled with CR during 2020 construction, surface water currently ponding on Site E access road. Water currently pumped back to TSF, long term drainage plan in development.
2019-05	Closure plan does not meet HSRC requirements.	Operational procedures do not align with closure design; long-term environmental hazards become difficult and costly to mitigate.	3	Develop the current concept level closure plan to align with the current life of mine strategy and HSRC requirements.	n/a	<b>Completed</b> – Updated closure plan issued 17 July 2020 (Golder 2020h).
2020-04 (2019-06)	Golder has recommended additional inundation study modelling of the downstream area, up to Lake Koocanusa.	n/a	3	Update inundation study with additional modelling at the confluence of the Elk River and Fording River, and at Lake Koocanusa.	n/a	<b>In Progress</b> – Draft inundation study issued in April 2020 (Golder 2020f)  Finalization placed on hold pending issuance of the Global International Standards on Tailings Management (GISTM 2020) guidance document.
2020-05 (2019-07)	■ OMS manual does not reflect: ■ current geotechnical instrumentation details including revised QPOs ■ revised MAC and Teck guidance documents ■ Multiple coordinate grid systems appear to be used in the OMS manual.	Potential to ineffectively respond to alerts and warnings from geotechnical instrumentation.	3	Update OMS manual to: ■ 2020-05a: remove non-functioning geotechnical instrumentation and update QPOs. ■ 2020-05b: update based on MAC (2019) and Teck (2019) ■ 2020-05c: use a single coordinate grid system	Q1 2021	<b>In progress</b>
2020-06	QPO actions are not fully aligned with Teck corporate Emergency Preparedness and Response Plan categories.	Potential to ineffectively respond to alerts and warnings and take required action.	4	Update QPO categories to align with Teck ERP categories	Q1 2021	<b>In progress</b>

Priority Level	Description
1	A high probability or actual 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 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 safety issues.
4	Best Management Practice – Further improvements are necessary to meet industry best practices or reduce potential risks.

## 7.0 CLOSING

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

We trust that this report meets your present requirements. If you have any questions or requirements, please contact the undersigned.

**Golder Associates Ltd.**



Martyn Willan, P.Eng.  
*Geotechnical Engineer*



Andy Haynes, P.Eng.  
*Principal, Senior Geotechnical Engineer*

ZPS/MBW/AJH/hp

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## STUDY LIMITATIONS

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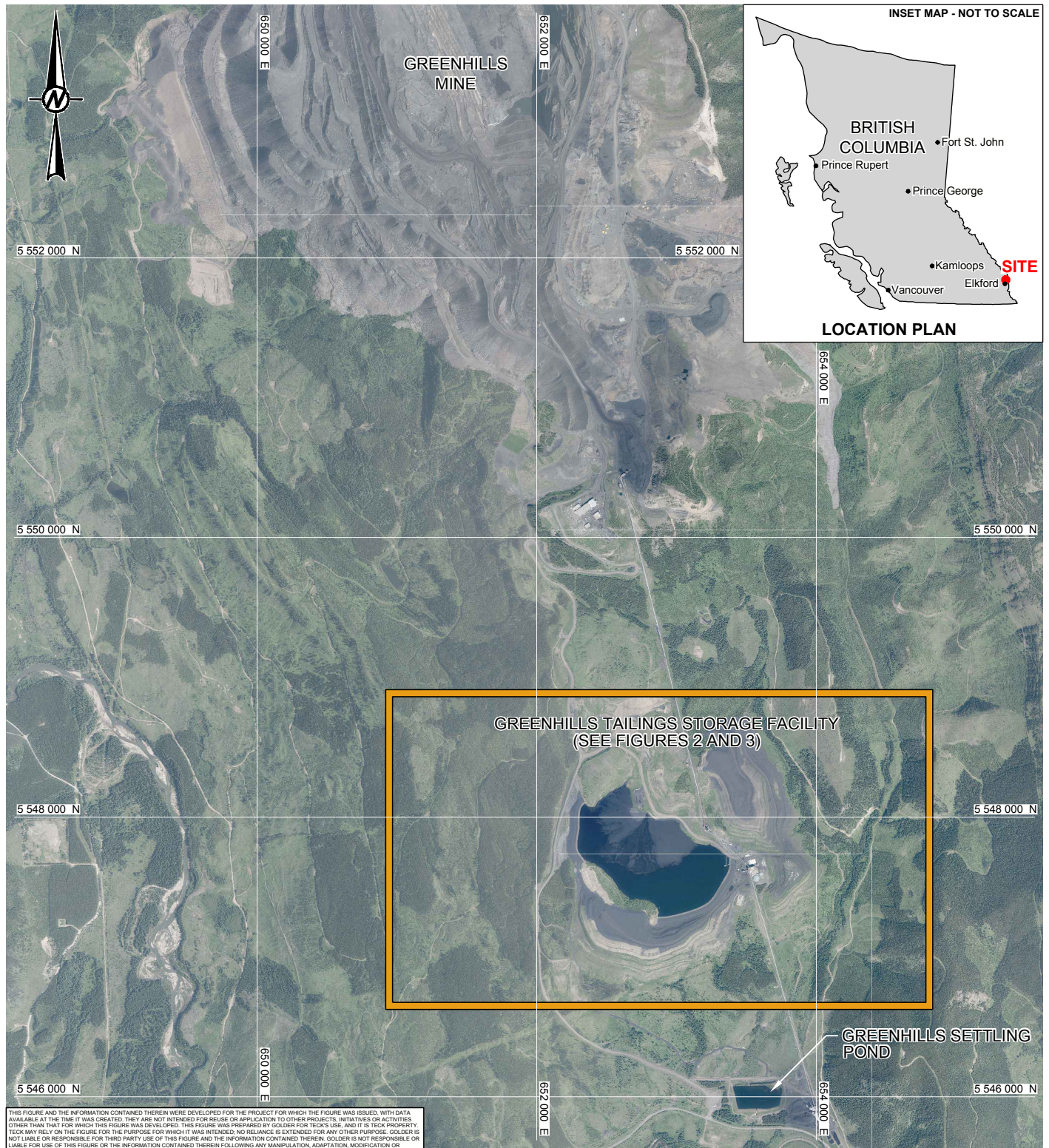
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## FIGURES



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#### NOTES

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2. COORDINATES ARE IN UTM NAD83 ZONE 11.

#### REFERENCE

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#### CLIENT

TECK COAL LIMITED  
GREENHILLS OPERATIONS  
ELKFORD, B.C.

#### CONSULTANT



YYYY-MM-DD 2021-03-24

DESIGNED Z.SMITH

PREPARED P. JHAJJ

REVIEWED M.WILLAN

APPROVED A.HAYNES

#### PROJECT

GREENHILLS TAILINGS STORAGE FACILITY  
2020 ANNUAL FACILITY REPORT

#### TITLE

**GREENHILLS OPERATIONS SITE PLAN**

PROJECT NO.  
19133994

PHASE/TASK/DOC  
3000/3003/150

REV.  
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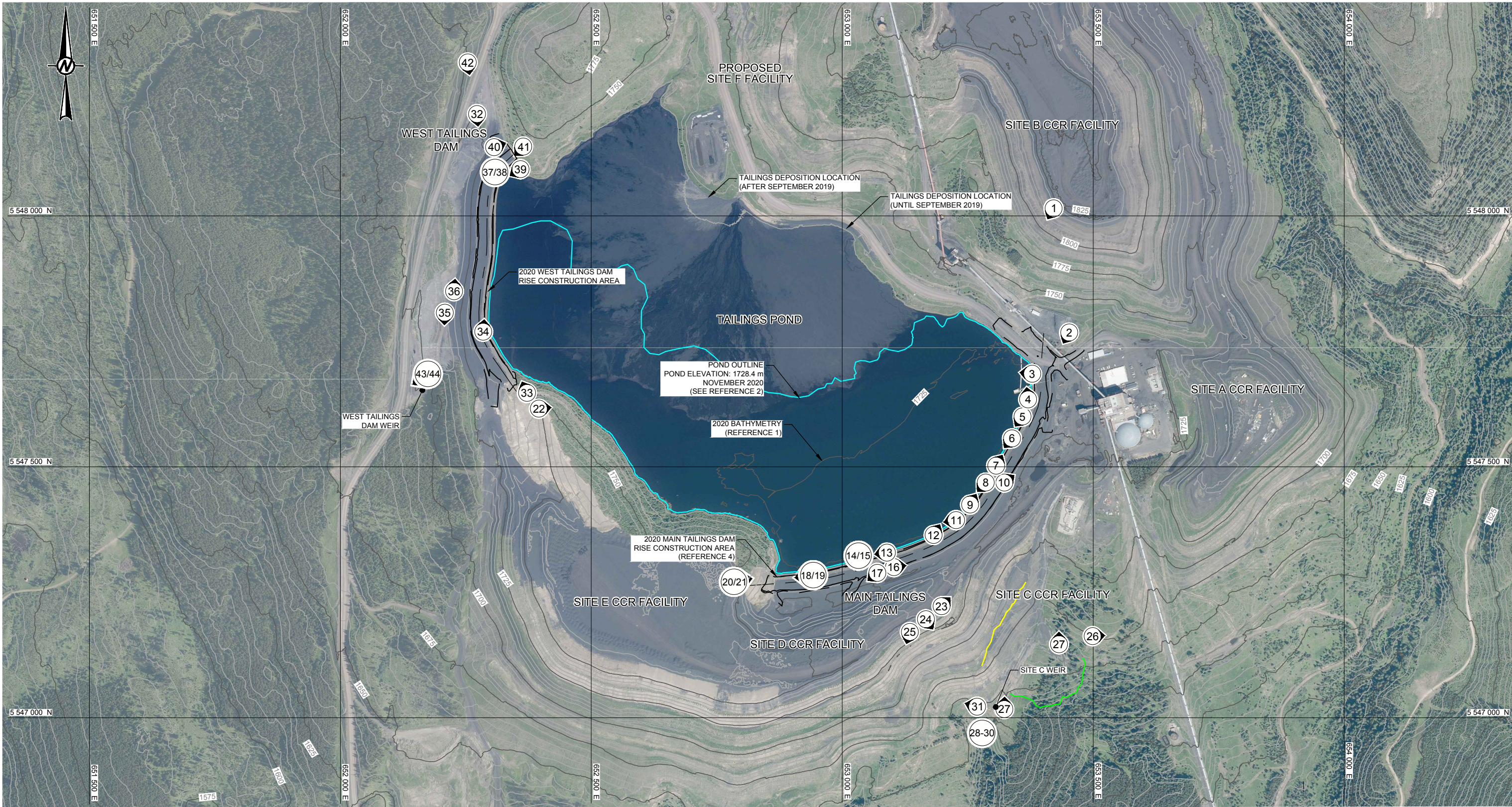
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#### LEGEND

- 2020 BATHYMETRY (SEE REFERENCE 1)
- 2020 TOPOGRAPHY (SEE REFERENCE 6)
- 2020 SITE VISIT PHOTO LOCATION
- 2012 TOE BULGE SITE C (SEE REFERENCE 5)
- 2012 SCARP SITE C (SEE REFERENCE 5)
- CCR COARSE COAL REFUSE

#### NOTES

- ALL UNITS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
- COORDINATES ARE IN UTM NAD83 ZONE 11, ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.
- BATHYMETRY CONTOURS (SEE REFERENCE 1) SHOWN AT 5.0 m MAJOR AND 1.0 m MINOR INTERVAL.
- TOPOGRAPHIC CONTOURS (SEE REFERENCE 6) SHOWN AT 25.0 m MAJOR AND 5.0 m MINOR INTERVAL.

#### REFERENCES

- 2020 BATHYMETRY INFORMATION PROVIDED BY TECK COAL LIMITED, FILE NAME: "Raw Bath survey points\_200721\_MG.msr" AND "200721\_tailings.00t.msr", DATED: 21 JULY 2020, RECEIVED: 05 AUGUST 2020.
- POND ELEVATION DOWNLOADED FROM TECK COAL'S INSTRUMENT MONITORING SOFTWARE, GEOEXPLORER, FOR GREENHILLS OPERATIONS; FILENAME: 'SENSOR LOCATIONS.csv', RECEIVED: 01 NOVEMBER 2020.
- 2020 AERIAL PHOTO PROVIDED BY TECK COAL LIMITED, FILE NAME: "2020 Aerial Combined\_AOI2".
- 2020 MAIN AND WEST TAILINGS DAM RAISE CONSTRUCTED AREA PROVIDED BY KRC (KETTLE RIVER CONTRACTING), RECEIVED: 2020 NOVEMBER 16, FILES AS FOLLOWS: MTD\_FINALSURFACE.dxf, MTD\_NORTHABUTMENT.dxf, MTD\_NORTHABUTMENT\_TOPTILL.dxf, MTD\_WESTABUTMENT\_KEY.dxf, WTD\_FINALSURFACE.dxf, WTD\_SOUTHABUTMENT\_KEY.dxf, AND WTD\_SOUTHABUTMENT\_NCRHOLE.dxf. ADDITIONAL SURVEY FILES FROM KRC RECEIVED: 2020 DECEMBER 17, FILES AS FOLLOWS: MTD\_PIPELINES.dxf AND WTD\_MTD\_TILL\_INTERFACE.dxf.
- 2012 SCARP AND TOE BULGE LOCATIONS PROVIDED BY TECK COAL LIMITED GREENHILLS OPERATIONS ON 13 MARCH 2014.
- 2020 LIDAR TOPOGRAPHY PROVIDED BY TECK COAL LIMITED, RECEIVED: 01 DECEMBER 2020, DATES FLOWN: 15-26 JULY 2020.

CLIENT  
TECK COAL LIMITED  
GREENHILLS OPERATIONS  
ELKFORD, B.C.

CONSULTANT



YYYY-MM-DD	2021-03-24
DESIGNED	Z.SMITH
PREPARED	P.JHAJJ
REVIEWED	M.WILLAN
APPROVED	A.HAYNES

PROJECT  
GREENHILLS TAILINGS STORAGE FACILITY  
2020 ANNUAL FACILITY REPORT

TITLE  
**2020 SITE VISIT PHOTOGRAPH LOCATIONS**

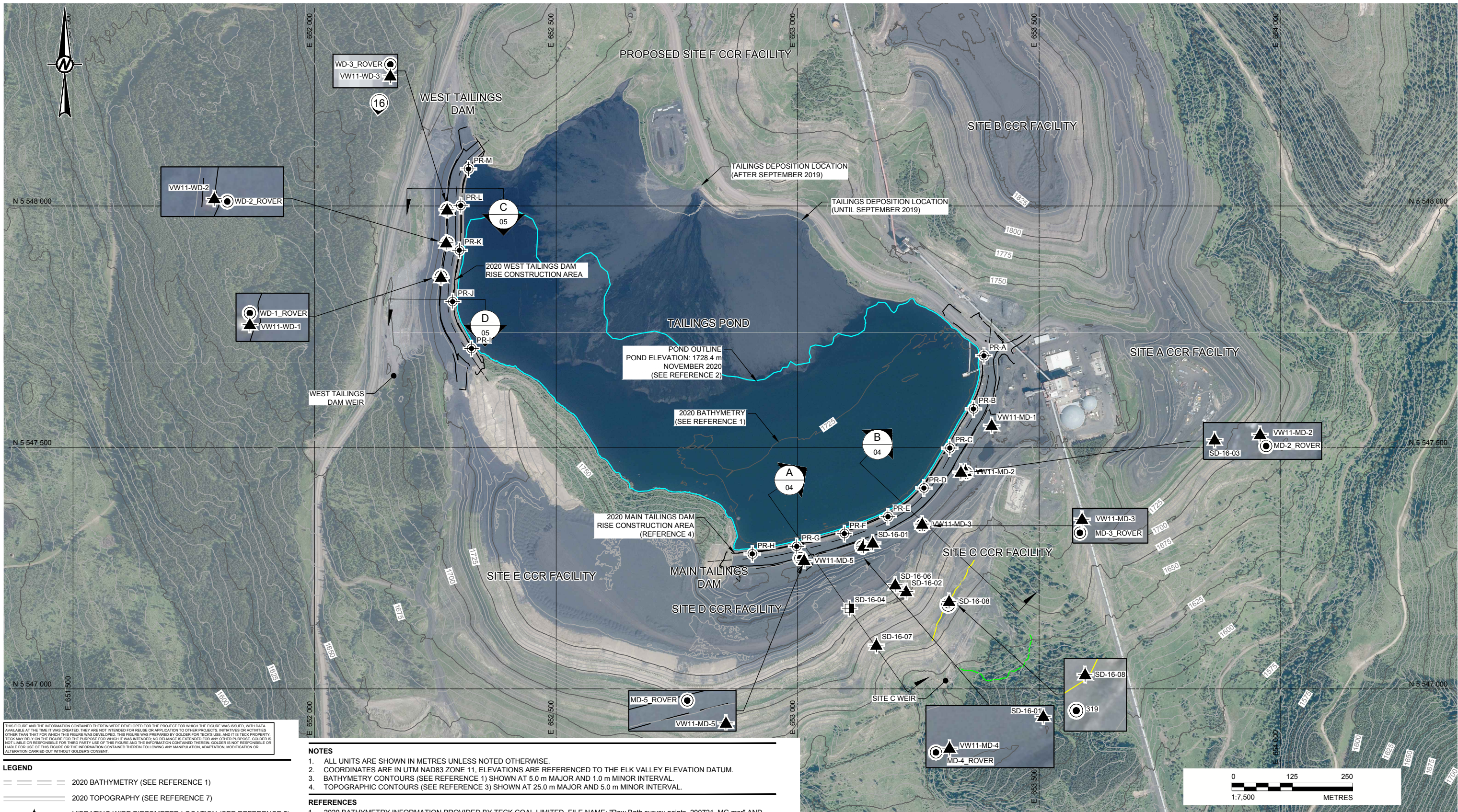
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- LEGEND**
- 2020 BATHYMETRY (SEE REFERENCE 1)
  - 2020 TOPOGRAPHY (SEE REFERENCE 7)
  - VIBRATING WIRE PIEZOMETER LOCATION (SEE REFERENCE 5)
  - INCLINOMETER AND VIBRATING WIRE PIEZOMETER LOCATION (SEE REFERENCE 5)
  - GPS UNIT LOCATION (SEE REFERENCE 6)
  - SURVEY PRISM LOCATION (REFERENCE 6)
  - 2012 TOE BULGE SITE C (SEE REFERENCE 7)
  - 2012 SCARP SITE C (SEE REFERENCE 7)
  - CCR COARSE COAL REFUSE

- NOTES**
- ALL UNITS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
  - COORDINATES ARE IN UTM NAD83 ZONE 11, ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.
  - BATHYMETRY CONTOURS (SEE REFERENCE 1) SHOWN AT 5.0 m MAJOR AND 1.0 m MINOR INTERVAL.
  - TOPOGRAPHIC CONTOURS (SEE REFERENCE 3) SHOWN AT 25.0 m MAJOR AND 5.0 m MINOR INTERVAL.
- REFERENCES**
- 2020 BATHYMETRY INFORMATION PROVIDED BY TECK COAL LIMITED, FILE NAME: "Raw Bath survey points\_200721\_MG.msr" AND "200721\_tailings.00t.msr", DATED: 21 JULY 2020, RECEIVED: 05 AUGUST 2020.
  - POND ELEVATION DOWNLOADED FROM TECK COAL'S INSTRUMENT MONITORING SOFTWARE, GEOEXPLORER, FOR GREENHILLS OPERATIONS; FILENAME: "SENSOR LOCATIONS.csv", RECEIVED: 01 NOVEMBER 2020.
  - 2020 AERIAL PHOTO PROVIDED BY TECK COAL LIMITED, FILE NAME: "2019 Aerial Combined\_AOI2".
  - 2020 MAIN AND WEST TAILINGS DAM RAISE CONSTRUCTED AREA PROVIDED BY KRC (KETTLE RIVER CONTRACTING), RECEIVED: 2020 NOVEMBER 16, FILES AS FOLLOWS: MTD\_FINALSURFACE.dxf, MTD\_NORTHABUTMENT.dxf, MTD\_SOUTHABUTMENT\_KEY.dxf, MTD\_SOUTHABUTMENT\_NCRHOLE.dxf. ADDITIONAL SURVEY FILES FROM KRC RECEIVED: 2020 DECEMBER 17, FILES AS FOLLOWS: MTD\_PIPELINES.dxf AND WTD\_MTD\_TILL\_INTERFACE.dxf.
  - VIBRATING WIRE PIEZOMETER AND INCLINOMETER LOCATIONS DOWNLOADED FROM TECK COAL'S INSTRUMENT MONITORING SOFTWARE, GEOEXPLORER, FOR GREENHILLS OPERATIONS; FILENAME: "Sensor Locations.csv", RECEIVED: 3 OCTOBER 2019.
  - PRISM AND GPS LOCATIONS DOWNLOADED FROM TECK COAL'S INSTRUMENT MONITORING SOFTWARE, GEOEXPLORER, FOR GREENHILLS OPERATIONS; FILENAME: "Geosensor Data.csv", RECEIVED: 18 SEPTEMBER 2019.
  - 2012 SCARP AND TOE BULGE LOCATIONS PROVIDED BY TECK COAL LIMITED GREENHILLS OPERATIONS ON 13 MARCH 2014.
  - 2020 LIDAR TOPOGRAPHY PROVIDED BY TECK COAL LIMITED. RECEIVED: 01 DECEMBER 2020, DATES FLOWN: 15-26 JULY 2020.

CLIENT  
TECK COAL LIMITED  
GREENHILLS OPERATIONS  
ELKFORD, B.C.

CONSULTANT



YYYY-MM-DD	2021-03-24
DESIGNED	Z.SMITH
PREPARED	P. JHAJJ
REVIEWED	M.WILLAN
APPROVED	A.HAYNES

PROJECT  
GREENHILLS TAILINGS STORAGE FACILITY  
2020 ANNUAL FACILITY REPORT

TITLE  
**TAILINGS STORAGE FACILITY INSTRUMENTATION LOCATIONS**

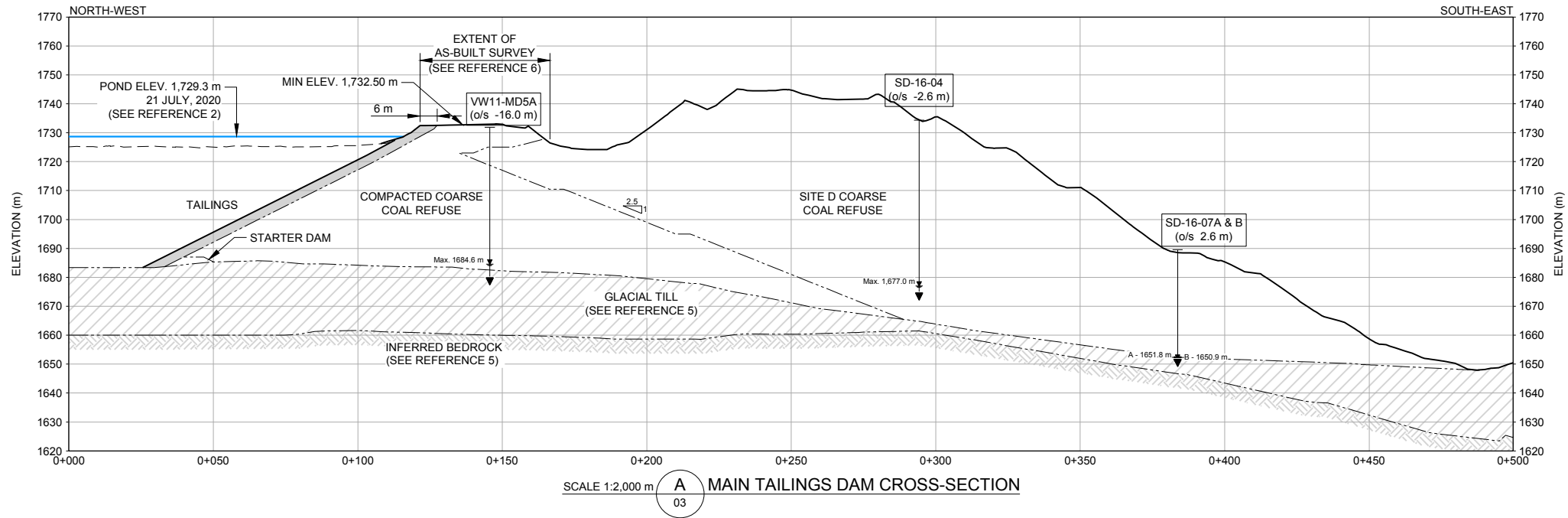
PROJECT NO.	PHASE/TASK/DOC	REV.	FIGURE
19133994	3000/3003/150	0	3

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

25 mm



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**LEGEND**

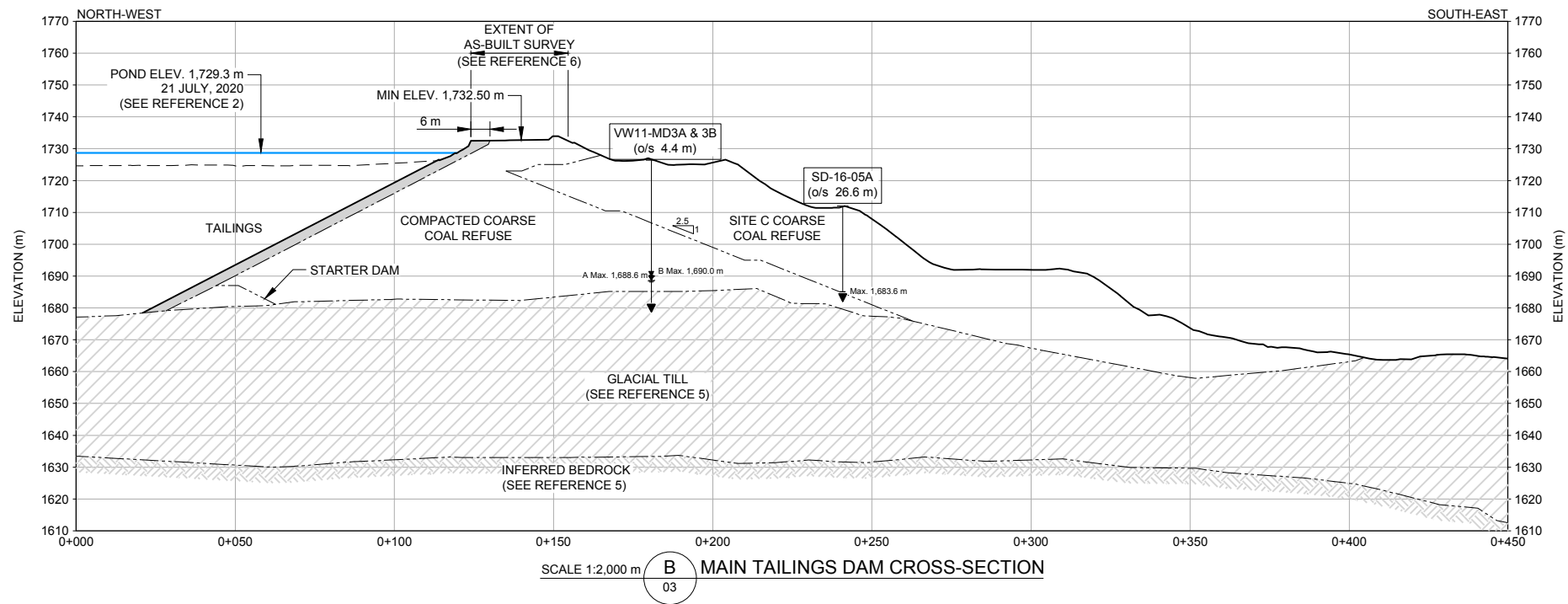
- JULY 2020 BATHYMETRY (SEE REFERENCE 1)
- NOVEMBER 2020 SURVEY (SEE REFERENCE 6)
- - - - - INFERRED CONTACT
- CLAY BLANKET
- GLACIAL TILL
- BEDROCK
- ▼ VIBRATING WIRE PIEZOMETER TIP ELEVATION (SEE NOTE 3)

**NOTES**

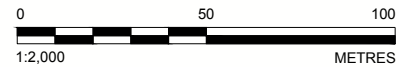
- ALL UNITS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
- MATERIAL BOUNDARIES ARE APPROXIMATE.
- VIBRATING WIRE PIEZOMETER MAXIMUM OBSERVATIONS FROM DATA BETWEEN 01 AUGUST 2019 AND 31 AUGUST 2020.
- ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.

**REFERENCES**

- 2020 BATHYMETRY INFORMATION PROVIDED BY TECK COAL LIMITED, FILE NAME: "Raw Bath survey points\_200721\_MG.msr" AND "200721\_tailings.00t.msr", DATED: 21 JULY 2020, RECEIVED: 05 AUGUST 2020.
- POND ELEVATION DOWNLOADED FROM TECK COAL'S INSTRUMENT MONITORING SOFTWARE, GEOEXPLORER, FOR GREENHILLS OPERATIONS JULY 2020.
- 2019 TOPOGRAPHY PROVIDED BY TECK COAL LIMITED, FLOWN 21 TO 29 JULY 2019.
- 2018 AS-BUILT INFORMATION PROVIDED BY TECK COAL LIMITED, FILE NAME: "2018-10-02 GHQ DAM - VOLUME CALC.dxf", DATED: 02 OCTOBER 2018.
- MAIN DAM SECTION INFERRED GLACIAL TILL AND INFERRED BEDROCK BASED ON HARDY (1980) REPORT ON TAILINGS DAM GREENHILLS SURFACE COAL MINING PROJECT AND GOLDER 2016 MAIN TAILINGS DAM INVESTIGATION. GOLDER REFERENCE NUMBER: 1658561-2017-021-R-REV0-3000
- 2020 MAIN AND WEST TAILINGS DAM RAISE CONSTRUCTED AREA PROVIDED BY KRC (KETTLE RIVER CONTRACTING), RECEIVED: 2020 NOVEMBER 16, FILES AS FOLLOWS: MTD\_FINALSURFACE.dxf, MTD\_NORTHABUTMENT.dxf, MTD\_NORTHABUTMENT\_TOPTILL.dxf, MTD\_WESTABUTMENT\_KEY.dxf, WTD\_FINALSURFACE.dxf, WTD\_SOUTHABUTMENT\_KEY.dxf, AND WTD\_SOUTHABUTMENT\_NCRHOLE.dxf. ADDITIONAL SURVEY FILES FROM KRC RECEIVED: 2020 DECEMBER 17, FILES AS FOLLOWS: MTD\_PIPELINES.dxf AND WTD\_MTD\_TILL\_INTERFACE.dxf.



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.



**CLIENT**

TECK COAL LIMITED  
GREENHILLS OPERATIONS  
ELKFORD, B.C.

**CONSULTANT**

YYYY-MM-DD 2021-03-24  
DESIGNED Z.SMITH  
PREPARED M.HEAL  
REVIEWED M.WILLAN  
APPROVED A.HAYNES

**PROJECT**

GREENHILLS TAILINGS STORAGE FACILITY  
2020 ANNUAL FACILITY REPORT

**TITLE**

MAIN TAILINGS DAM - CROSS-SECTIONS A AND B

**PROJECT NO.**

19133994

**PHASE/TASK/DOC**

3000/3003/150

**REV.**

0

**FIGURE**

4

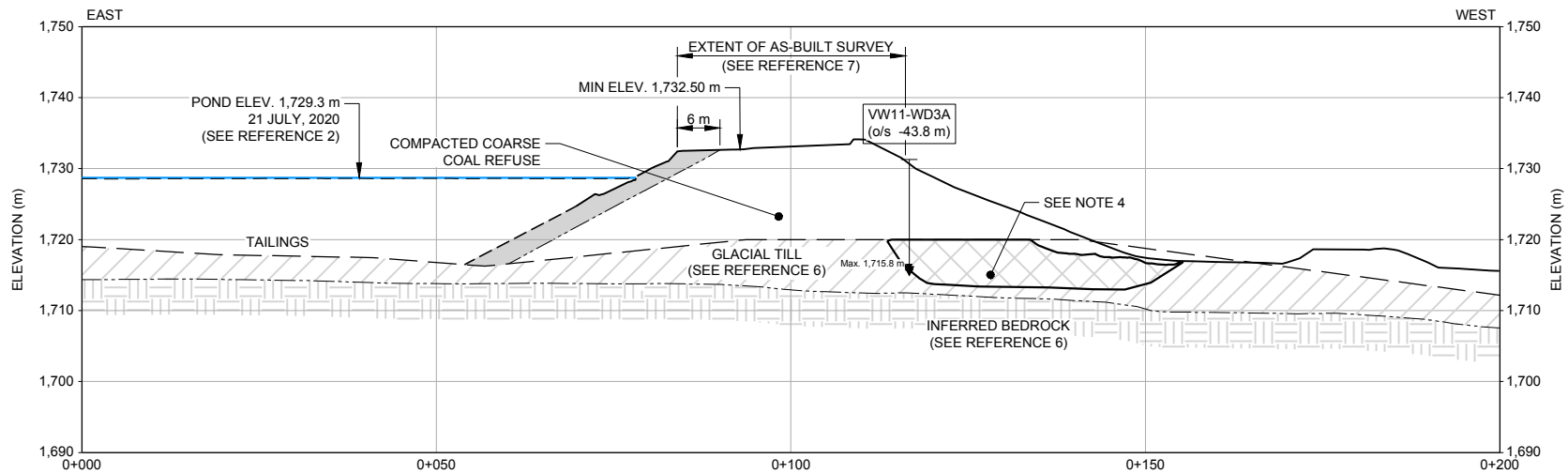


IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

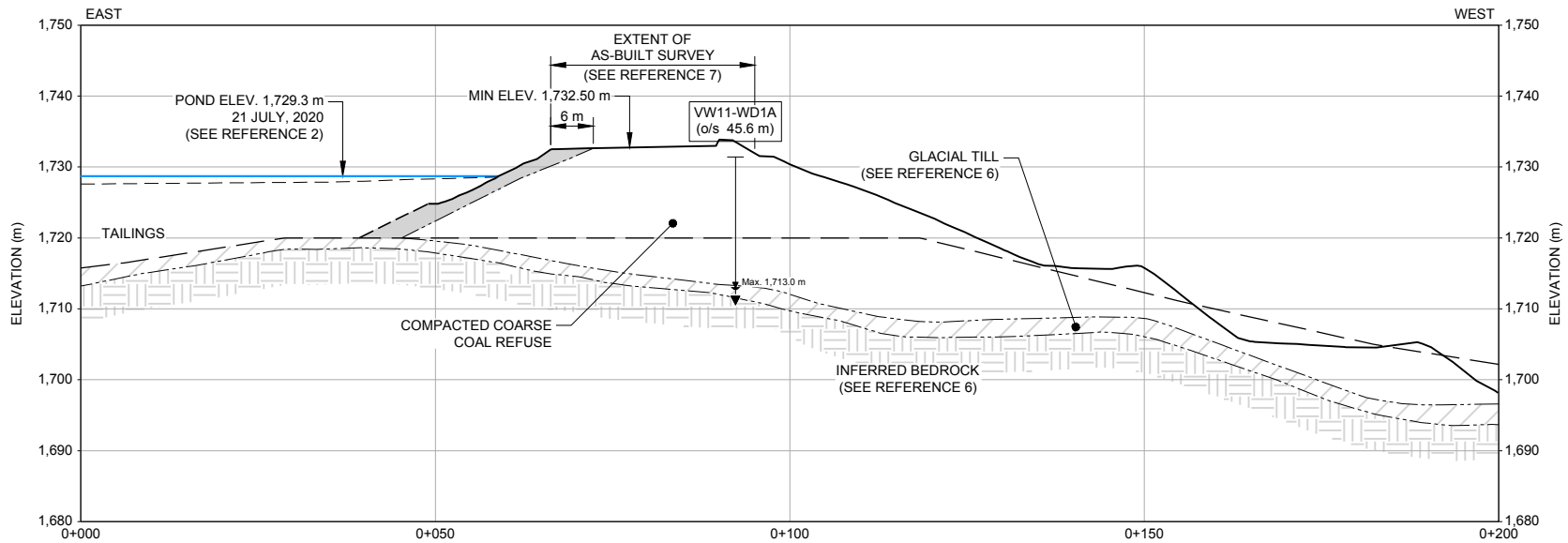
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SCALE 1:1,000 m **C** WEST TAILINGS DAM CROSS-SECTION  
03



SCALE 1:1,000 m **D** WEST TAILINGS DAM CROSS-SECTION  
03

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.

CLIENT  
TECK COAL LIMITED  
GREENHILLS OPERATIONS  
ELKFORD, B.C.

CONSULTANT



YYYY-MM-DD	2021-03-24
DESIGNED	Z.SMITH
PREPARED	M.HEAL
REVIEWED	M.WILLAN
APPROVED	A.HAYNES

#### LEGEND

- OCTOBER 2019 BATHYMETRY (SEE REFERENCE 1)
- NOVEMBER 2020 SURVEY (SEE REFERENCE 7)
- - - APPROXIMATE ORIGINAL GROUND SURFACE (SEE REFERENCE 5)
- - - - - INFERRED CONTACT
- CLAY BLANKET
- WASTE ROCK
- GLACIAL TILL
- BEDROCK
- ▼ VIBRATING WIRE PIEZOMETER TIP ELEVATION (SEE NOTE 3)

#### NOTES

- ALL UNITS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
- MATERIAL BOUNDARIES ARE APPROXIMATE.
- VIBRATING WIRE PIEZOMETER MAXIMUM OBSERVATIONS FROM DATA BETWEEN 01 AUGUST 2019 AND 31 AUGUST 2020.
- LOOSE MATERIAL STRIPPED FROM FOUNDATION AND BACKFILLED WITH WASTE ROCK BASED ON GOLDER 2016 *GREENHILLS OPERATIONS MAIN AND WEST TAILINGS DAMS*. REPORT PREPARED FOR TECK COAL LIMITED, GHQ. REPORT NO. 1313960014.3000. SUBMITTED 26 JANUARY 2016.
- ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.

#### REFERENCES

- 2019 BATHYMETRY INFORMATION PROVIDED BY TECK COAL LIMITED, FILE NAME: "191017 tailings pond sounding surface\_MG.dxf", DATED: 17 OCTOBER 2019, RECEIVED: 04 DECEMBER 2019.
- POND ELEVATION DOWNLOADED FROM TECK COAL'S INSTRUMENT MONITORING SOFTWARE, GEOEXPLORER, FOR GREENHILLS OPERATIONS JULY 2020.
- 2019 TOPOGRAPHY PROVIDED BY TECK COAL LIMITED, FLOWN 21 TO 29 JULY 2019.
- 2018 AS-BUILT INFORMATION PROVIDED BY TECK COAL LIMITED, FILE NAME: "2018-10-02 GHQ DAM - VOLUME CALC.dxf", DATED: 02 OCTOBER 2018.
- SEPTEMBER 2014 GROUND SURFACE PROVIDED BY TECK COAL LIMITED, RECEIVED: 23 SEPTEMBER 2014.
- WEST DAM SECTION TYPICAL STRATIGRAPHY OBTAINED FROM GOLDER. 2014. *GREENHILLS OPERATIONS WEST TAILING DAM RAISE TO ELEVATION 1,735 m*. REPORT PREPARED FOR TECK GHQ. REPORT NO. 13-1321-0018. SUBMITTED 11 FEBRUARY 2014.
- 2020 MAIN AND WEST TAILINGS DAM RAISE CONSTRUCTED AREA PROVIDED BY KRC (KETTLE RIVER CONTRACTING), RECEIVED: 2020 NOVEMBER 16, FILES AS FOLLOWS: MTD\_FINALSURFACE.dxf, MTD\_NORTHABUTMENT.dxf, MTD\_NORTHABUTMENT\_TOPTILL.dxf, MTD\_WESTABUTMENT\_KEY.dxf, MTD\_FINALSURFACE.dxf, MTD\_SOUTHABUTMENT\_KEY.dxf, AND MTD\_SOUTHABUTMENT\_NCRHOLE.dxf. ADDITIONAL SURVEY FILES FROM KRC RECEIVED: 2020 DECEMBER 17, FILES AS FOLLOWS: MTD\_PIPELINES.dxf AND MTD\_MTD\_TILL\_INTERFACE.dxf.



PROJECT  
GREENHILLS TAILINGS STORAGE FACILITY  
2020 ANNUAL FACILITY REPORT

TITLE  
**WEST TAILINGS DAM - CROSS-SECTIONS C AND D**

PROJECT NO.	PHASE/TASK/DOC	REV.	FIGURE
19133994	3000/3003/150	0	<b>5</b>

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

25 mm

**APPENDIX A**

# 2020 Site Inspection Photos



**Photograph 1: Tailings Storage Facility – Overview; Looking Southwest, 4 September 2020**



**Photograph 2: Main Tailings Dam and Reclaim Barge – Looking Southwest, 21 August 2020**





**Photograph 3: Tailings Storage Facility – Looking Northwest, 1 September 2020**



**Photograph 4: Main Tailings Dam – Reclaim Barge and Upstream Crest; Looking North, 1 September 2020**





**Photograph 5: Main Tailings Dam – Till Blanket and Dam Crest; Looking Southwest, 1 September 2020**



**Photograph 6: Main Tailings Dam – Vegetation on Upstream Crest; Looking Southwest, 1 September 2020**





**Photograph 7: Main Tailings Dam – Upstream Crest and Reclaim Barge; Looking Northeast, 1 September 2020**



**Photograph 8: Main Tailings Dam – Freeboard Indicator; Looking Southwest, 1 September 2020**





**Photograph 9: Main Tailings Dam – Freeboard Indicator; Looking Northeast, 1 September 2020**



**Photograph 10: Main Tailings Dam – Downstream Crest; Looking East, 1 September 2020**





**Figure 11: Main Tailings Dam - Upstream Crest Riprap Erosion; Looking West, 1 September 2020**



**Photograph 12: Main Tailings Dam – Upstream Crest; Looking Northeast, 1 September 2020**





**Photograph 13: Main Tailings Dam – Prism and Vegetation on Dam Crest; Looking West, 1 September 2020**



**Photograph 14: Main Tailings Dam – Minor Erosion Rills on Upstream Crest; Looking West, 1 September 2020**





**Photograph 15: Main Tailings Dam – Minor Erosion Rills on Upstream Crest; Looking North, 1 September 2020**



**Photograph 16: Main Tailings Dam –Crest and Downstream Slope; Looking East, 1 September 2020**





**Photograph 17: Main Tailings Dam – Downstream Slope and Access Ramp; Looking Southwest, 1 September 2020**



**Photograph 18: Main Tailings Dam – Upstream Crest and West Abutment; Looking West, 1 September 2020**





**Photograph 19: Main Tailings Dam – West Abutment; Looking West, 1 September 2020**



**Photograph 20: Main Tailings Dam – Dam Crest; Looking East, 1 September 2020**





**Photograph 21: Main Tailings Dam – Looking East, 1 September 2020**



**Photograph 22: Main Tailings Dam – Looking East, 1 September 2020**





**Photograph 23: Site C Coarse Coal Refuse Facility – Downstream Crest; Looking Northeast, 1 September 2020**



**Photograph 24: Site C Coarse Coal Refuse Facility – Seepage Weir and Downstream Creek; Looking Southeast, 1 September 2020**





**Photograph 25: Site C Coarse Coal Refuse Facility – Downstream Benches; Looking Southwest 1 September 2020**



**Photograph 26: Site C Coarse Refuse Facility – Smart Ditch at Toe; Looking Northeast, 1 September 2020**





**Photograph 27: Site C Weir; Looking Northeast – 1 September 2020**



**Photograph 28: Site C Weir; Looking Southwest – 1 September 2020**





**Photograph 29: Site C Weir; Looking Southwest – 1 September 2020**



**Photograph 30: Site C/D Coarse Coal Refuse Facility – Toe and Seepage; Looking Northwest, 1 September 2020**





**Photograph 31: West Tailings Dam – Overview; Looking South, 21 August 2020**



**Photograph 32: West Tailings Dam – Looking Northwest, 1 September 2020**





**Photograph 33: West Tailings Dam – Till Blanket and Upstream Slope; Preparation in Progress for 2020 Dam Raise; Looking North, 1 September 2020**



**Photograph 34: West Tailings Dam – Downstream Slope; Looking South, 1 September 2020**





**Photograph 35: West Tailings Dam – Downstream Slope; Looking North, 1 September 2020**



**Photograph 36: West Tailings Dam – Till Blanket; Preparation in Progress for 2020 Dam Raise; Looking South, 1 September 2020**





**Photograph 37: West Tailings Dam - Superficial Cracking on Till Blanket; Looking South, 1 September 2020**



**Photograph 38: West Tailings Dam – Upstream Slope; Preparation in Progress for 2020 Dam Raise; Looking West, 1 September 2020**





**Photograph 39: West Tailings Dam – North Abutment; Preparation in Progress for 2020 Dam Raise; Looking Northeast 1 September 2020**



**Photograph 40: West Tailings Dam – North Abutment and West Tailings Dam Crest; Looking South, 1 September 2020**





**Photograph 41: West Tailings Dam – Downstream Crest; Looking Southeast, 1 September 2020**



**Photograph 42: West Dam Seepage Weir; Looking Southwest – 1 September 2020**



**Photograph 43: West Dam Seepage Weir; Looking Southwest – 1 September 2020**



**APPENDIX B**

**September 2020 Annual Golder  
Inspection Reports**

<b>Client:</b>	<b>Teck Coal Limited</b>	<b>By:</b>	<b>Andy Haynes, P.Eng. and Martyn Willan, P.Eng.</b>
<b>Project:</b>	<b>GHO 2020 Annual Facility Report</b>	<b>Date:</b>	<b>1 September 2020</b>
<b>Location:</b>	<b>Main Tailings Dam</b>		

## GENERAL INFORMATION


Dam Type: Compacted CCR with till blanket

<b>Weather Conditions:</b>	Clear and sunny	<b>Temp:</b>	13°C
----------------------------	-----------------	--------------	------

INSPECTION ITEM	OBSERVATIONS/DATA	PHOTO	COMMENTS & OTHER DATA
<b>1. DAM CREST</b>			
1.1 Crest Elevation (Till)	1,731.1 m	2,5,6,7,8,9,11,12, 13,14,16,18,20,21	Crest elevation from as-constructed report (Golder 2019b)
1.2 Reservoir Level / Freeboard	1,728.7 m Approximately 2.4 m freeboard	4,6,7,8,9,10, 11,12,14,20	Pond level from GHO GPS 313 reading on 1 September 2020
1.3 Distance to Tailings Pond (if applicable)	Water against upstream slope of dam.  Approximately 2.4 m freeboard	1,2, 4,6,7,8,9,10, 11,12,14,20	
1.4 Surface Cracking	Minor cracks in till at crest on upstream side near interface with riprap.		Regrade during 2020 dam raise
1.5 Unexpected Settlement	None observed		
1.6 Lateral Movement	None observed		
1.7 Other Unusual Conditions	Minor localized depressions at interface with riprap on upstream side	14,15	To be repaired during 2020 dam construction
<b>2. UPSTREAM SLOPE</b>		6,7,8,9,11,12,14,20	
2.1 Slope Angle	2:1		
2.2 Signs of Erosion	Minor wave cut erosion below previously placed riprap	9,11,20,	To be repaired during 2020 dam construction
2.3 Signs of Movement (Deformation)	None observed		
2.4 Cracks	None observed		

INSPECTION ITEM	OBSERVATIONS/DATA	PHOTO	COMMENTS & OTHER DATA
2.5 Face Liner Condition (if applicable)	n/a		
2.5 Other Unusual Conditions	Vegetation growth on upstream crest	6,7	
<b>3. DOWNSTREAM SLOPE</b>		10,16,17,21,23,24,25	
3.1 Slope Angle	2.5:1		
3.2 Signs of Erosion	None observed		
3.3 Signs of Movement (Deformation)	Site C slump first observed in April 2019. No additional movement observed.		Continue Monitoring
3.4 Cracks	None observed		
3.5 Seepage or Wet Areas	None observed		
3.6 Vegetation Growth	Not of concern		
3.7 Other Unusual Conditions	None observed		
<b>4. DOWNSTREAM TOE AREA</b>		2,1017,21,23,24,25,26,30	
4.1 Seepage from Dam	Seepage/surface water runoff observed in collection channel  Some localized areas of seepage observed downstream of collection channel	26,27,28,29	
4.2 Signs of Erosion	Some localized erosion on Site C		No action required at this time
4.3 Signs of Turbidity in Seepage Water	None observed		
4.4 Discoloration/Staining	Some red staining in seepage channel and at weir	26,27,28,29	
4.5 Outlet Operating Problem (if applicable)	Some build-up of sediment at Site C weir	27	Remove sediment when equipment is available
4.6 Other Unusual Conditions	Animal burrows at toe		No action required at this time continue monitoring

INSPECTION ITEM	OBSERVATIONS/DATA	PHOTO	COMMENTS & OTHER DATA
<b>5. ABUTMENTS</b>		4,18,19,21,	
5.1 Seepage at Contact Zone (abutment/embankment)	None observed		
5.2 Signs of Erosion	None observed		
5.3 Excessive Vegetation	None observed		
5.4 Presence of Rodent Burrows	None observed		
5.5 Other Unusual Conditions	Ponded water at east abutment	10	Remove water and fill with CCR during dam construction
<b>6. RESERVOIR</b>			
6.1 Stability of Slopes	Satisfactory		
6.2 Floating Debris	None observed		
6.3 Other Unusual Conditions	Water levels reduced compared to 2019 annual visit	1	
<b>7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE</b>	n/a		
<b>8. INSTRUMENTATION</b>			
8.1 Piezometers	Yes		21 installed
8.2 Settlement Cells	None		
8.3 Thermistors	None		
8.4 Survey Monuments / GPS Units	Yes	5,6,7,8,9,11,13,16,17,18,20	7 GPS and 8 Survey Prisms installed
8.5 Accelerograph	None		
8.6 Inclinator	Yes		2 installed
8.7 Weirs and Flow Monitors	Site C weir (1.8 L/s)		
8.8 Data Logger(s)	Yes		Installed for various instruments
8.9 Other		4	GPS 313 on barge to monitor pond level  Visual freeboard indicator  GPS 319 and 320 on Site C coarse refuse stockpile

INSPECTION ITEM	OBSERVATIONS/DATA	PHOTO	COMMENTS & OTHER DATA
<b>9. DOCUMENTATION</b>			
9.1 Operation, Maintenance and Surveillance (OMS) Manual 9.1.1 OMS Manual exists	Yes		GHO SP&P No. 1543
9.1.2 OMS Plan reflects current dam conditions	No		Update in progress
9.1.3 Date of last revision	24 June 2019		Version 04
9.2 Emergency Preparedness Plan (EPP) 9.2.1 EPP Exists	Yes		GHO SP&P No. 1583
9.2.2 EPP Reflects Current Conditions	No		Update in progress
9.2.3 Date of Last Revision	18 December 2018		Version 01
9.2 Tailings and Water Retaining Structures (TWRS) Management Plan 9.2.1 TWRS Management Plan Exists	Yes		Draft issued May 2020
<b>10. NOTES</b> None			
Inspector's Signature		Date:	1 September 2020

**Client:** Teck Coal Limited **By:** Andy Haynes, P.Eng. and  
Martyn Willan, P.Eng.

**Project:** GHO 2020 Annual Facility Report **Date:** 1 September 2020

**Location:** West Tailings Dam

## GENERAL INFORMATION

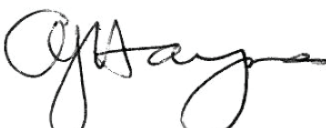
Dam Type: Compacted CCR with till blanket

<b>Weather Conditions:</b>	Clear and sunny	<b>Temp:</b>	13°C
----------------------------	-----------------	--------------	------

INSPECTION ITEM	OBSERVATIONS/DATA	PHOTO	COMMENTS & OTHER DATA
<b>1. DAM CREST</b>		31,32,33,36,37,40	
1.1 Crest Elevation (Till)	1,731.1 m		Crest elevation from as-constructed report (Golder 2019b)
1.2 Reservoir Level / Freeboard	1,728.7 m Approximately 2.4 m freeboard	31,32,33,36,38,40	Pond level from GHO GPS 313 reading on 1 September 2020
1.3 Distance to Tailings Pond (if applicable)	Shallow water at upstream slope of dam.	31,32,33,36,38,40	
1.4 Surface Cracking	Minor cracks in till at crest on upstream side near interface with riprap.	37	Regrade during 2020 dam raise
1.5 Unexpected Settlement	None observed		
1.6 Lateral Movement	None observed		
1.7 Other Unusual Conditions	Minor localized depressions at interface with riprap on upstream side	38	To be repaired during 2020 dam construction
<b>2. UPSTREAM SLOPE</b>		33,36,38,40	
2.1 Slope Angle	2:1		
2.2 Signs of Erosion	Erosion on upstream face with channels cut to allow drainage in April 2018.		Trim upstream face and install riprap during 2020 dam raise
2.3 Signs of Movement (Deformation)	None observed		



INSPECTION ITEM	OBSERVATIONS/DATA	PHOTO	COMMENTS & OTHER DATA
2.4 Cracks	None observed		
2.5 Face Liner Condition (if applicable)	n/a		
2.5 Other Unusual Conditions	None		
<b>3. DOWNSTREAM SLOPE</b>		31,34,35,41	
3.1 Slope Angle	2.5:1		
3.2 Signs of Erosion	None observed		
3.3 Signs of Movement (Deformation)	None observed		
3.4 Cracks	None observed		
3.5 Seepage or Wet Areas	None observed		
3.6 Vegetation Growth	Not of concern		
3.7 Other Unusual Conditions	None		
<b>4. DOWNSTREAM TOE AREA</b>		31,35,40	
4.1 Seepage from Dam	Seepage observed in Site D culvert and at West Dam Weir		
4.2 Signs of Erosion	None observed		
4.3 Signs of Turbidity in Seepage Water	None observed		
4.4 Discoloration/Staining	None observed		
4.5 Outlet Operating Problem (if applicable)	n/a		
4.6 Other Unusual Conditions	Small pond at toe		
<b>5. ABUTMENTS</b>		39,40	
5.1 Seepage at Contact Zone (abutment/embankment)	None observed		
5.2 Signs of Erosion	None observed		
5.3 Excessive Vegetation	None observed		
5.4 Presence of Rodent Burrows	None observed		
5.5 Other Unusual Conditions	None observed		Preparation of north abutment for dam construction in progress during inspection
<b>6. RESERVOIR</b>		31,32,33,36,40	
6.1 Stability of Slopes	Satisfactory		
6.2 Floating Debris	None observed		
6.3 Other Unusual Conditions	None observed		

INSPECTION ITEM	OBSERVATIONS/DATA	PHOTO	COMMENTS & OTHER DATA
<b>7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE</b>	n/a		
<b>8. INSTRUMENTATION</b>			
8.1 Piezometers	Yes		6 installed
8.2 Settlement Cells	None		
8.3 Thermistors	None		
8.4 Survey Monuments / GPS Units	Yes		3 GPS units and 5 survey prisms installed
8.5 Accelerograph	None		
8.6 Inclinator	None		
8.7 Weirs and Flow Monitors	West Dam Weir (1.0 L/s)	42,43	
8.8 Data Logger(s)	Yes		Installed for various instruments
8.9 Other	None		
<b>9. DOCUMENTATION</b>			
<b>9. DOCUMENTATION</b>			
9.1 Operation, Maintenance and Surveillance (OMS) Manual 9.1.1 OMS Manual exists	Yes		GHO SP&P No. 1543
9.1.2 OMS Plan reflects current dam conditions	No		Update required
9.1.3 Date of last revision	24 June 2019		Version 04
9.2 Emergency Preparedness Plan (EPP) 9.2.1 EPP Exists	Yes		GHO SP&P No. 1583
9.2.2 EPP Reflects Current Conditions	No		Update planned following completion of inundation study
9.2.3 Date of Last Revision	18 December 2018		Version 01
9.2 Tailings and Water Retaining Structures (TWRS) Management Plan 9.2.1 TWRS Management Plan Exists	Yes		Draft issued May 2020
<b>10. NOTES</b>			
Surface of dam crest rutted from vehicle traffic associated with dam raise construction			
Inspector's Signature		Date:	1 September 2020

**APPENDIX C**

**TSF Registry**



Mine Name:	Greenhills Operations
Permit No:	No. C-137 (and amendments)

General Mine Information	
Owner/company	Teck Coal Limited
Nearest community	Elkford
Region	Elk Valley / East Kootenay
Ore(s) mined	Coal
Mine operational status	Operational
Number of tailings impoundments	1

TSF Documentation	
Date of last DSI (Annual Inspection)	September 2020 (site visit)
Date of last DSR	December 2017
Date of next DSR	2022
Date of OMS update	24 June 2019
Date of EPRP update	18 December 2018
Date of EPRP test	27 August 2019
Date of dam breach and inundation study	April 2020
Tailings Management system (name)	GHO TWRS Management System (Draft)
Tailings management system (last audit)	September 2020 Teck Tailings Governance Review
TSF risk assessment last reviewed	August 2020
Water balance and water management plan (last update)	3 March 2020
Date of last as-built	22 March 2019

TSF Information	
TSF name	Greenhills Tailings Storage Facility
TSF operating status	Active
Year facility was last used (if closed)	N/A
Number of dams	2
Engineer of record	Andy Haynes (Golder Associates Ltd.)
TSF qualified person	Andrew Knight
Spillway present	No
Spillway date of last maintenance	N/A
Quantitative Performance Objectives (QPOs)	Yes
Volume of impoundment	19.5 million m <sup>3</sup> (to permitted elevation 1,735 m)

Dam Information	
Dam name	Main Tailings Dam
Height of dam	50 m
Consequence classification	High
Slope	Downstream: 2.5H:1V; Upstream: 2H:1V
Minimum factor of safety (long term steady state)	2.0
Minimum factor of safety (pseudo-static)	1.2
Permitted elevation	1,735 m
Current elevation	1,731.14 m (In 2019/2020 reporting period, raised in October 2020 to 1,732.5 m)
Seismic design (AEP)	1 in 2,475 years
Flood design (AEP)	1/3 between 1/1,000 year return period and PMF
Type of dam construction (upstream, downstream, centre)	Downstream
Type of dam core (till core, rock fill, cyclone sand, etc.)	Till blanket

Dam Information	
Dam names	West Tailings Dam
Height of dam	25 m
Consequence classification	High
Slope	Downstream: 2.5H:1V; Upstream: 2H:1V
Minimum factor of safety (long term steady state)	1.8
Minimum factor of safety (pseudo-static)	1.1
Permitted elevation	1,735 m
Current elevation	1,731.14 m (In 2019/2020 reporting period, raised in October 2020 to 1,732.5 m)
Seismic design (AEP)	1 in 2,475 years
Flood design (AEP)	1/3 between 1/1000 year return period and PMF
Type of dam construction (upstream, downstream, centre)	Downstream
Type of dam core (till core, rock fill, cyclone sand, etc.)	Till blanket

**Sources:**

KCB (Klohn Crippen Berger). 2017. Teck Coal Limited final report: Greenhills Operations dam safety review of Main and West Tailings Dams and Greenhills Settling Pond Dam. File No. M10126A01.730. December 2017.

GHO. 2019a. Tailings Pond Dam Breach Emergency Preparedness and Response Plan (Dam Breach EPRP). SP&P No. 1583. Ver. 1. Date of Issue: 31 January 2019. Date of Revision: 18 December 2018.

GHO. 2019b. Operation, Maintenance, and Surveillance Manual for Greenhills Tailings Storage Facility. Standard Practices and Procedures No. 1543. Ver. 4. Date of Revision: 24 June 2019

Golder. 2014. Geotechnical report, Greenhills Operations West Tailings Dam raise to elevation 1735 m. Report prepared for Teck Coal Limited- Greenhills Operations. Report No. 13-1321-0018. 11 February 2014.

Golder. 2017a. Tailings storage facility dam breach flood inundation study. Report prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 1528359-2016-081-R-Rev0-4000. 17 April 2017.

Golder. 2017b. Stability review and update of the quantitative performance objectives for Greenhills tailings pond dams. Technical memorandum prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 1780315-2017-097-R-Rev0-1000. 21 December 2017.

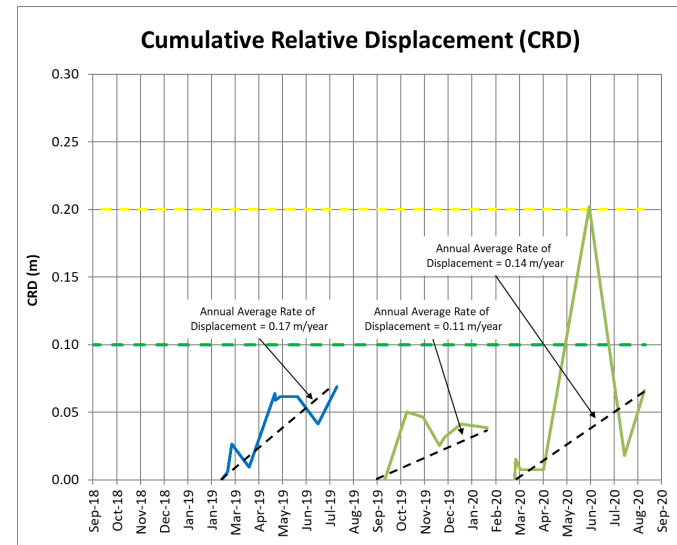
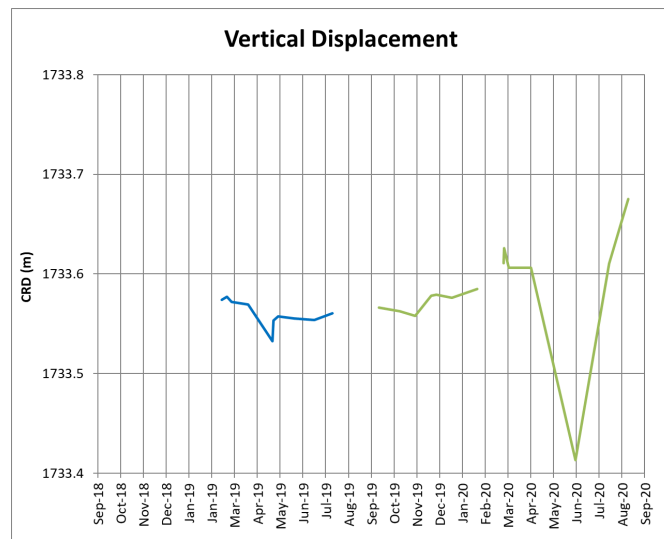
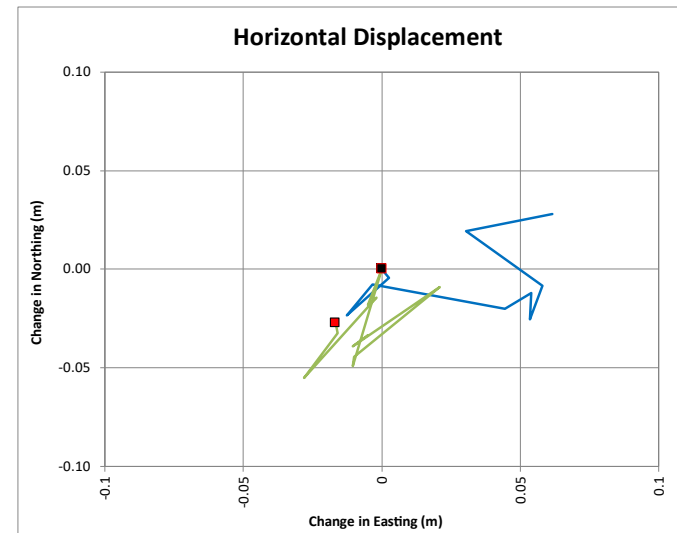
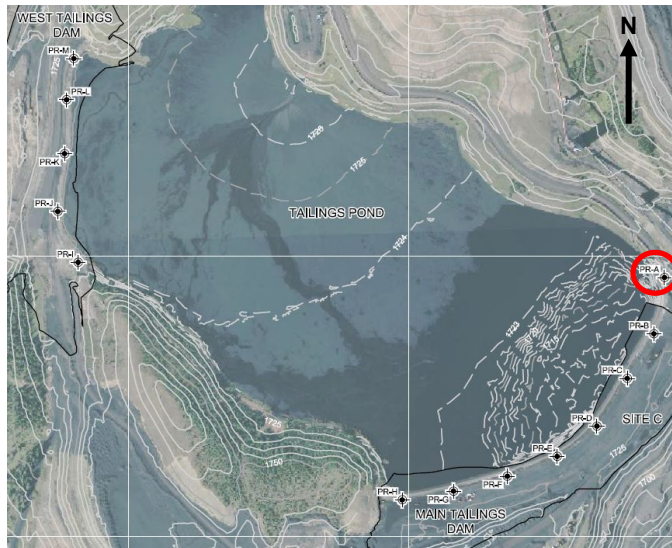
Golder. 2019a. 2018 Construction Report. Greenhills Operations Main and West Dams. Report prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 18103265-FINAL-Rev0. 22 March 2019.

Golder. 2019b. 2018 Dam Safety Inspection for Greenhills Tailings Facility. Report Prepared for Teck Coal Limited, Greenhills Operations. Reference No. 1894290-2018-133-R-Rev0-2000. Submitted 26 March 2019.

Wood . 2018. 2017 risk assessment of tailings dams classified as High or Higher: Greenhills Operations – Main and West Dams. TE173054. 12 May 2018.

**APPENDIX D**

# GPS & Prism Plots



■ Initial Location

■ Final Location

— 2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)

— 2018/2019 Annual Inspection Reporting Period (1 September 2018 to 31 July 2019)

— Green Notification (100 mm)

— Yellow Warning (200 mm)

○ Instrument Location

References:

-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.

Notes:

-Prism data reset in February 2020 due to change in survey total station pillar

-Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020

-Annual average rate of displacement was calculated based on prorating the data available to represent 12 months of movement. i.e. data was forecast forward assuming a linear increase.

-Data gaps present due to survey prisms being offline or moved during dam raise construction

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GOLDER

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DESIGN ZPS

REVIEW MBW

APPROVED AJH

PROJECT

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2020 ANNUAL FACILITY REPORT

TITLE

MAIN TAILINGS DAM - PRISM A  
DISPLACEMENT PLOTS

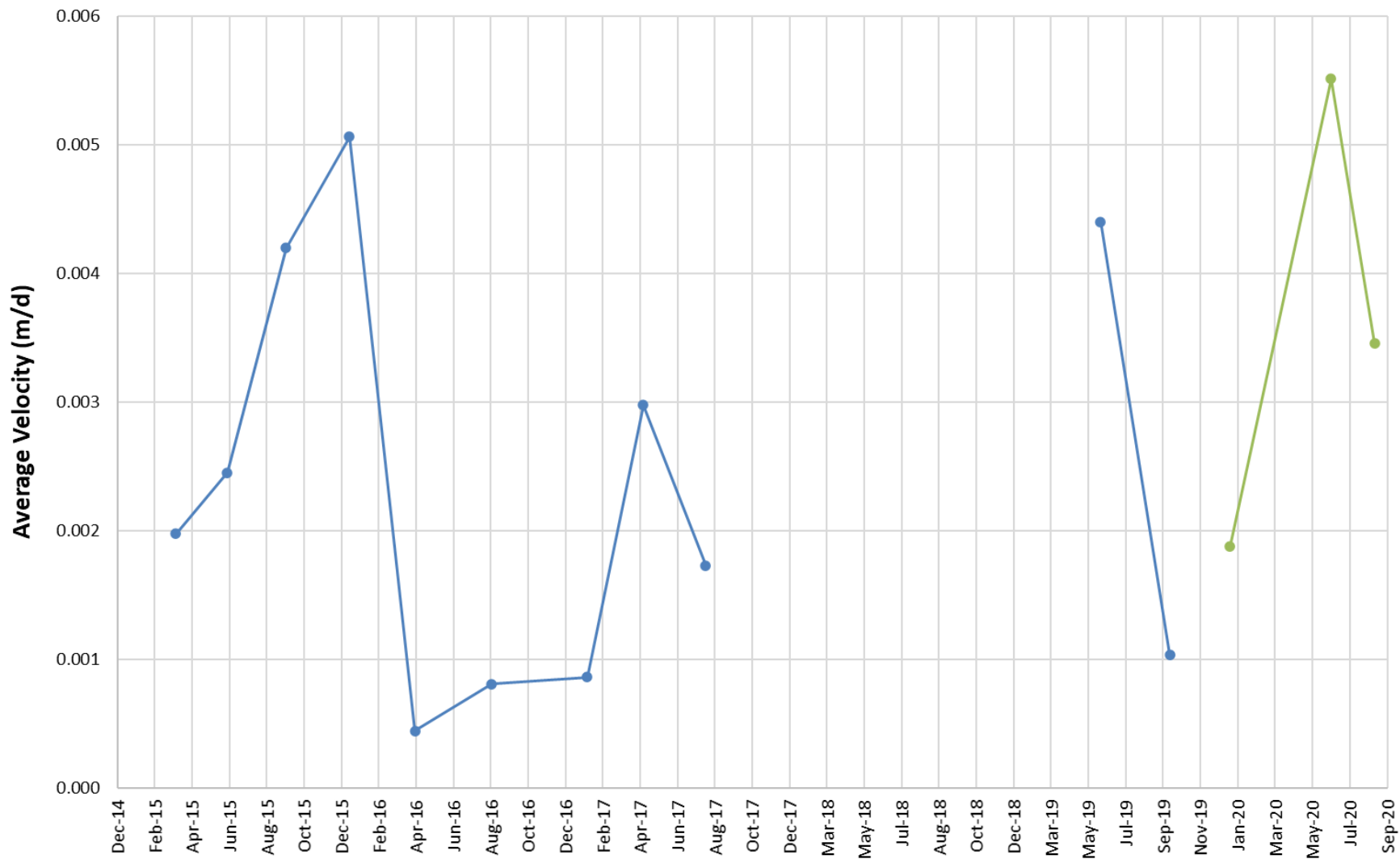
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FIGURE  
D-1





2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)  
Historic Data (Before 1 August 2019)

Notes:  
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-Average velocity data presented at the end of the calculation period (i.e. end of three months of data)

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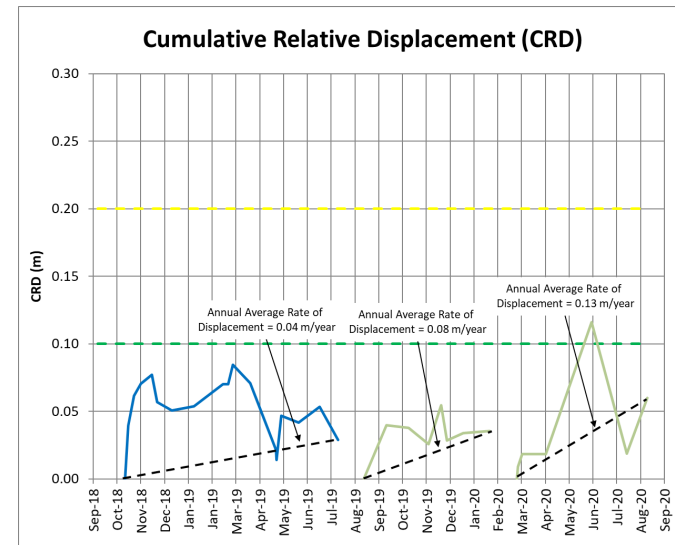
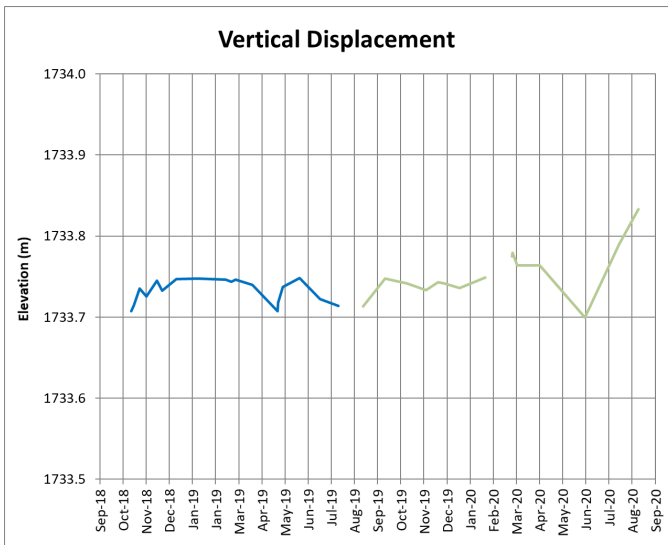
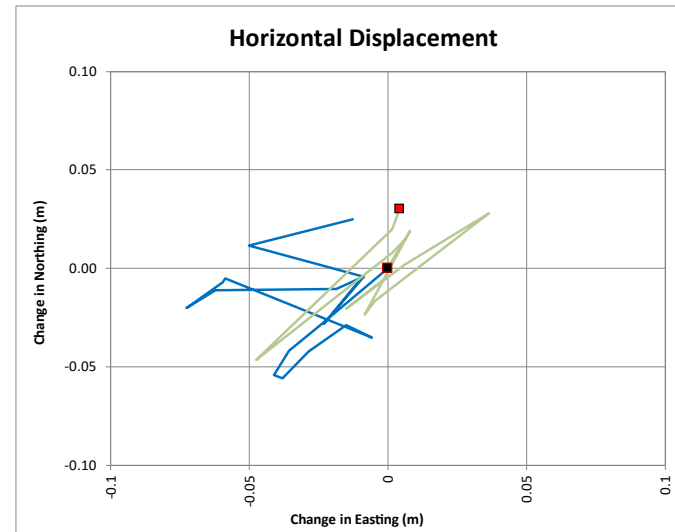
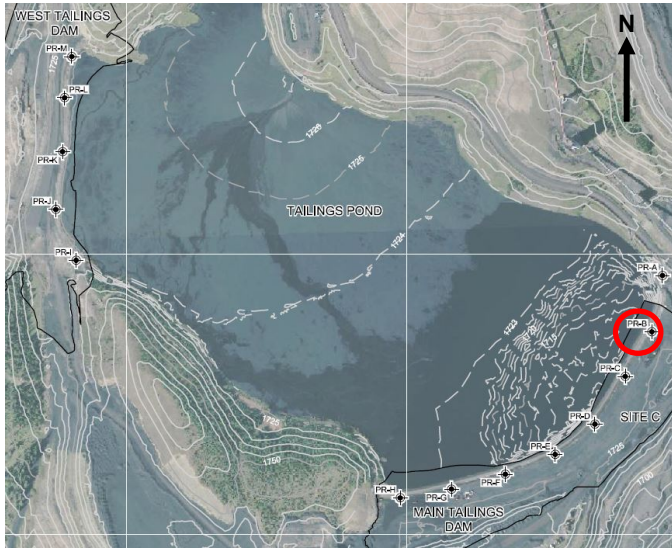
TITLE  
MAIN TAILINGS DAM - PRISM A  
AVERAGE VELOCITY PLOT

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FIGURE  
D-2



- Initial Location
- Final Location

- 2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)
- 2018/2019 Annual Inspection Reporting Period (1 September 2018 to 31 July 2019)
- Green Notification (100 mm)
- Yellow Warning (200 mm)
- Instrument Location

References:  
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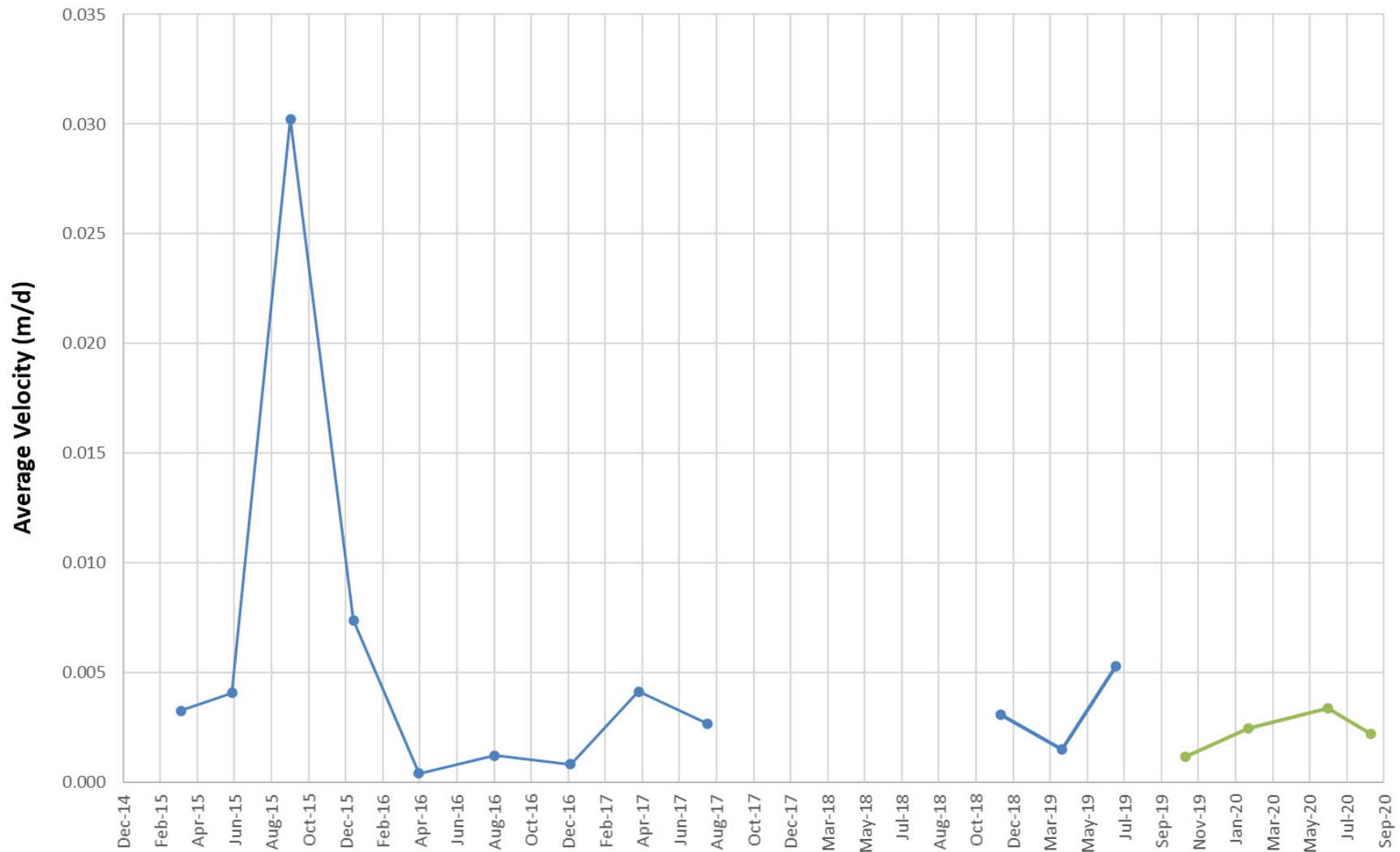
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PREPARED	ZPS
DESIGN	ZPS
REVIEW	MBW
APPROVED	AJH

PROJECT  
**GREENHILLS TAILINGS STORAGE FACILITY**  
**2020 ANNUAL FACILITY REPORT**

TITLE  
**MAIN TAILINGS DAM - PRISM B**  
**DISPLACEMENT PLOTS**

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FIGURE  
**D-3**



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TITLE  
**MAIN TAILINGS DAM - PRISM B  
AVERAGE VELOCITY PLOT**

PROJECT No.  
**19133994**

Phase/Task/DOC.  
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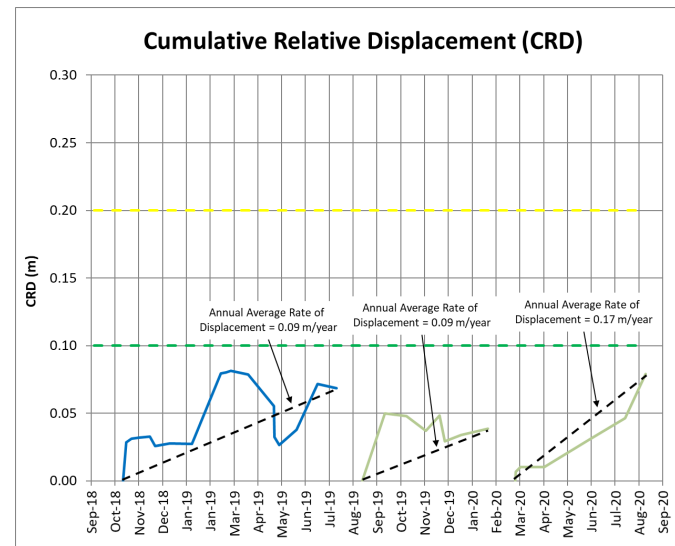
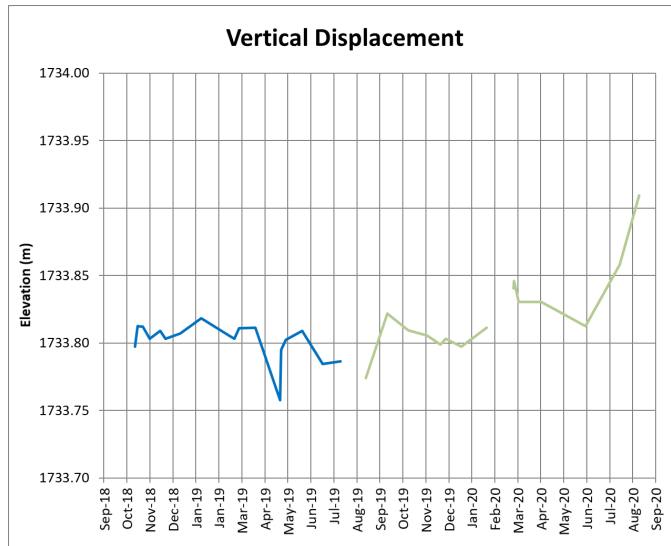
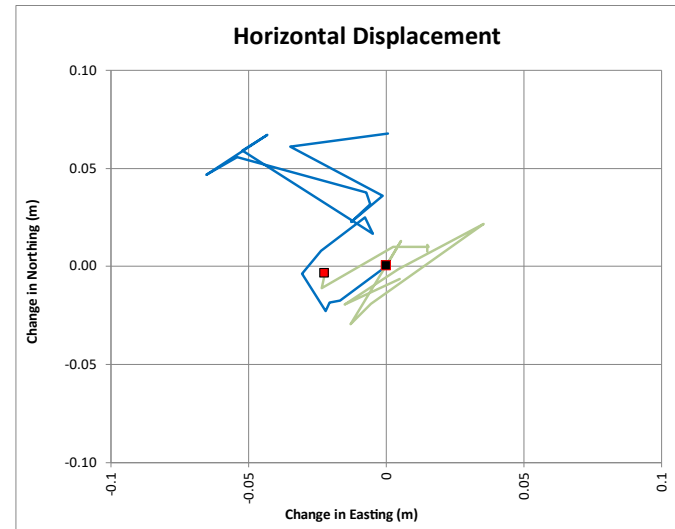
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FIGURE  
**D-4**

Notes:  
-Prism data reset in February 2020 due to change in survey total station pillar  
-Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020  
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-Average velocity calculated in metres per day from the average movement over the preceding approximately three-month period  
-Average velocity data presented at the end of the calculation period (i.e. end of three months of data)

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- Initial Location
- Final Location
- 2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)
- 2018/2019 Annual Inspection Reporting Period (1 September 2018 to 31 July 2019)
- Green Notification (100 mm)
- Yellow Warning (200 mm)
- Instrument Location

References:  
 -2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
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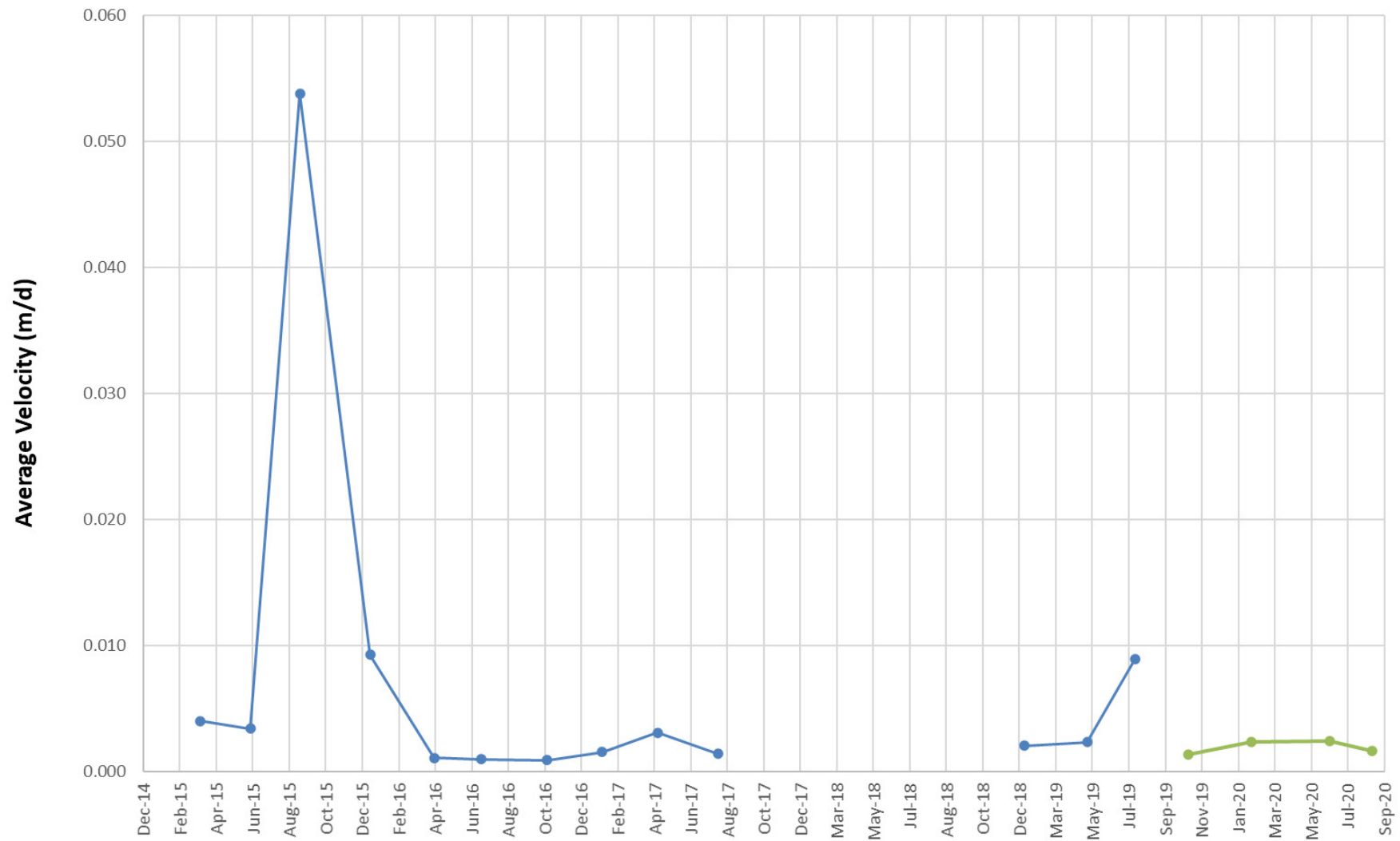
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**GREENHILLS TAILINGS STORAGE FACILITY**  
**2020 ANNUAL FACILITY REPORT**

TITLE  
**MAIN TAILINGS DAM - PRISM C**  
**DISPLACEMENT PLOTS**

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FIGURE  
**D-5**



2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)  
 Historic Data (Before 1 August 2019)

Notes:  
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 -Average velocity calculated in metres per day from the average movement over the preceding approximately three-month period  
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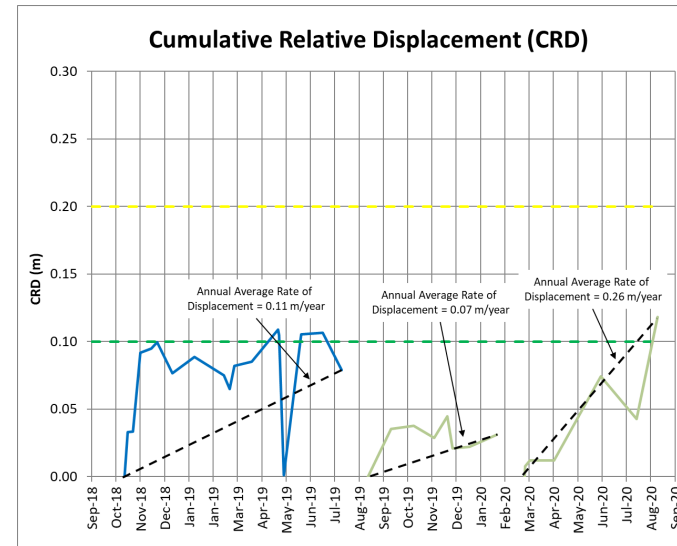
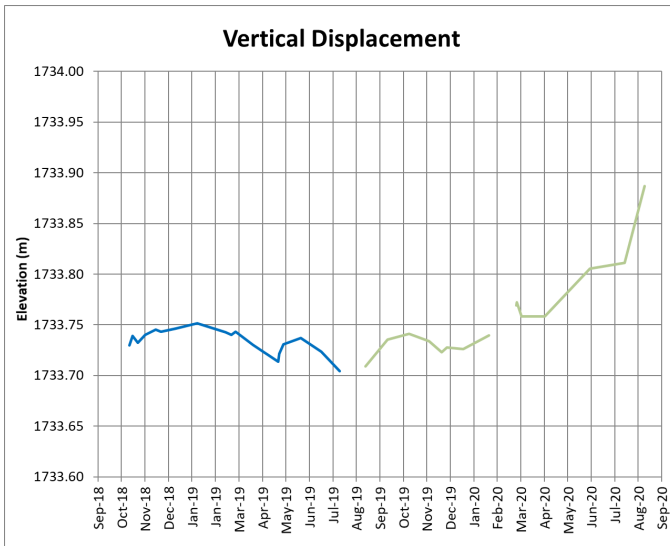
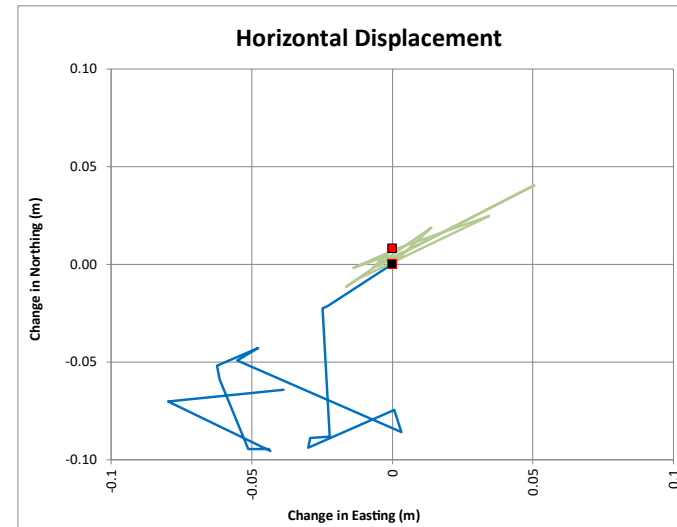
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**MAIN TAILINGS DAM - PRISM C**  
**AVERAGE VELOCITY PLOT**

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FIGURE  
 D-6



- Initial Location
- Final Location
- 2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)
- 2018/2019 Annual Inspection Reporting Period (1 September 2018 to 31 July 2019)
- Green Notification (100 mm)
- Yellow Warning (200 mm)
- Instrument Location

References:  
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 Notes:  
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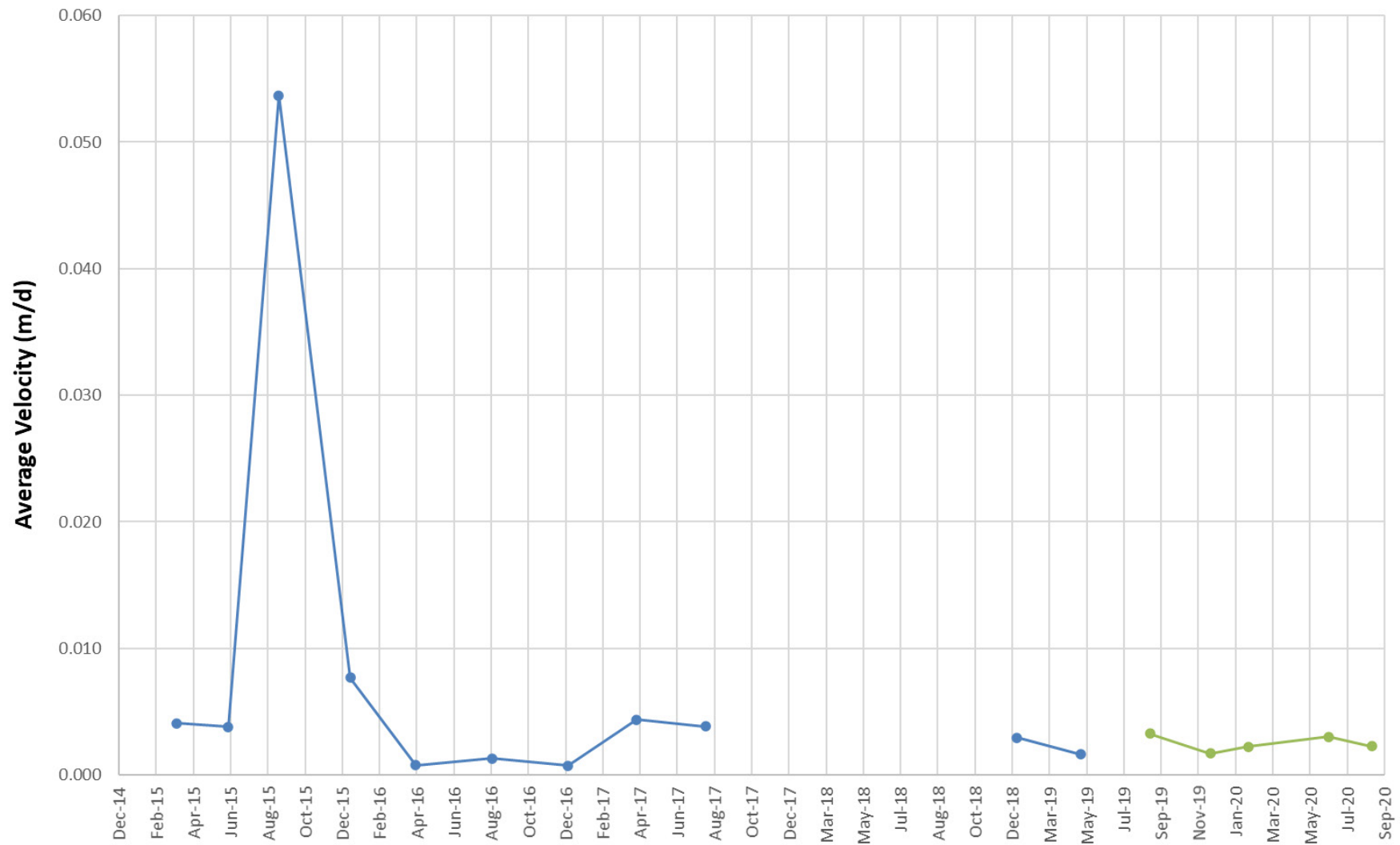
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**MAIN TAILINGS DAM - PRISM D**  
**DISPLACEMENT PLOTS**

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FIGURE  
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2020 ANNUAL FACILITY REPORT

TITLE  
**MAIN TAILINGS DAM - PRISM D  
AVERAGE VELOCITY PLOT**

PROJECT No.  
**19133994**

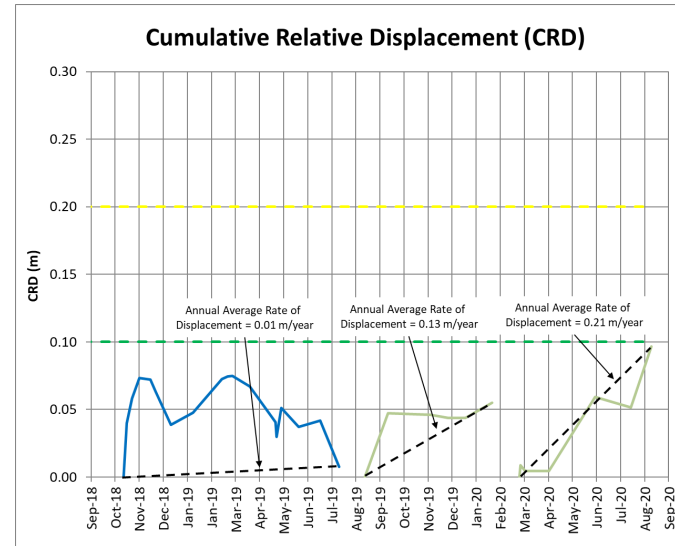
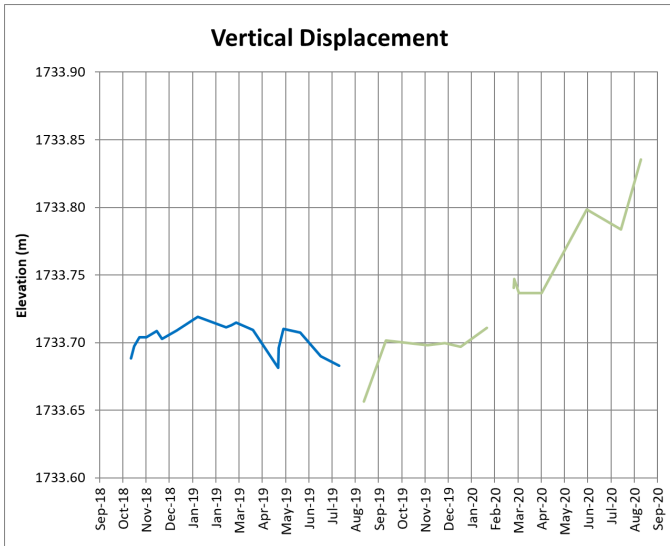
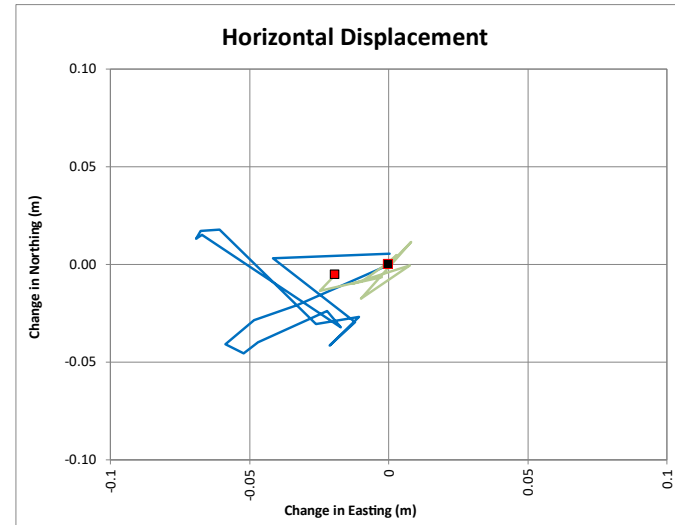
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FIGURE  
**D-8**

Notes:

- Prism data reset in February 2020 due to change in survey total station pillar
- Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020
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- Average velocity calculated in metres per day from the average movement over the preceding approximately three-month period
- Average velocity data presented at the end of the calculation period (i.e. end of three months of data)



- Initial Location
- Final Location
- 2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)
- 2018/2019 Annual Inspection Reporting Period (1 September 2018 to 31 July 2019)
- Green Notification (100 mm)
- Yellow Warning (200 mm)
- Instrument Location

References:  
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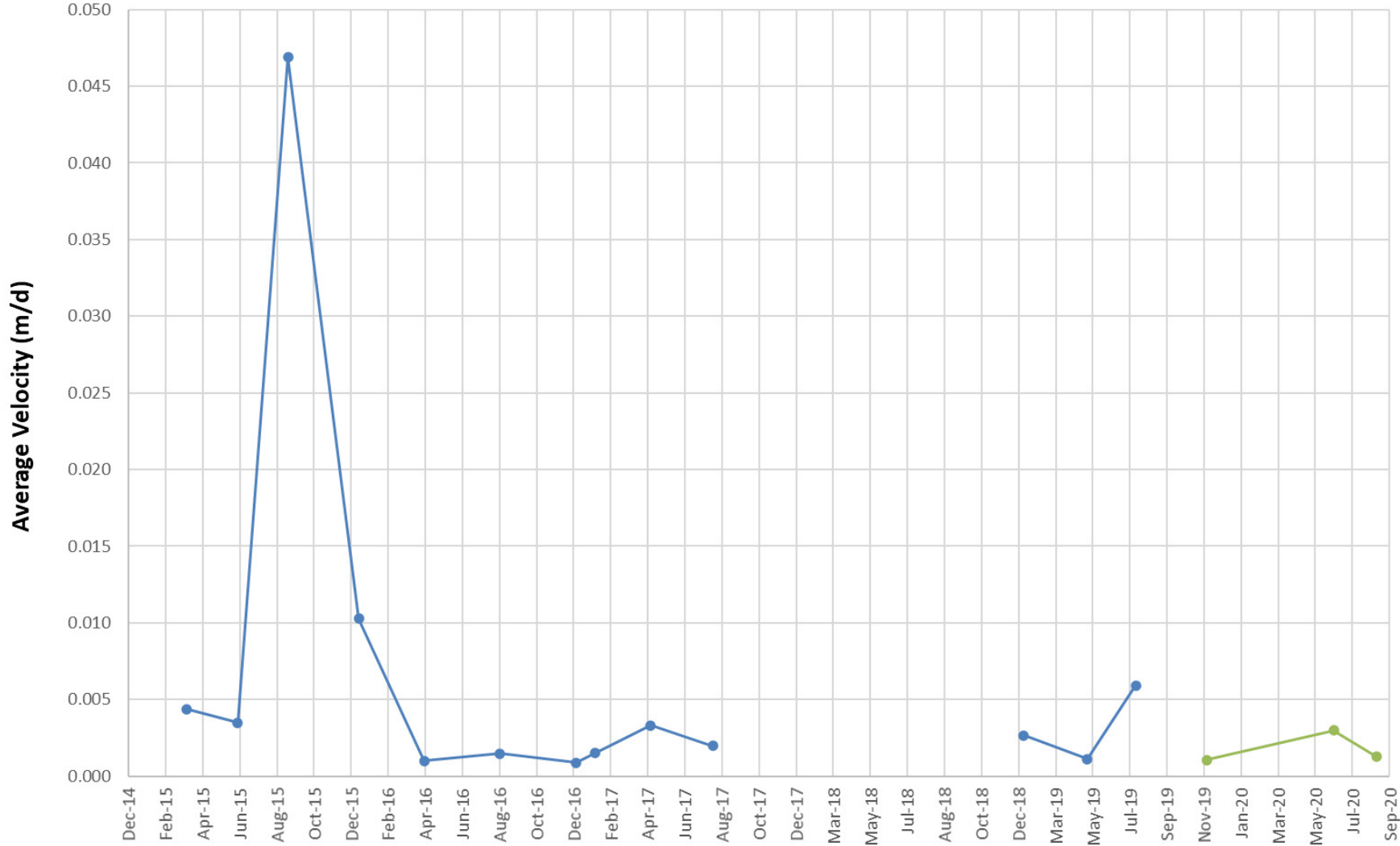
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PREPARED	ZPS
DESIGN	ZPS
REVIEW	MBW
APPROVED	AJH

PROJECT  
**GREENHILLS TAILINGS STORAGE FACILITY**  
**2020 ANNUAL FACILITY REPORT**

TITLE  
**MAIN TAILINGS DAM - PRISM E**  
**DISPLACEMENT PLOTS**

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FIGURE  
**D-9**



2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)  
Historic Data (Before 1 August 2019)

Notes:  
-Prism data reset in February 2020 due to change in survey total station pillar  
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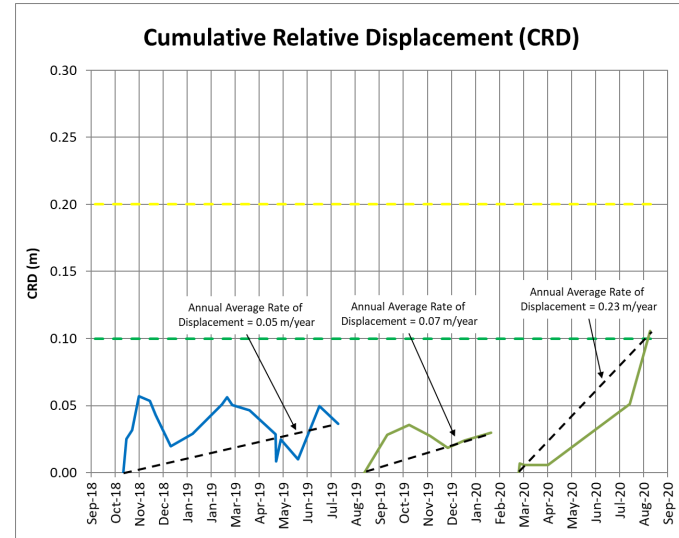
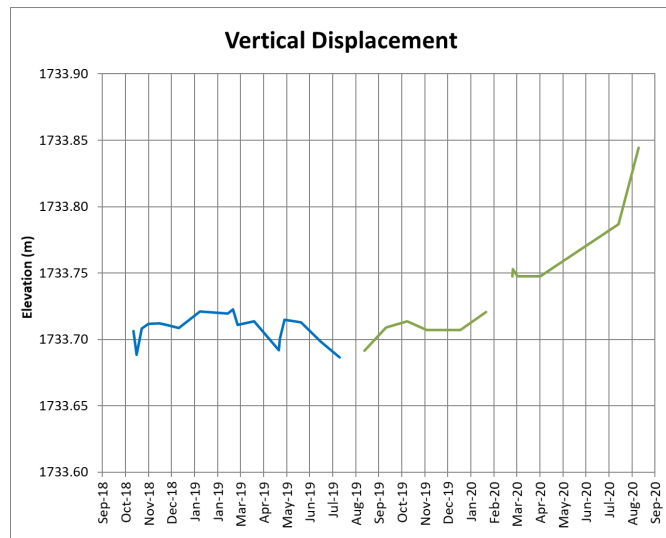
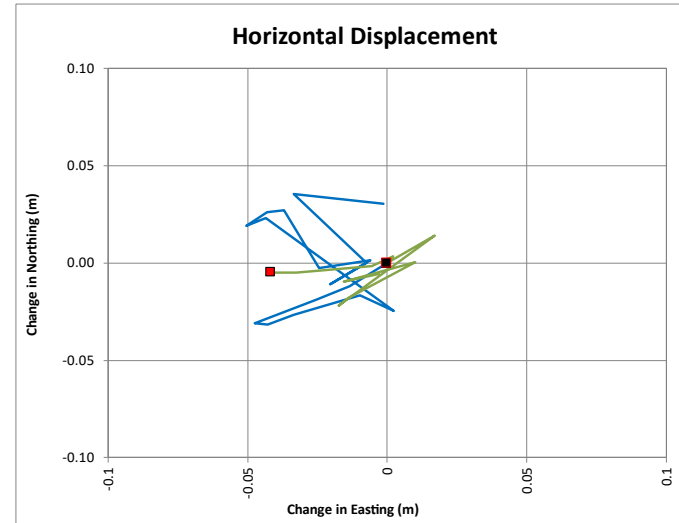
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PREPARED	ZPS
DESIGN	ZPS
REVIEW	MBW
APPROVED	AJH

PROJECT  
GREENHILLS TAILINGS STORAGE FACILITY  
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TITLE  
MAIN TAILINGS DAM - PRISM E  
AVERAGE VELOCITY PLOT

PROJECT No. 19133994	Phase/Task/DOC. 3000/3003/2020-150	Rev. 0	FIGURE D-10
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- Initial Location
- Final Location
- 2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)
- 2018/2019 Annual Inspection Reporting Period (1 September 2018 to 31 July 2019)
- Green Notification (100 mm)
- Yellow Warning (200 mm)
- Instrument Location

References:  
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PREPARED	ZPS
DESIGN	ZPS
REVIEW	MBW
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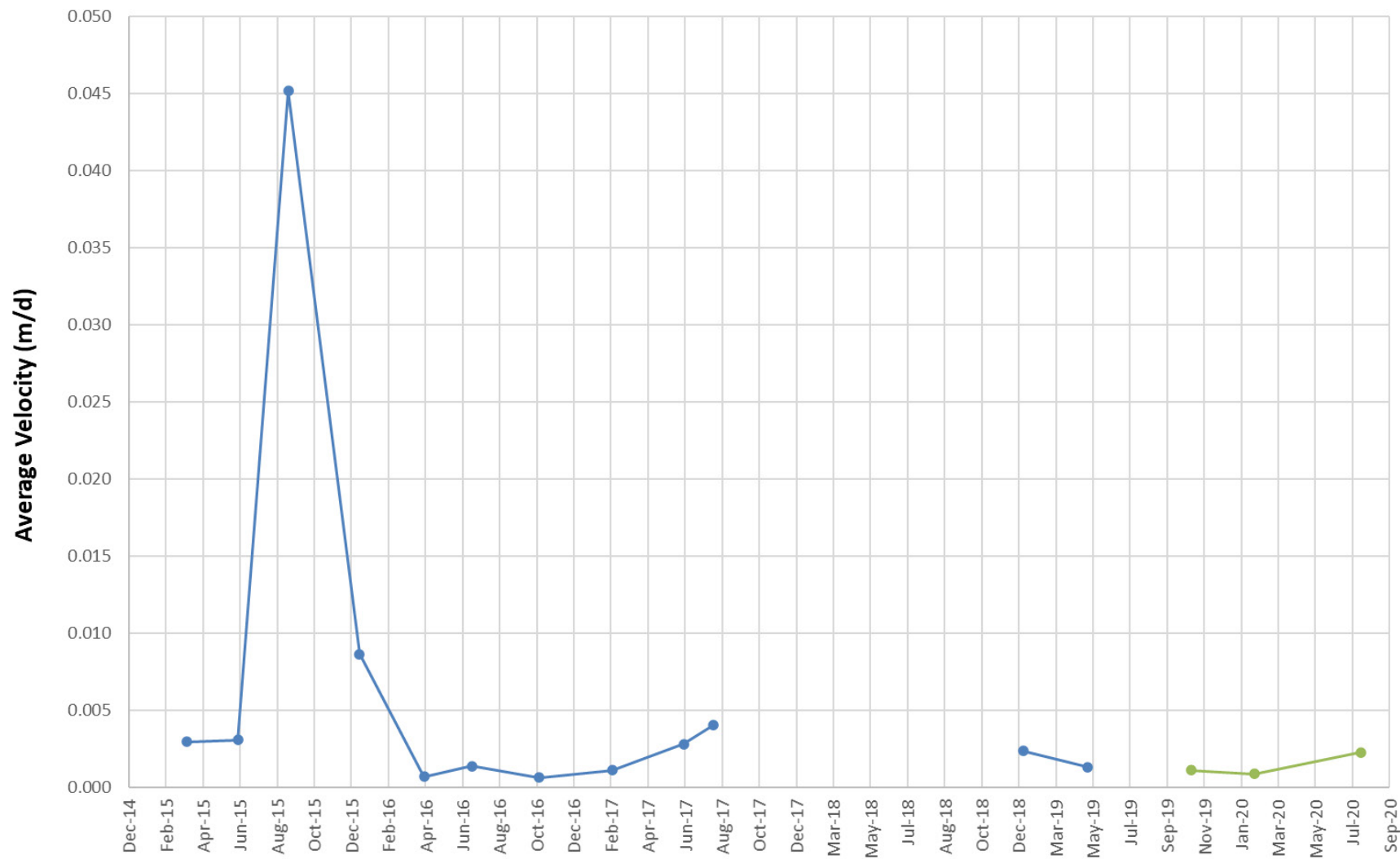
TITLE  
**MAIN TAILINGS DAM - PRISM F**  
**DISPLACEMENT PLOTS**

PROJECT No.  
**19133994**

Phase/Task/DOC.  
**3000/3003/2020-150**

Rev.  
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FIGURE  
**D-11**



2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)  
Historic Data (Before 1 August 2019)

Notes:  
-Prism data reset in February 2020 due to change in survey total station pillar  
-Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020  
-Data gaps present due to survey prisms being offline or moved during dam raise construction  
-Average velocity calculated in metres per day from the average movement over the preceding approximately three-month period  
-Average velocity data presented at the end of the calculation period (i.e. end of three months of data)

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PROJECT  
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2020 ANNUAL FACILITY REPORT

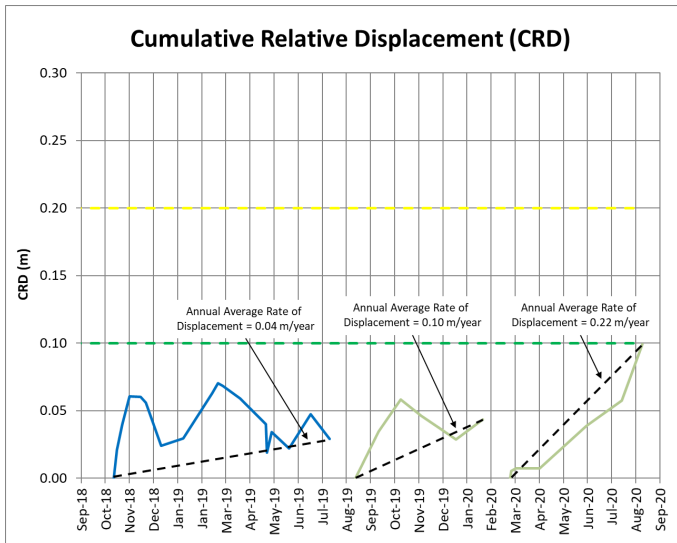
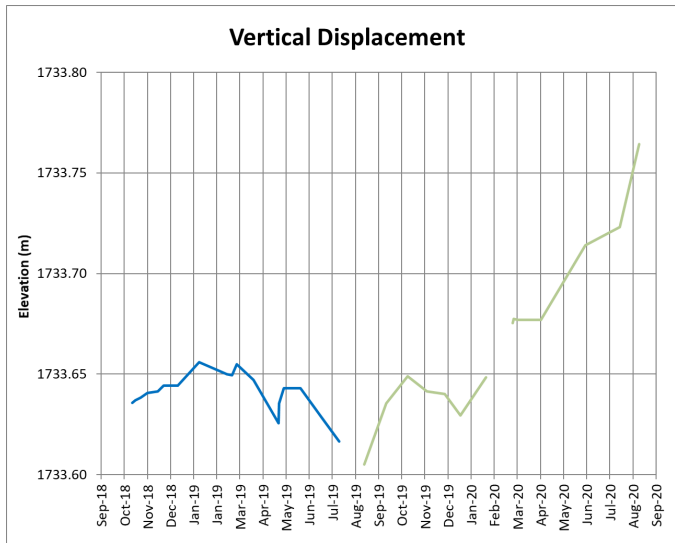
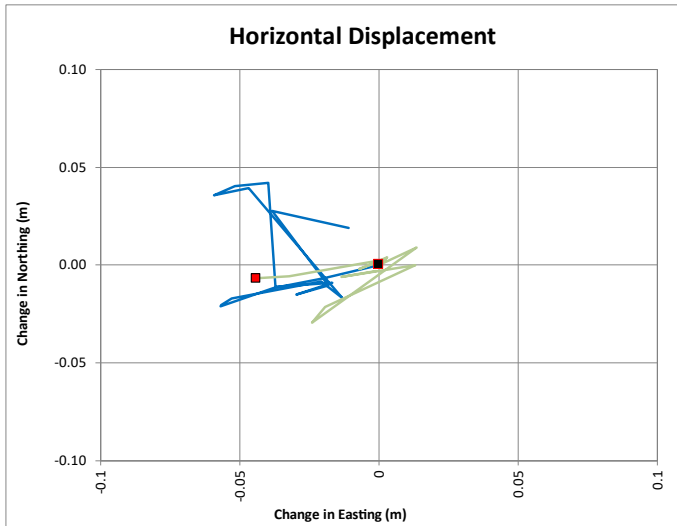
TITLE  
**MAIN TAILINGS DAM - PRISM F  
AVERAGE VELOCITY PLOT**

PROJECT No.  
**19133994**

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**3000/3003/2020-150**

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FIGURE  
**D-12**



■ Initial Location  
■ Final Location

— 2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)  
— 2018/2019 Annual Inspection Reporting Period (1 September 2018 to 31 July 2019)

— Green Notification (100 mm)  
— Yellow Warning (200 mm)

○ Instrument Location

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.

Notes:  
-Prism data reset in February 2020 due to change in survey total station pillar  
-Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020  
-Annual average rate of displacement was calculated based on prorating the data available to represent 12 months of movement. i.e. data was forecast forward assuming a linear increase.  
-Data gaps present due to survey prisms being offline or moved during dam raise construction

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**2020 ANNUAL FACILITY REPORT**

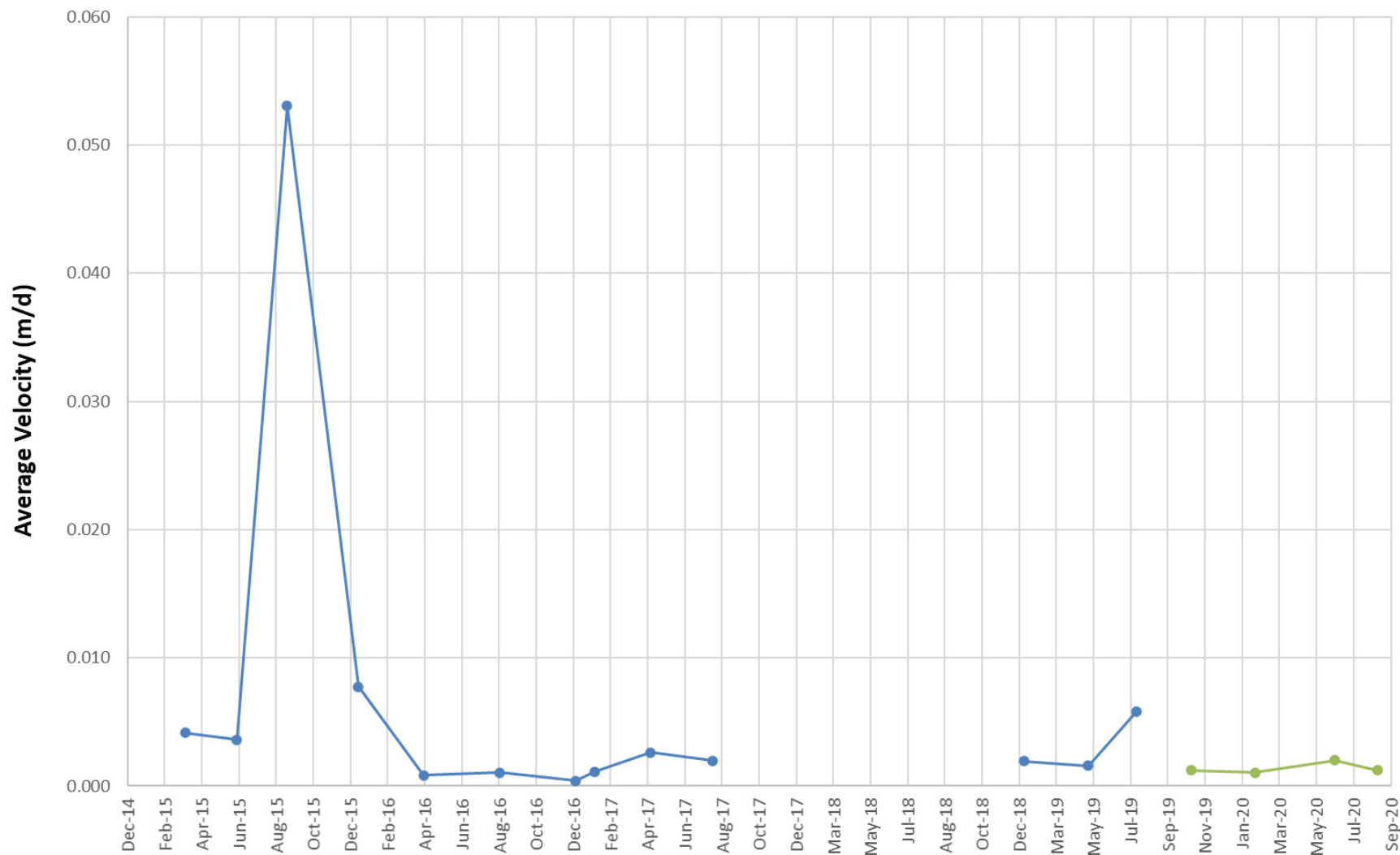
TITLE  
**MAIN TAILINGS DAM - PRISM G**  
**DISPLACEMENT PLOTS**

PROJECT No. **19133994** Phase/Task/DOC. **3000/3003/2020-150**

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FIGURE  
**D-13**





2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)  
 Historic Data (Before 1 August 2019)

Notes:  
 -Prism data reset in February 2020 due to change in survey total station pillar  
 -Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020  
 -Data gaps present due to survey prisms being offline or moved during dam raise construction  
 -Average velocity calculated in metres per day from the average movement over the preceding approximately three-month period  
 -Average velocity data presented at the end of the calculation period (i.e. end of three months of data)

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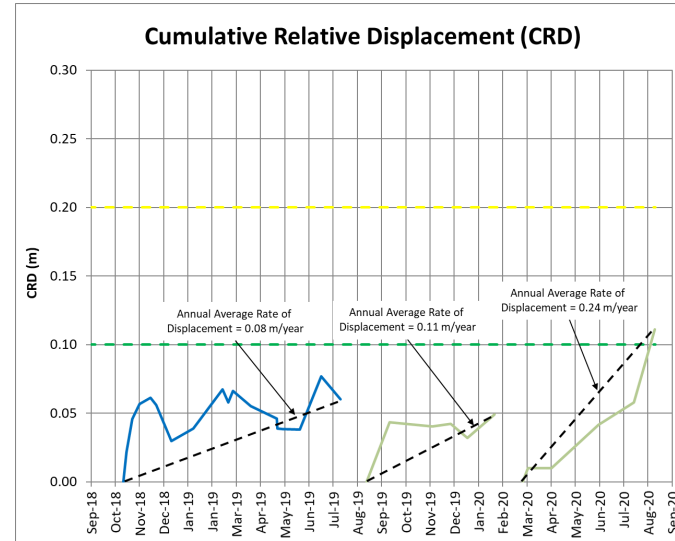
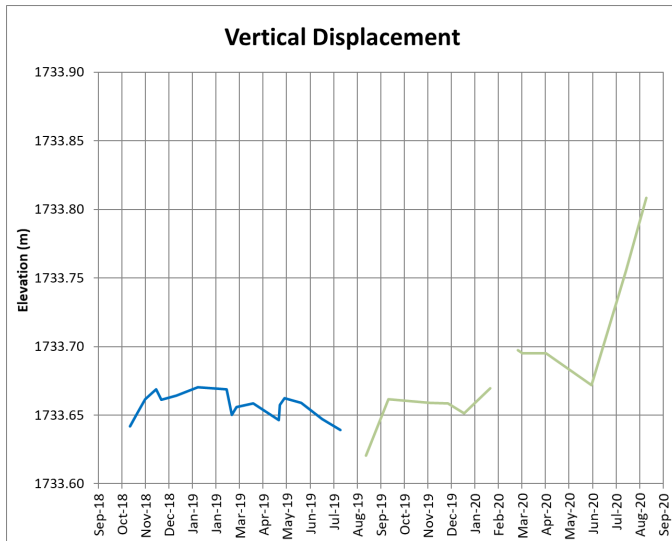
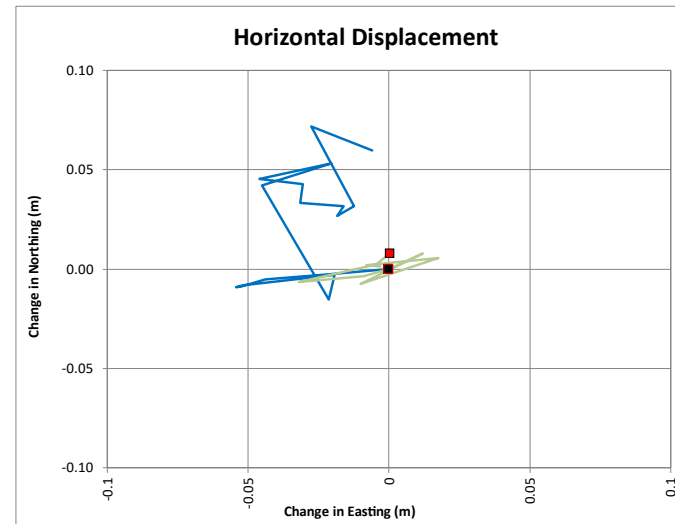
TITLE  
 MAIN TAILINGS DAM - PRISM G  
 AVERAGE VELOCITY PLOT

PROJECT No.  
 19133994

Phase/Task/DOC.  
 3000/3003/2020-150

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 0

FIGURE  
 D-14



- Initial Location
- Final Location
- 2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)
- 2018/2019 Annual Inspection Reporting Period (1 September 2018 to 31 July 2019)
- Green Notification (100 mm)
- Yellow Warning (200 mm)
- Instrument Location

References:  
 -2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
 Notes:  
 -Prism data reset in February 2020 due to change in survey total station pillar  
 -Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020  
 -Annual average rate of displacement was calculated based on prorating the data available to represent 12 months of movement. i.e. data was forecast forward assuming a linear increase.  
 -Data gaps present due to survey prisms being offline or moved during dam raise construction

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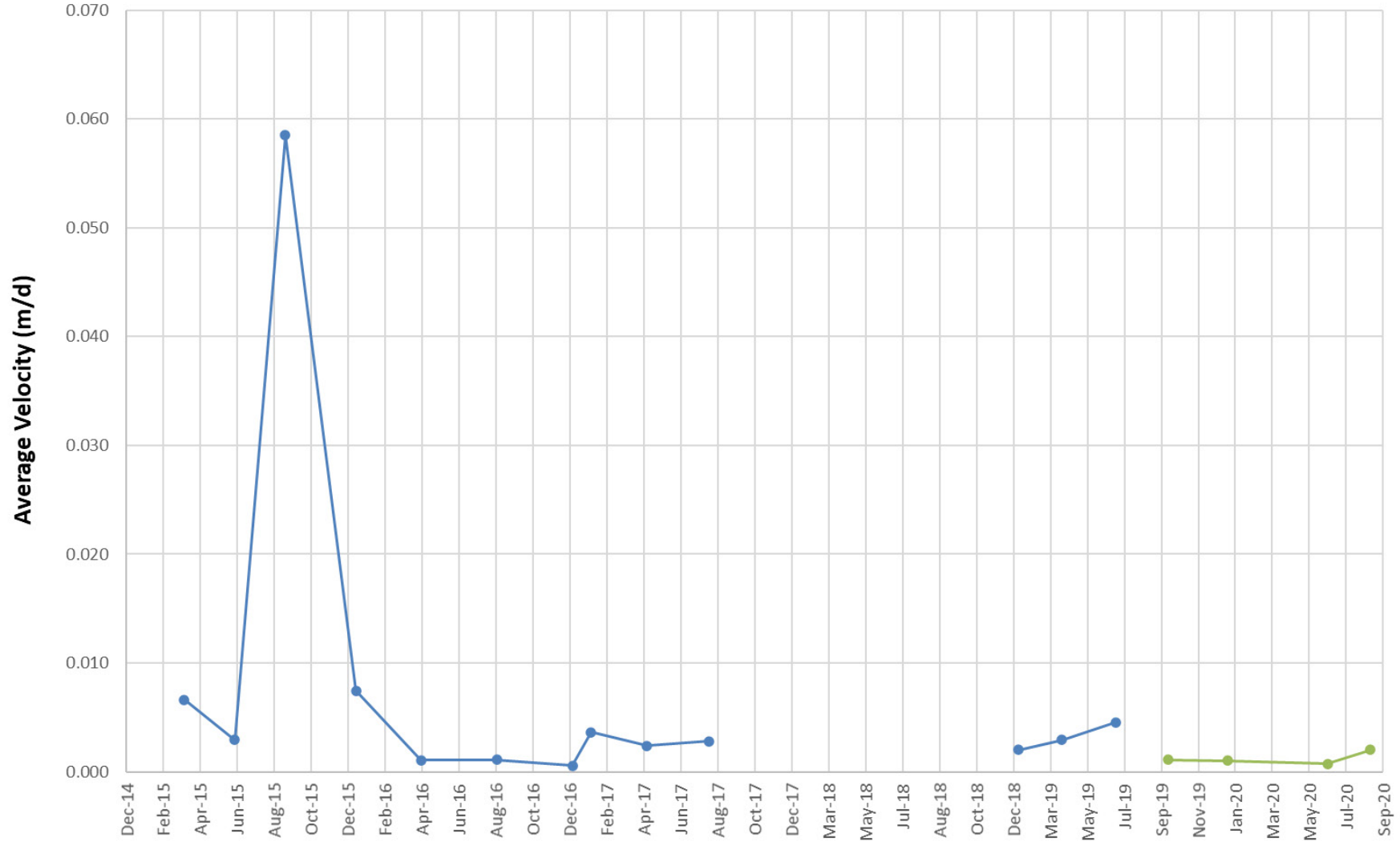
PROJECT  
**GREENHILLS TAILINGS STORAGE FACILITY**  
**2020 ANNUAL FACILITY REPORT**

TITLE  
**MAIN TAILINGS DAM - PRISM H**  
**DISPLACEMENT PLOTS**

PROJECT No. **19133994** Phase/Task/DOC. **3000/3003/2020-150**

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FIGURE  
**D-15**



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PROJECT  
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TITLE  
**MAIN TAILINGS DAM - PRISM H  
AVERAGE VELOCITY PLOT**

PROJECT No.  
**19133994**

Phase/Task/DOC.  
**3000/3003/2020-150**

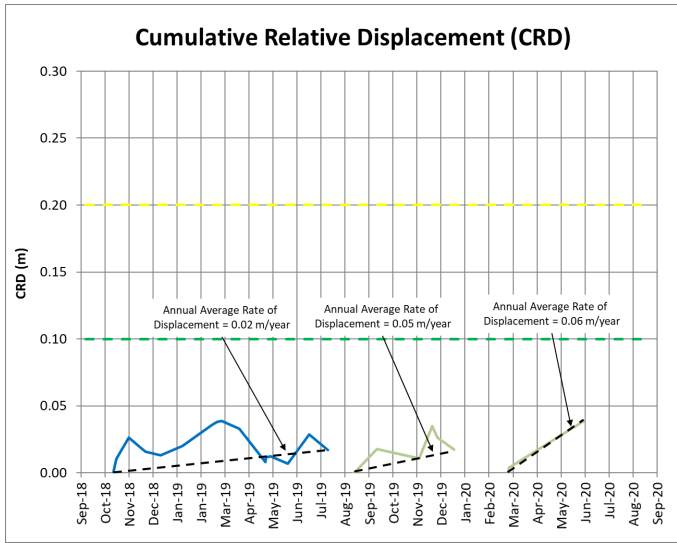
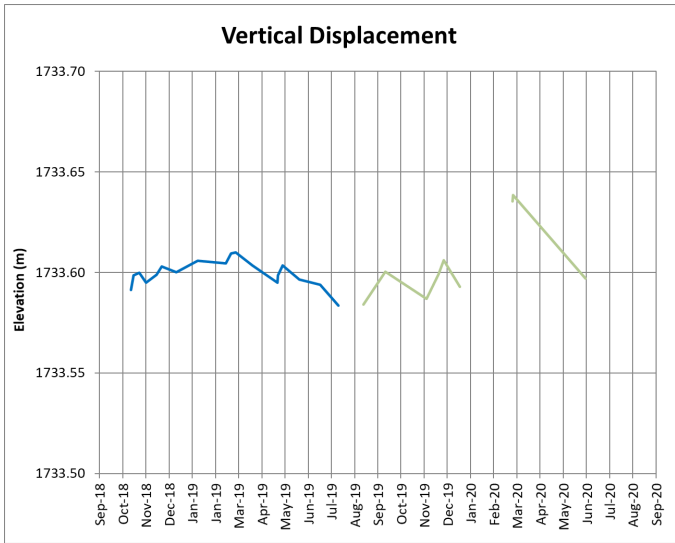
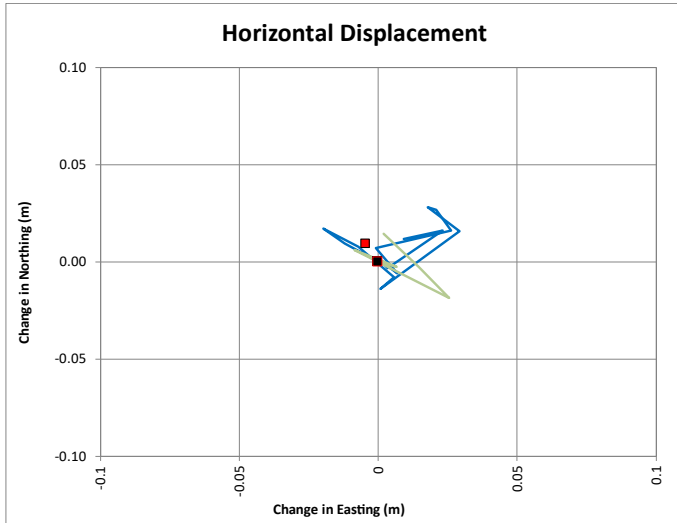
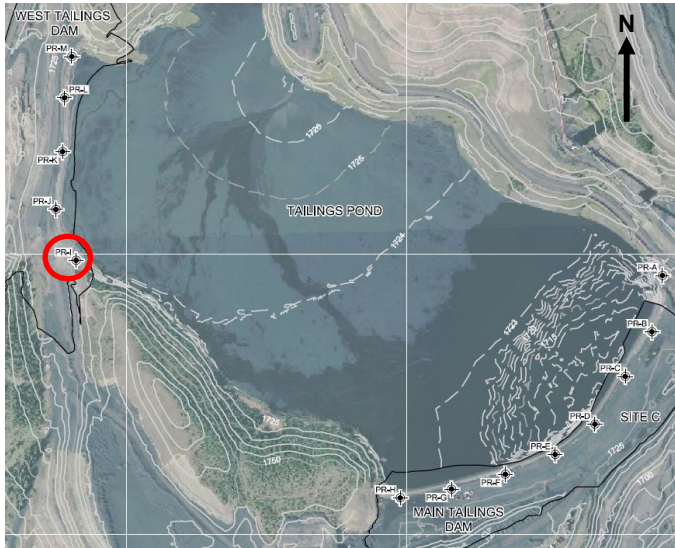
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FIGURE  
**D-16**

Notes:

- Prism data reset in February 2020 due to change in survey total station pillar
- Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020
- Data gaps present due to survey prisms being offline or moved during dam raise construction
- Average velocity calculated in metres per day from the average movement over the preceding approximately three-month period
- Average velocity data presented at the end of the calculation period (i.e. end of three months of data)





■ Initial Location  
■ Final Location

— 2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)  
— 2018/2019 Annual Inspection Reporting Period (1 September 2018 to 31 July 2019)

— Green Notification (100 mm)  
— Yellow Warning (200 mm)

○ Instrument Location

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
Notes:  
-Prism data reset in February 2020 due to change in survey total station pillar  
-Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020  
-Annual average rate of displacement was calculated based on prorating the data available to represent 12 months of movement. i.e. data was forecast forward assuming a linear increase.  
-Data gaps present due to survey prisms being offline or moved during dam raise construction

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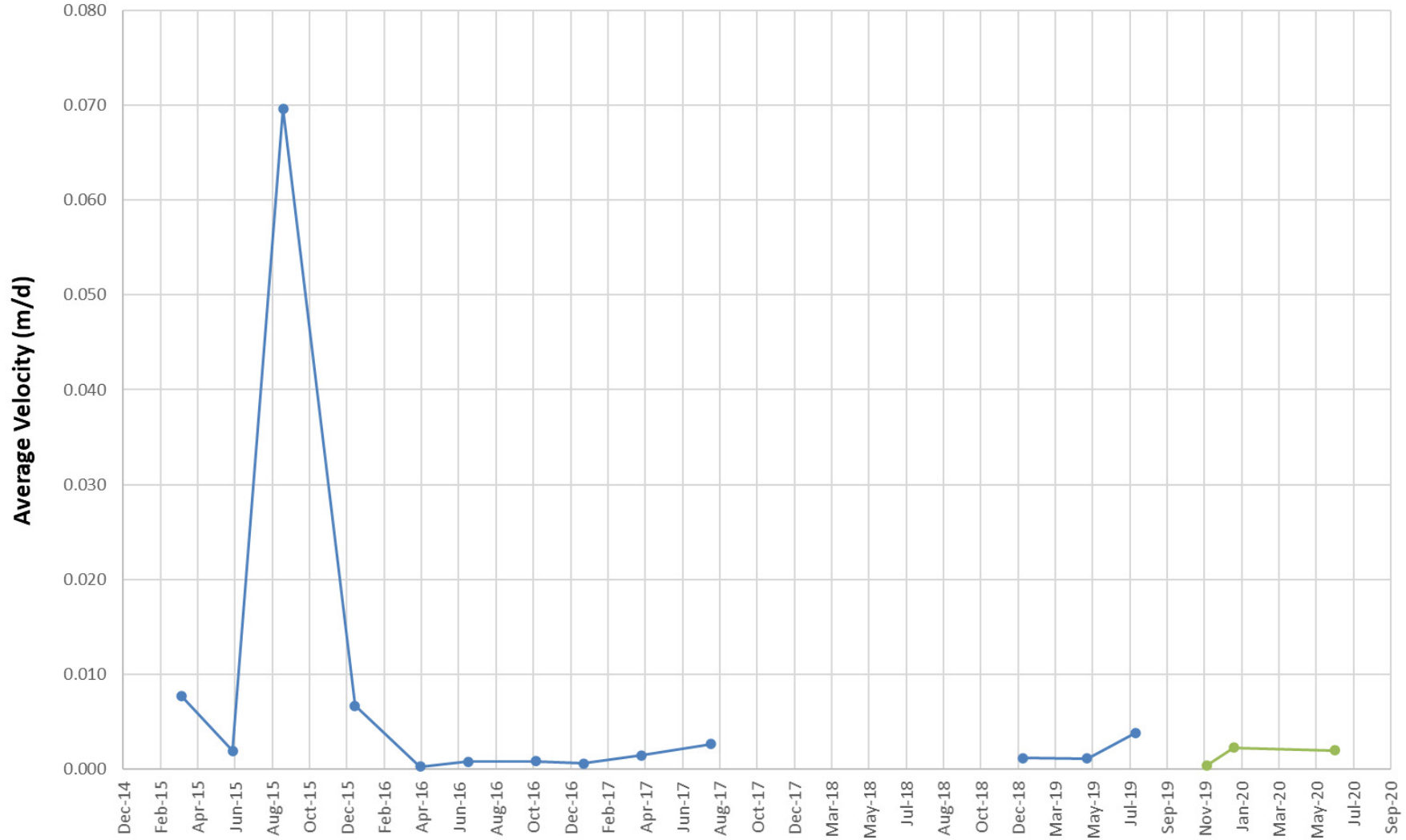
PROJECT  
**GREENHILLS TAILINGS STORAGE FACILITY**  
**2020 ANNUAL FACILITY REPORT**

TITLE  
**WEST TAILINGS DAM - PRISM I**  
**DISPLACEMENT PLOTS**

PROJECT No. **19133994** Phase/Task/DOC. **3000/3003/2020-150**

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FIGURE  
**D-17**



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2020 ANNUAL FACILITY REPORT

TITLE  
**MAIN TAILINGS DAM - PRISM I  
AVERAGE VELOCITY PLOT**

PROJECT No.  
**19133994**

Phase/Task/DOC.  
**3000/3003/2020-150**

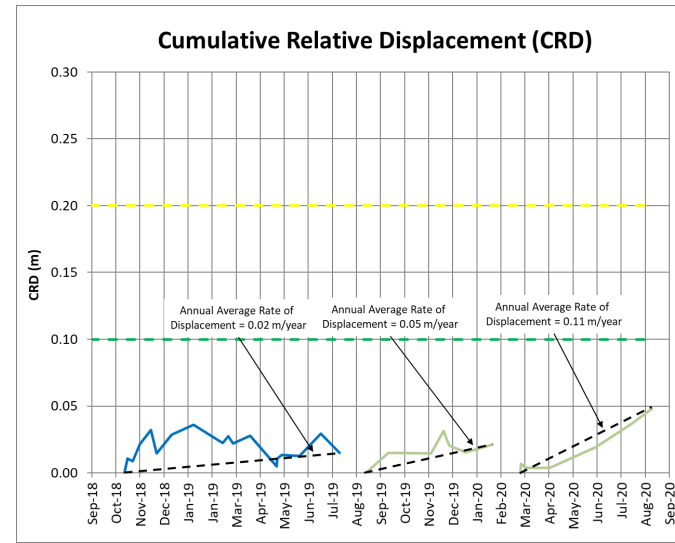
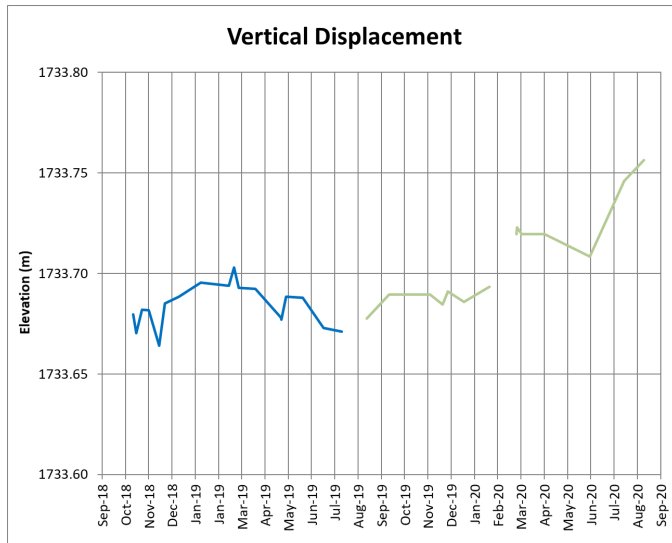
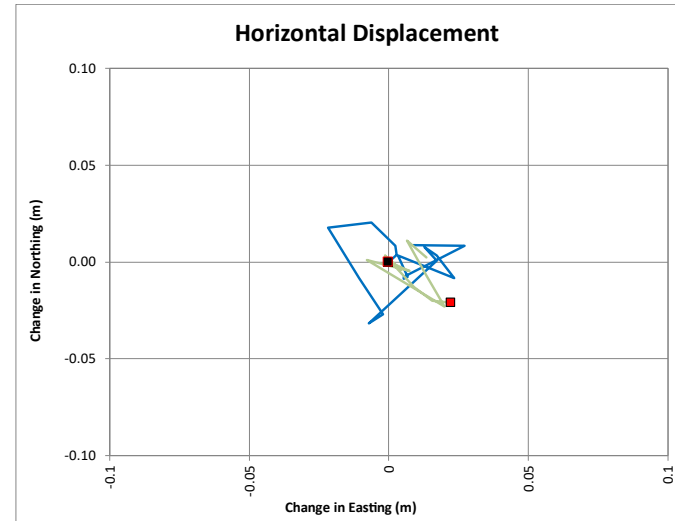
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FIGURE  
**D-18**

Notes:

- Prism data reset in February 2020 due to change in survey total station pillar
- Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020
- Data gaps present due to survey prisms being offline or moved during dam raise construction
- Average velocity calculated in metres per day from the average movement over the preceding approximately three-month period
- Average velocity data presented at the end of the calculation period (i.e. end of three months of data)

2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)  
Historic Data (Before 1 August 2019)



- Initial Location
- Final Location

- 2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)
- 2018/2019 Annual Inspection Reporting Period (1 September 2018 to 31 July 2019)
- Green Notification (100 mm)
- Yellow Warning (200 mm)
- Instrument Location

References:  
 -2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
 Notes:  
 -Prism data reset in February 2020 due to change in survey total station pillar  
 -Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020  
 -Annual average rate of displacement was calculated based on prorating the data available to represent 12 months of movement. i.e. data was forecast forward assuming a linear increase.  
 -Data gaps present due to survey prisms being offline or moved during dam raise construction

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DESIGN	ZPS
REVIEW	MBW
APPROVED	AJH

PROJECT  
**GREENHILLS TAILINGS STORAGE FACILITY**  
**2020 ANNUAL FACILITY REPORT**

TITLE  
**WEST TAILINGS DAM - PRISM J**  
**DISPLACEMENT PLOTS**

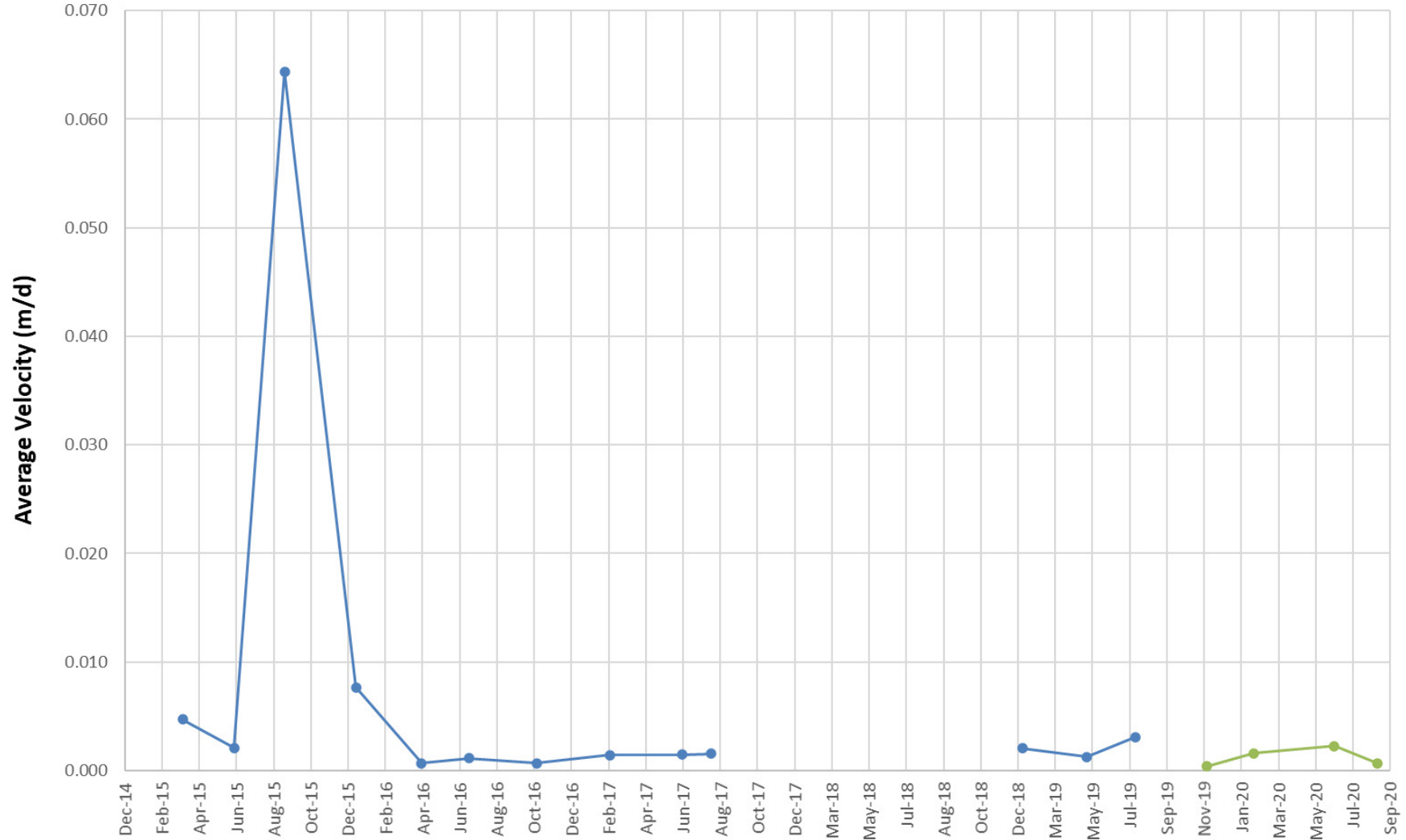
PROJECT No.  
**19133994**

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**3000/3003/2020-150**

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FIGURE  
**D-19**





2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)  
 Historic Data (Before 1 August 2019)

Notes:  
 -Prism data reset in February 2020 due to change in survey total station pillar  
 -Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020  
 -Data gaps present due to survey prisms being offline or moved during dam raise construction  
 -Average velocity calculated in metres per day from the average movement over the preceding approximately three-month period  
 -Average velocity data presented at the end of the calculation period (i.e. end of three months of data)

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REVIEW	MBW
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PROJECT  
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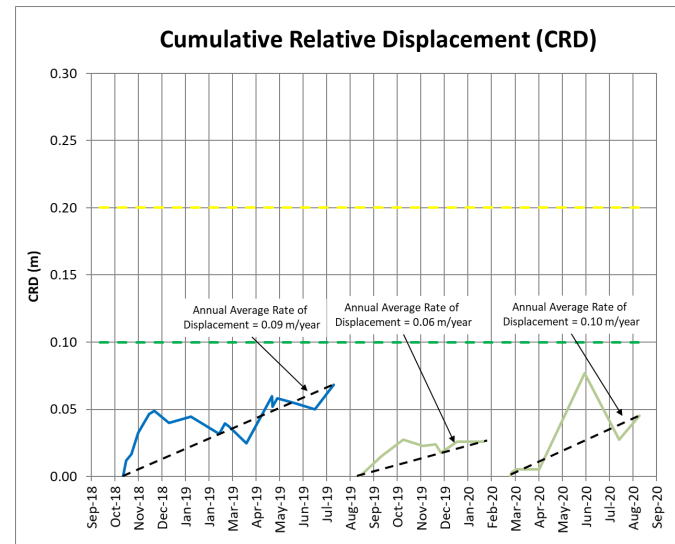
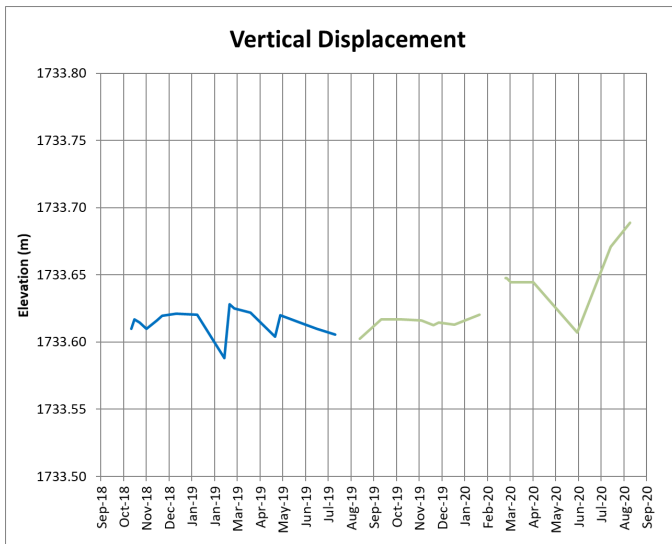
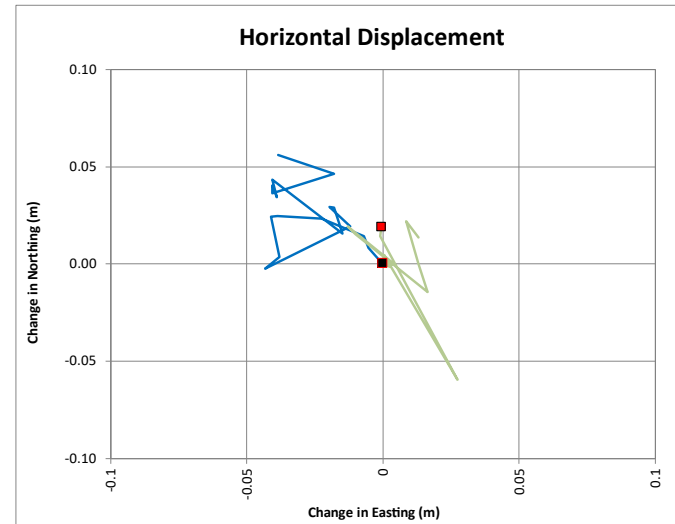
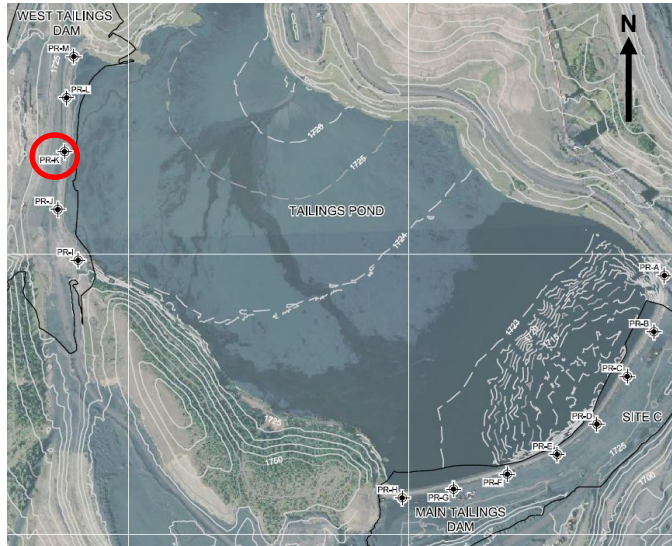
TITLE  
**MAIN TAILINGS DAM - PRISM J**  
**AVERAGE VELOCITY PLOT**

PROJECT No.  
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 3000/3003/2020-150

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FIGURE  
 D-20



- Initial Location
- Final Location
- 2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)
- 2018/2019 Annual Inspection Reporting Period (1 September 2018 to 31 July 2019)
- Green Notification (100 mm)
- Yellow Warning (200 mm)
- Instrument Location

References:  
 -2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
 Notes:  
 -Prism data reset in February 2020 due to change in survey total station pillar  
 -Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020  
 -Annual average rate of displacement was calculated based on prorating the data available to represent 12 months of movement. i.e. data was forecast forward assuming a linear increase.  
 -Data gaps present due to survey prisms being offline or moved during dam raise construction

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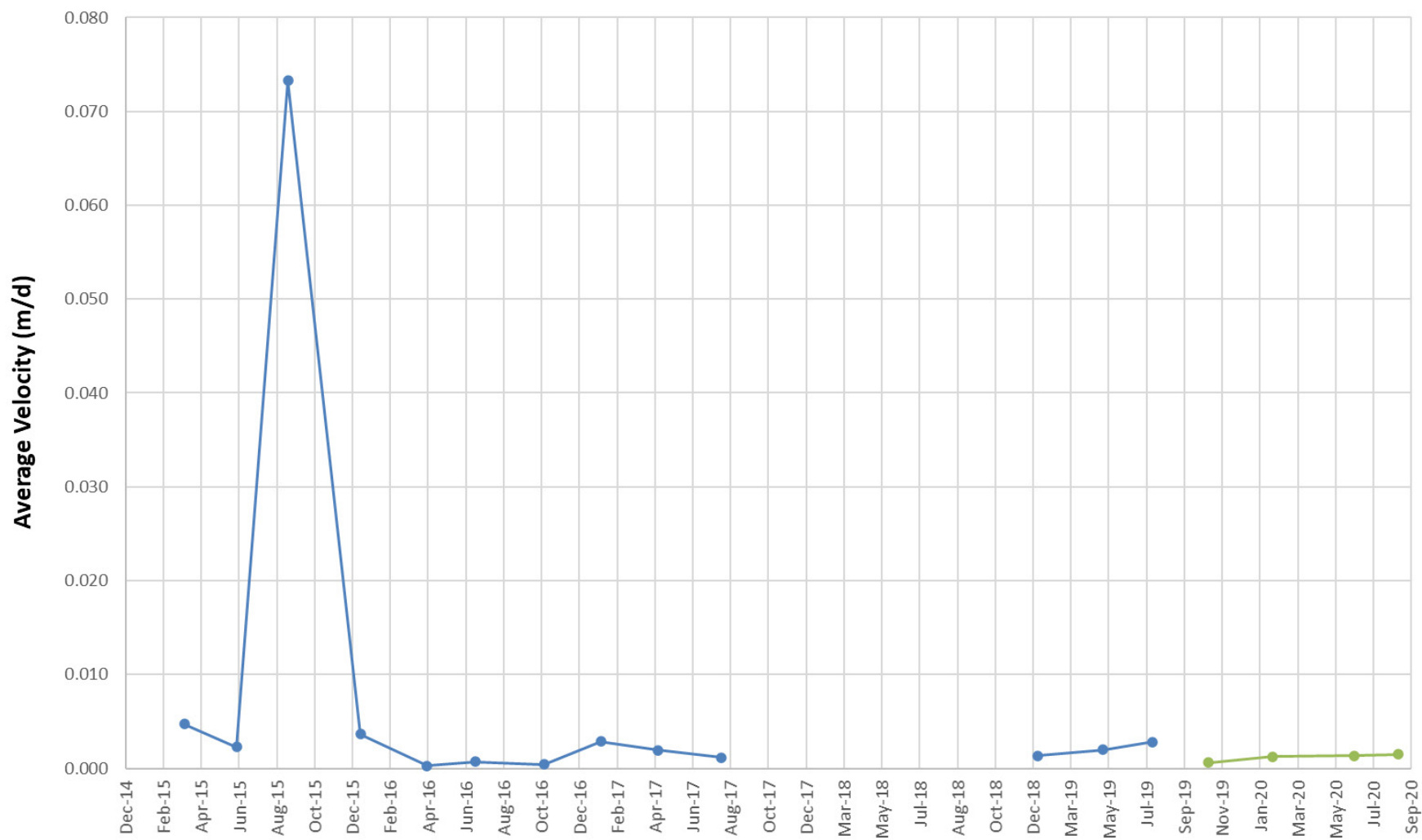
PROJECT  
**GREENHILLS TAILINGS STORAGE FACILITY**  
**2020 ANNUAL FACILITY REPORT**

TITLE  
**WEST TAILINGS DAM - PRISM K**  
**DISPLACEMENT PLOTS**

PROJECT No. **19133994** Phase/Task/DOC. **3000/3003/2020-150**

Rev. **0**

FIGURE  
**D-21**



2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)  
 Historic Data (Before 1 August 2019)

Notes:  
 -Prism data reset in February 2020 due to change in survey total station pillar  
 -Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020  
 -Data gaps present due to survey prisms being offline or moved during dam raise construction  
 -Average velocity calculated in metres per day from the average movement over the preceding approximately three-month period  
 -Average velocity data presented at the end of the calculation period (i.e. end of three months of data)

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DESIGN	ZPS
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PROJECT  
 GREENHILLS TAILINGS STORAGE FACILITY  
 2020 ANNUAL FACILITY REPORT

TITLE  
**MAIN TAILINGS DAM - PRISM K**  
**AVERAGE VELOCITY PLOT**

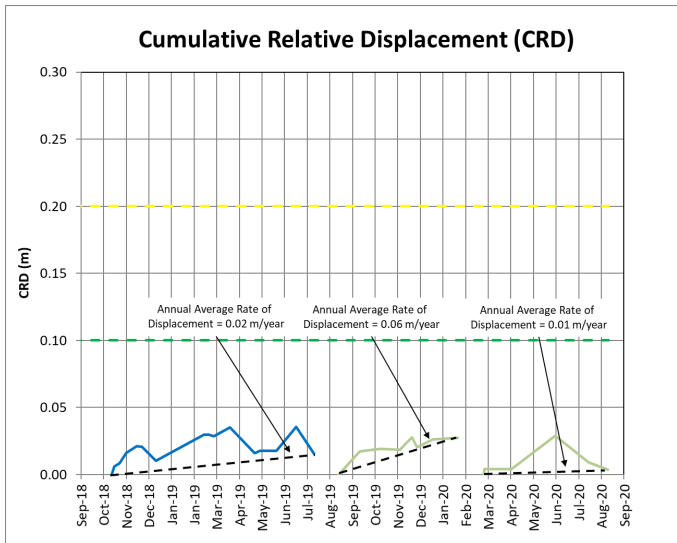
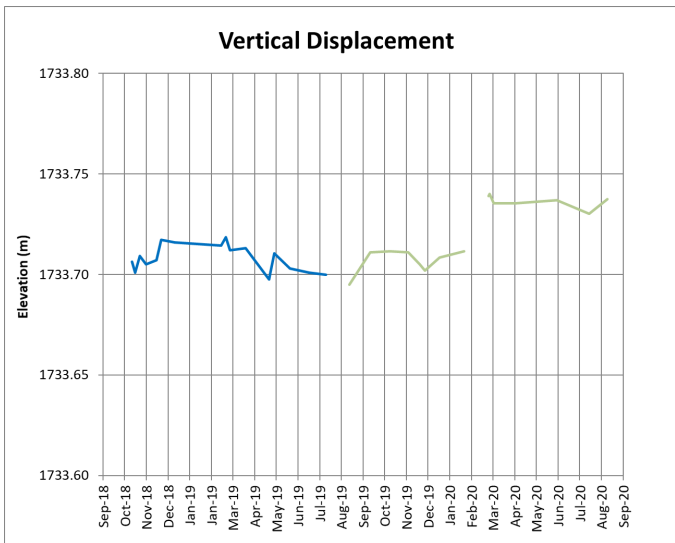
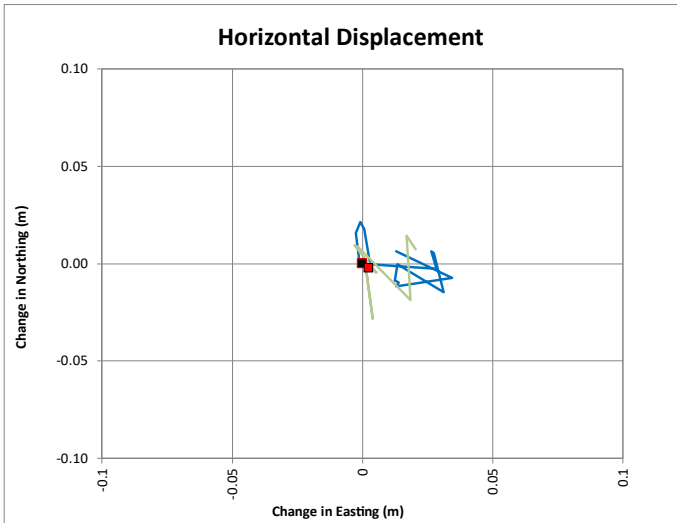
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FIGURE  
 D-22





Initial Location

Final Location

2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)

2018/2019 Annual Inspection Reporting Period (1 September 2018 to 31 July 2019)

Green Notification (100 mm)

Yellow Warning (200 mm)

Instrument Location

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.

Notes:

-Prism data reset in February 2020 due to change in survey total station pillar

-Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020

-Annual average rate of displacement was calculated based on prorating the data available to represent 12 months of movement. i.e. data was forecast forward assuming a linear increase.

-Data gaps present due to survey prisms being offline or moved during dam raise construction

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#### PROJECT

GREENHILLS TAILINGS STORAGE FACILITY  
2020 ANNUAL FACILITY REPORT

#### TITLE

WEST TAILINGS DAM - PRISM L  
DISPLACEMENT PLOTS

PROJECT No.

19133994

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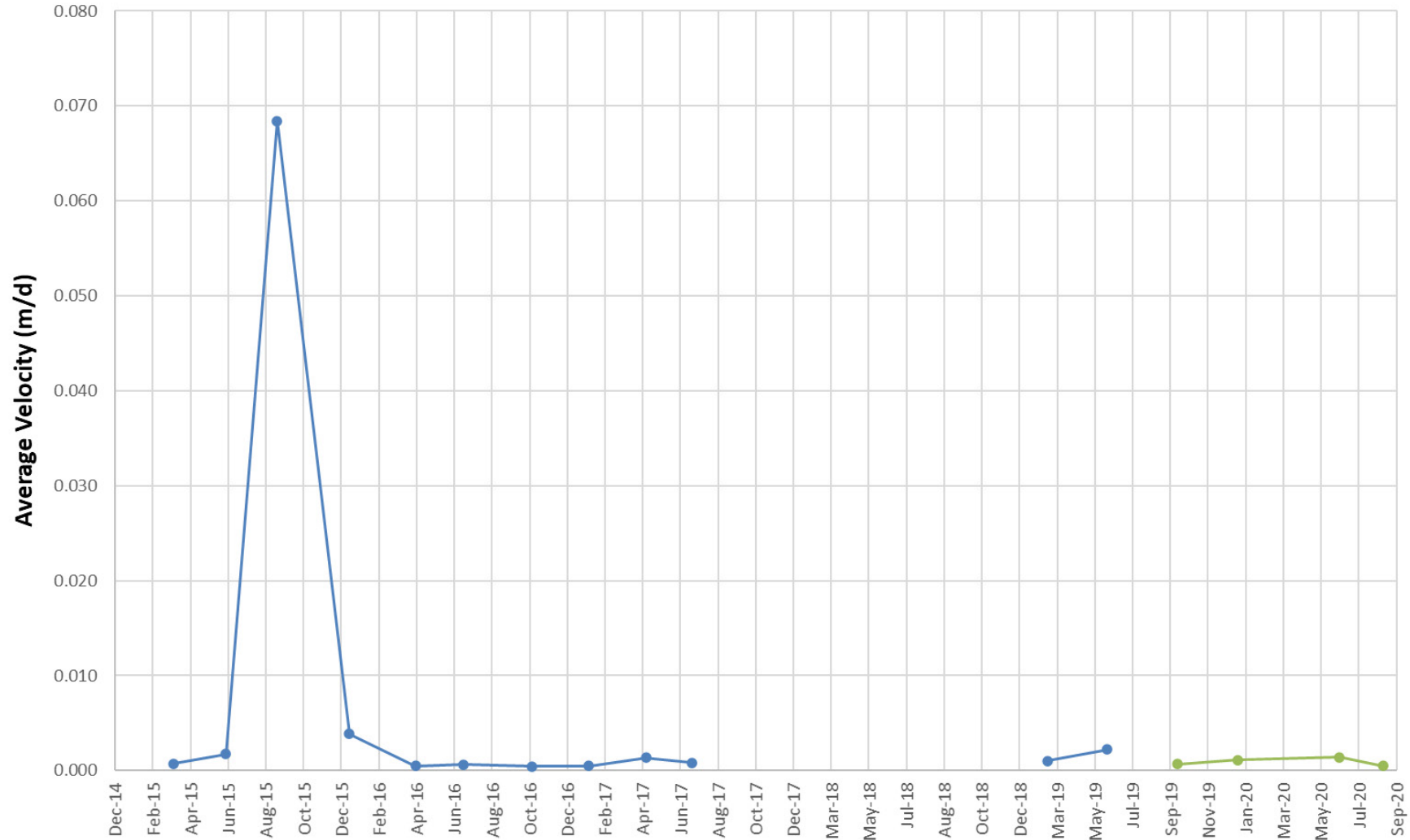
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FIGURE

D-23



2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)  
Historic Data (Before 1 August 2019)

Notes:  
-Prism data reset in February 2020 due to change in survey total station pillar  
-Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020  
-Data gaps present due to survey prisms being offline or moved during dam raise construction  
-Average velocity calculated in metres per day from the average movement over the preceding approximately three-month period  
-Average velocity data presented at the end of the calculation period (i.e. end of three months of data)

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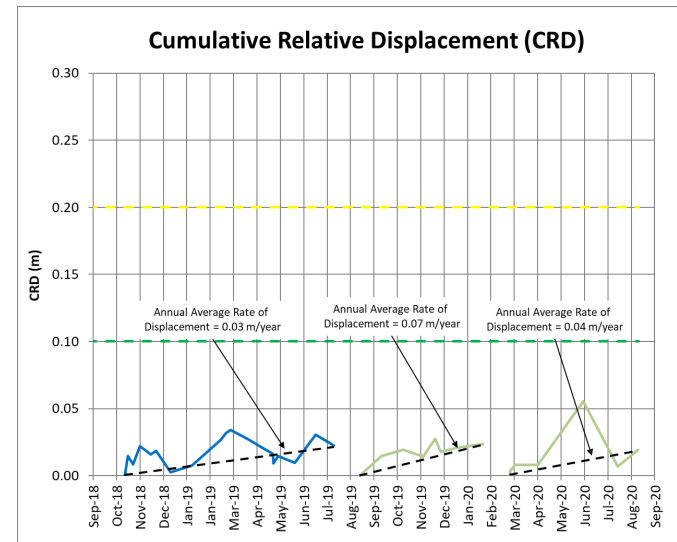
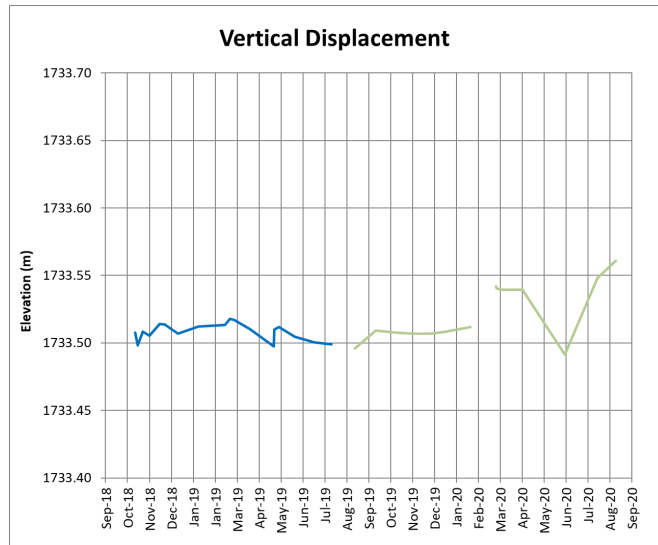
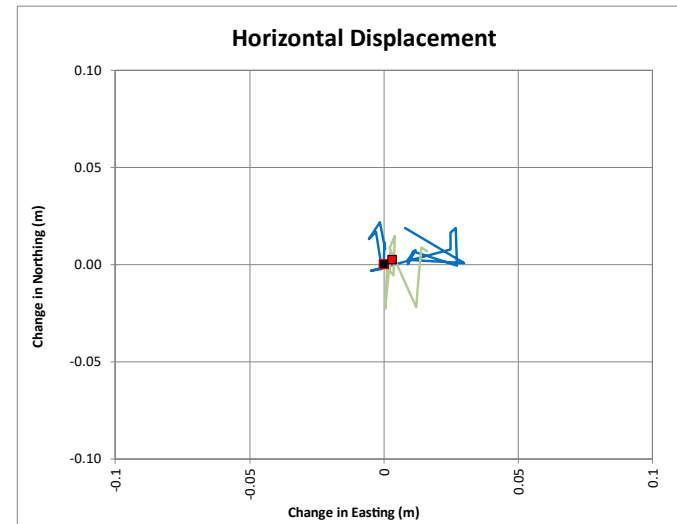


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DESIGN	ZPS
REVIEW	MBW
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PROJECT  
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2020 ANNUAL FACILITY REPORT

TITLE  
**MAIN TAILINGS DAM - PRISM L  
AVERAGE VELOCITY PLOT**

PROJECT No. <b>19133994</b>	Phase/Task/DOC. <b>3000/3003/2020-150</b>	Rev. <b>0</b>	FIGURE <b>D-24</b>
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- Initial Location
- Final Location
- 2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)
- 2018/2019 Annual Inspection Reporting Period (1 September 2018 to 31 July 2019)
- Green Notification (100 mm)
- Yellow Warning (200 mm)
- Instrument Location

References:  
 -2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
 Notes:  
 -Prism data reset in February 2020 due to change in survey total station pillar  
 -Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020  
 -Annual average rate of displacement was calculated based on prorating the data available to represent 12 months of movement. i.e. data was forecast forward assuming a linear increase.  
 -Data gaps present due to survey prisms being offline or moved during dam raise construction

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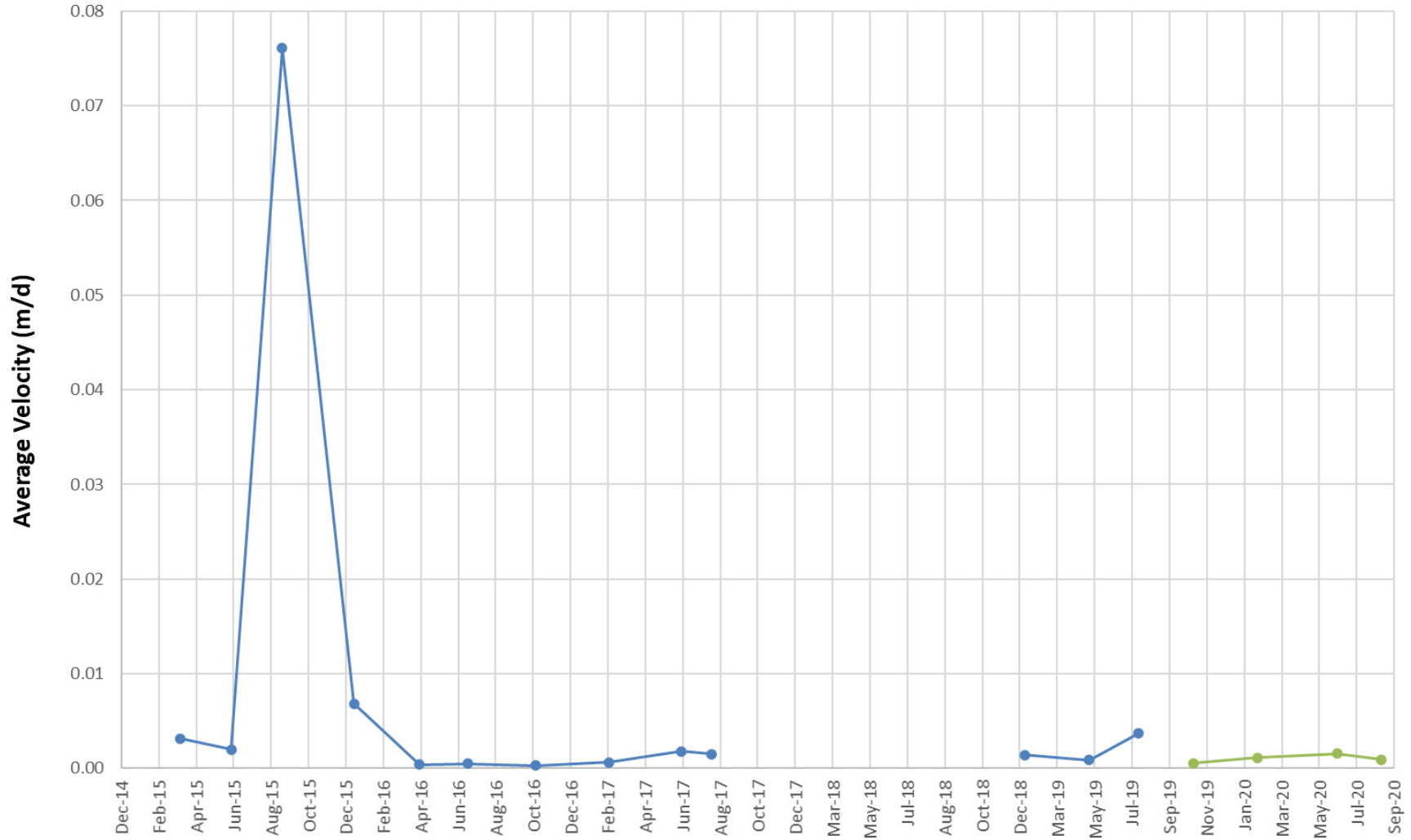
TITLE  
**WEST TAILINGS DAM - PRISM M**  
**DISPLACEMENT PLOTS**

PROJECT No. **19133994** Phase/Task/DOC. **3000/3003/2020-150**

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FIGURE  
**D-25**





2019/2020 Annual Inspection Data (1 August 2019 to 31 August 2020)  
 Historic Data (Before 1 August 2019)

Notes:  
 -Prism data reset in February 2020 due to change in survey total station pillar  
 -Data from January to August 2020 may be erroneous due to errors in total station. Total station calibrated 8 July 2020  
 -Data gaps present due to survey prisms being offline or moved during dam raise construction  
 -Average velocity calculated in metres per day from the average movement over the preceding approximately three-month period  
 -Average velocity data presented at the end of the calculation period (i.e. end of three months of data)

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DESIGN	ZPS
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 2020 ANNUAL FACILITY REPORT

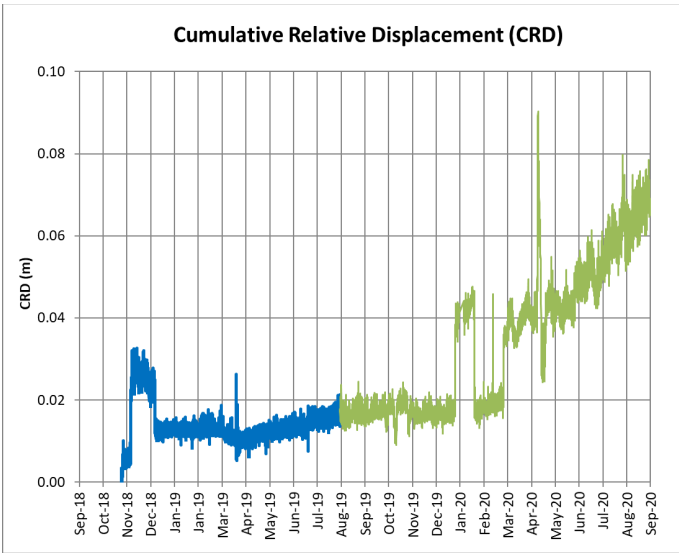
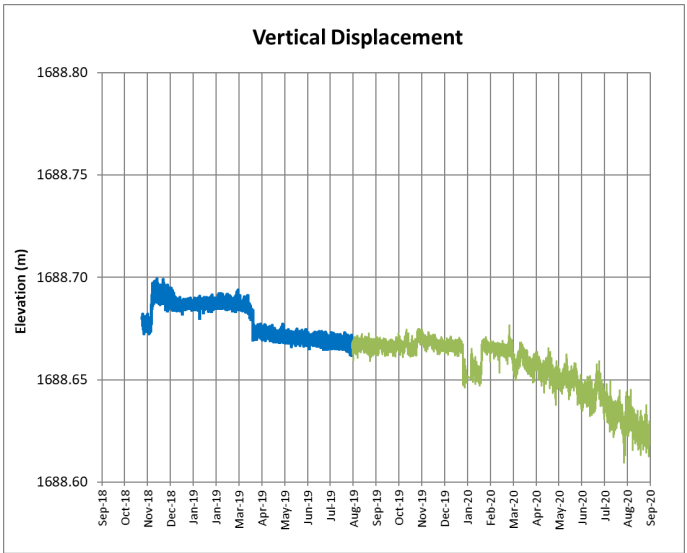
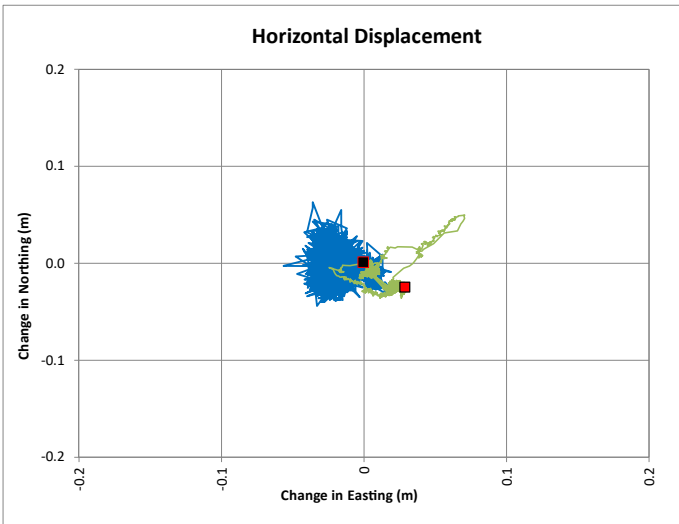
TITLE  
 MAIN TAILINGS DAM - PRISM M  
 AVERAGE VELOCITY PLOT

PROJECT No.  
 19133994

Phase/Task/DOC.  
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FIGURE  
 D-26



■ Initial Location  
■ Final Location  
— 2019/2020 DSI Monitoring Data (1 August 2019 to 31 August 2020)  
— Historical Data Prior to 2019/2020 DSI Reporting Period  
○ Instrument Location

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
Notes:  
-Data gaps present due to intermittent data signal, erroneous readings, or instrument or data logger malfunctions

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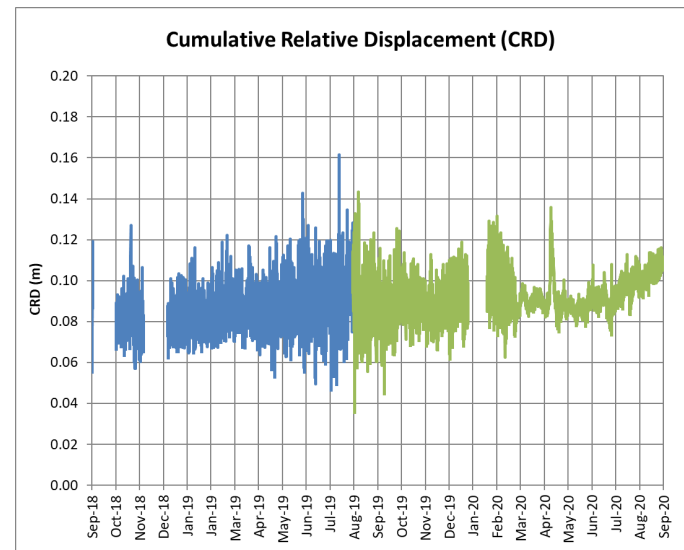
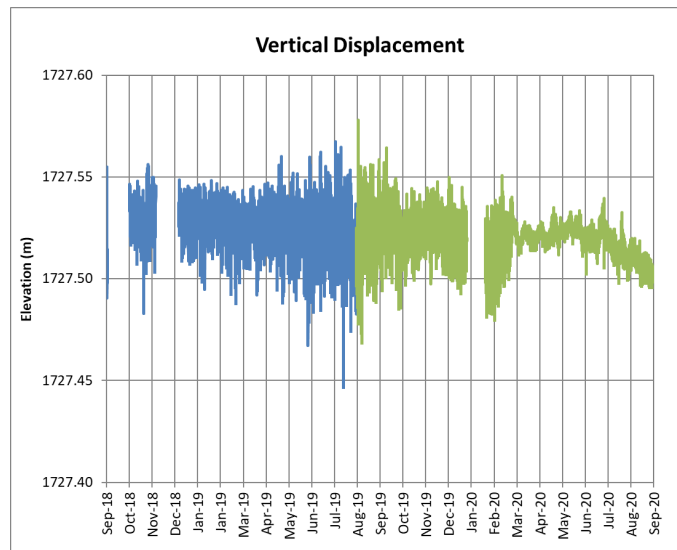
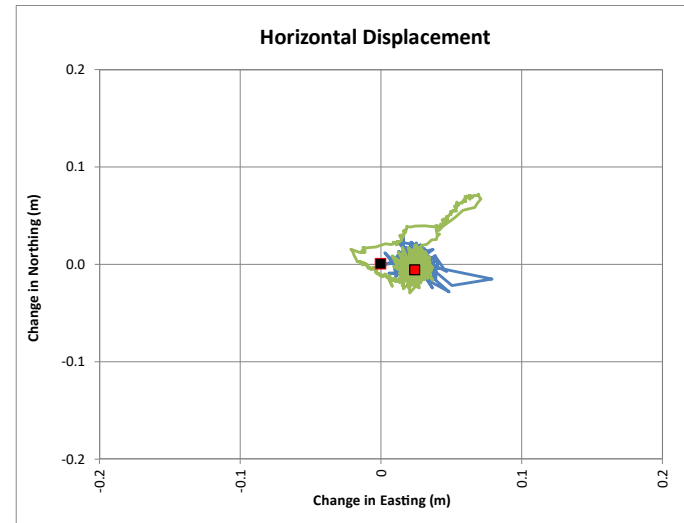


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PROJECT  
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2020 ANNUAL FACILITY REPORT

TITLE  
MAIN TAILINGS DAM – GPS UNIT 319

PROJECT No. 19133994 Phase/Task/DOC. 3000/3003/2020-150 Rev. 0 FIGURE D-27



- Initial Location
- Final Location

— 2019/2020 DSI Monitoring Data (1 August 2019 to 31 August 2020)

— Historical Data Prior to 2019/2020 DSI Reporting Period

- Instrument Location

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TITLE  
**MAIN TAILINGS DAM - GPS UNIT 320**

PROJECT No.  
**19133994**

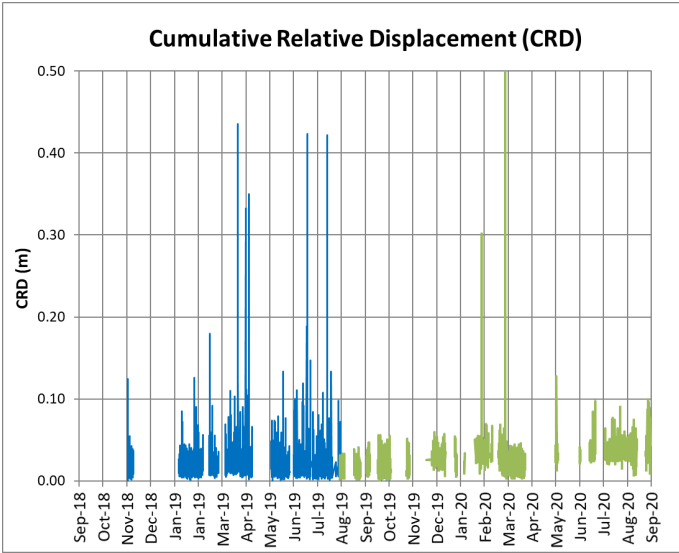
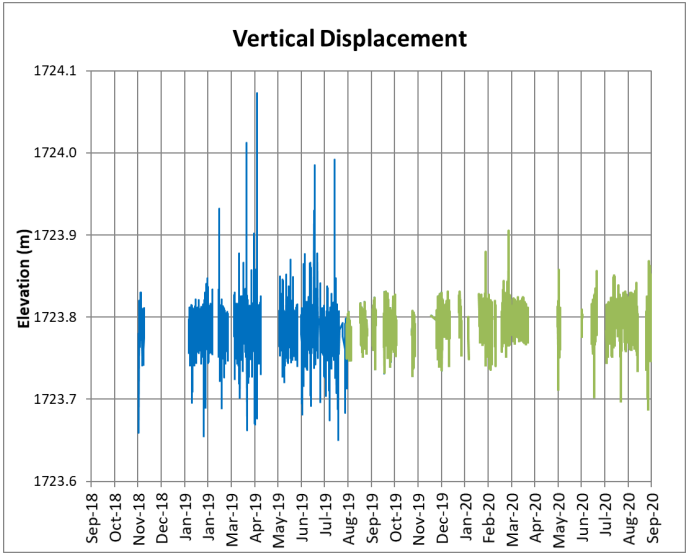
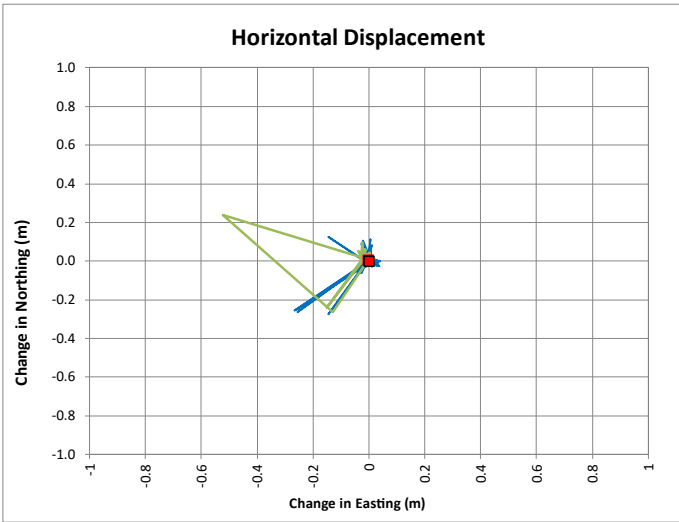
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**3000/3003/2020-150**

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FIGURE  
**D-28**

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
Notes:  
-Data gaps present due to intermittent data signal, erroneous readings, or instrument or data logger malfunctions





- Initial Location
- Final Location
- 2019/2020 DSI Monitoring Data (1 August 2019 to 31 August 2020)
- Historical Data Prior to 2019/2020 DSI Reporting Period
- Instrument Location

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
Notes:  
-Data gaps present due to intermittent data signal, erroneous readings, or instrument or data logger malfunctions

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2020 ANNUAL FACILITY REPORT

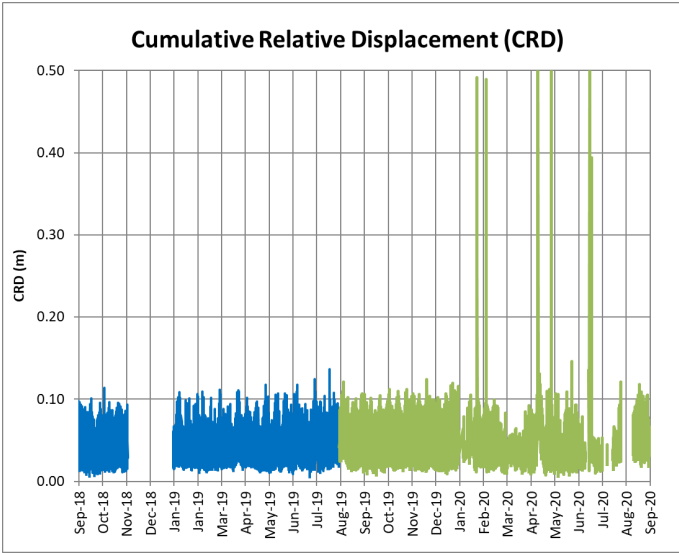
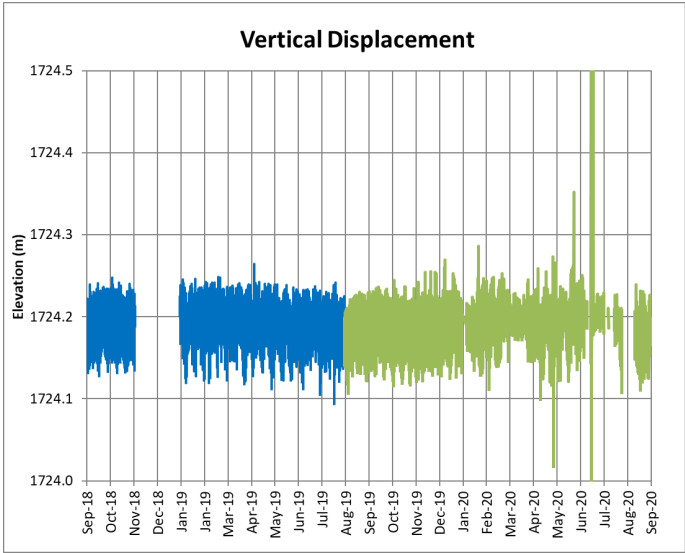
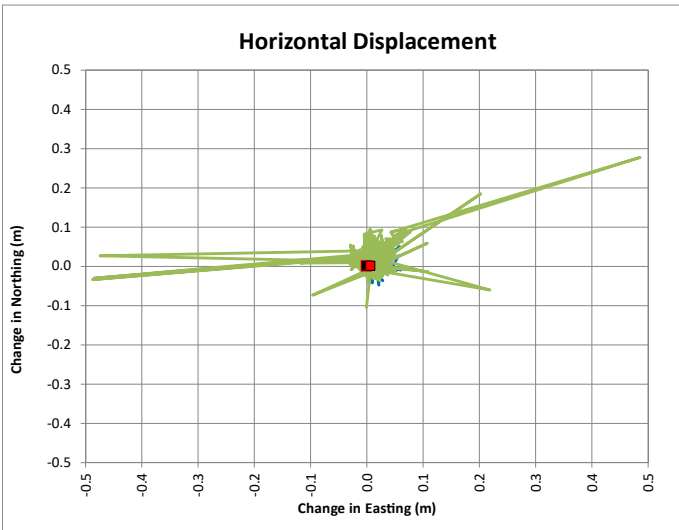
TITLE  
**MAIN TAILINGS DAM - GPS UNIT MD-1 ROVER**

PROJECT No.  
**19133994**

Phase/Task/DOC.  
**3000/3003/2020-150**

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FIGURE  
**D-29**



Initial Location  
Final Location

2019/2020 DSI Monitoring Data (1 August 2019 to 31 August 2020)

Historical Data Prior to 2019/2020 DSI Reporting Period

Instrument Location

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2020 ANNUAL FACILITY REPORT

TITLE  
MAIN TAILINGS DAM - GPS UNIT MD-2 ROVER

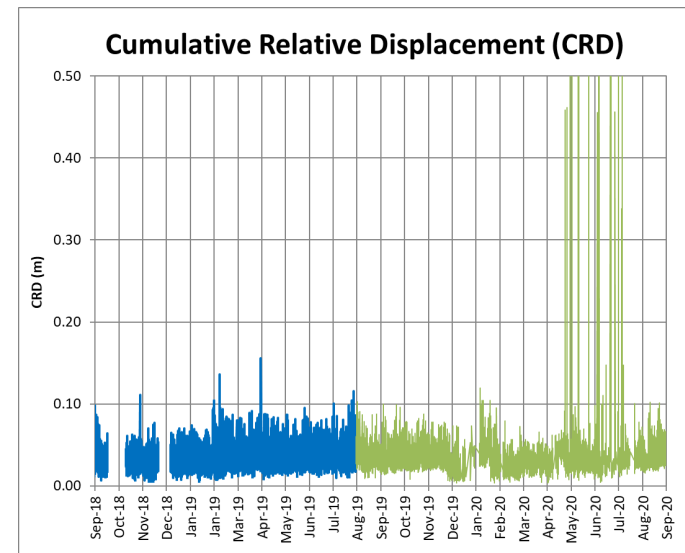
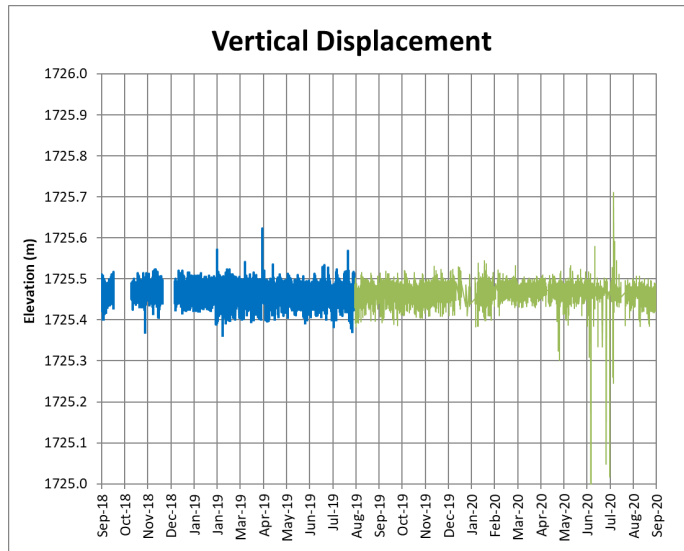
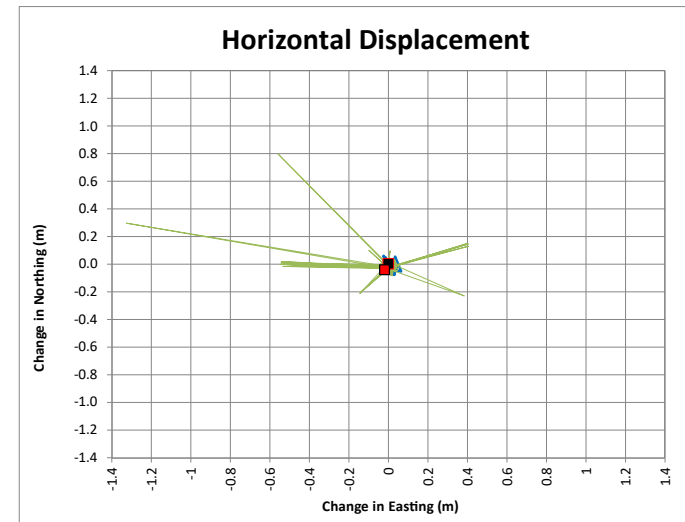
PROJECT No.  
19133994

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FIGURE  
D-30

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
Notes:  
-Data gaps present due to intermittent data signal, erroneous readings, or instrument or data logger malfunctions



- Initial Location
- Final Location

— 2019/2020 DSI Monitoring Data (1 August 2019 to 31 August 2020)

— Historical Data Prior to 2019/2020 DSI Reporting Period

- Instrument Location

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
Notes:  
-Data gaps present due to intermittent data signal, erroneous readings, or instrument or data logger malfunctions

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2020 ANNUAL FACILITY REPORT**

TITLE  
**MAIN TAILINGS DAM - GPS UNIT MD-3 ROVER**

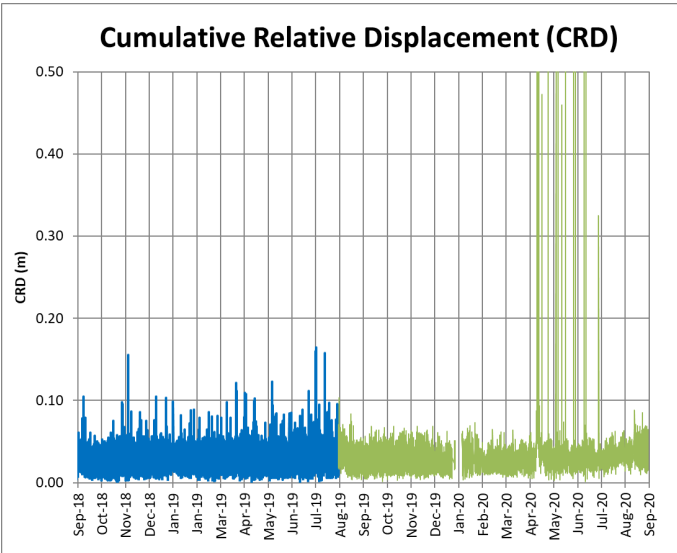
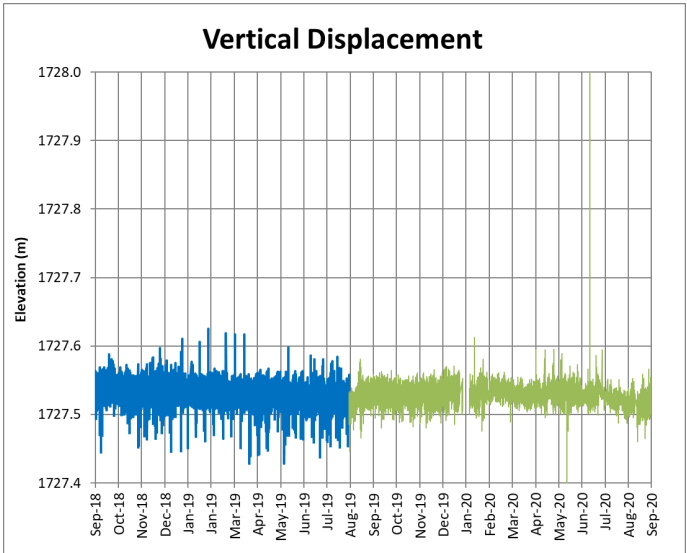
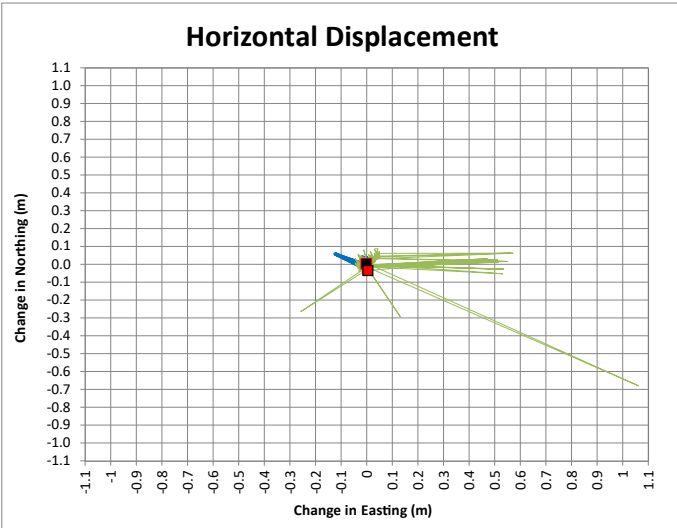
PROJECT No.  
**19133994**

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**3000/3003/2020-150**

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**0**

FIGURE  
**D-31**





Initial Location  
Final Location

2019/2020 DSI Monitoring Data (1 August 2019 to 31 August 2020)

Historical Data Prior to 2019/2020 DSI Reporting Period

Instrument Location

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
Notes:  
-Data gaps present due to intermittent data signal, erroneous readings, or instrument or data logger malfunctions

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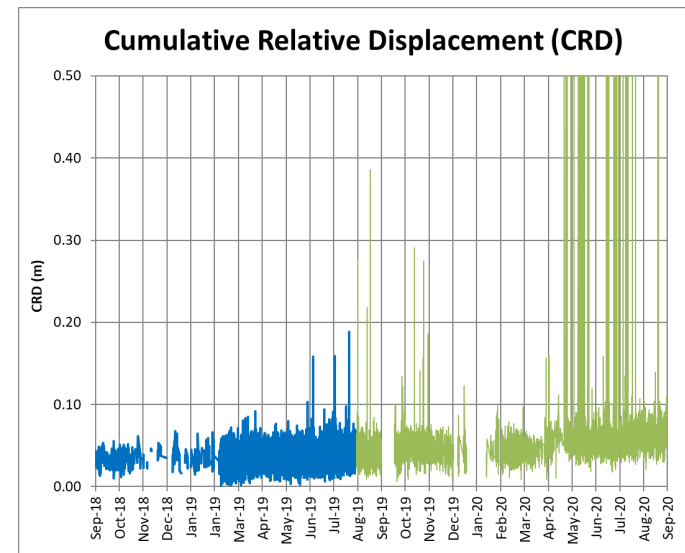
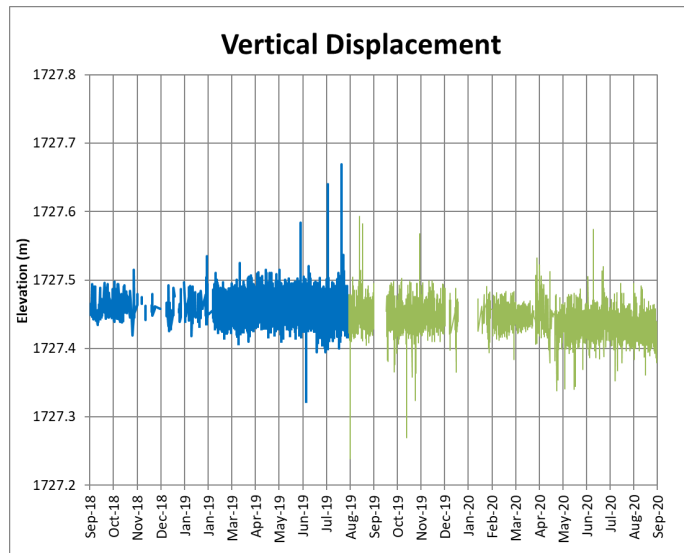
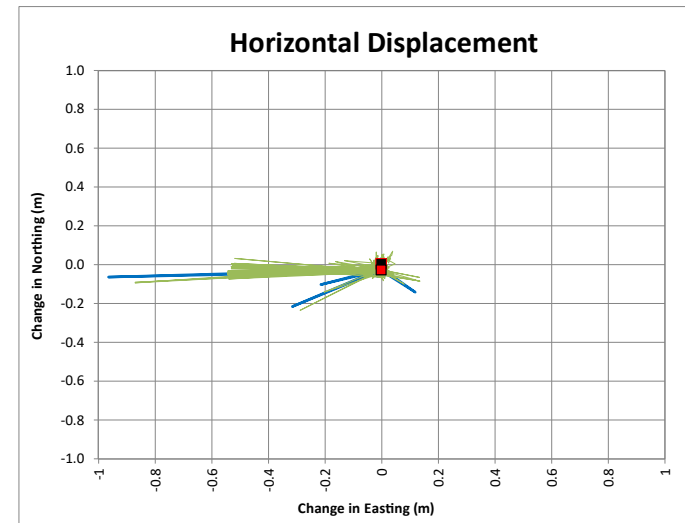
TITLE  
MAIN TAILINGS DAM - GPS UNIT MD-4 ROVER

PROJECT No.  
19133994

Phase/Task/DOC.  
3000/3003/2020-150

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FIGURE  
D-32



- Initial Location
- Final Location

— 2019/2020 DSI Monitoring Data (1 August 2019 to 31 August 2020)

— Historical Data Prior to 2019/2020 DSI Reporting Period

- Instrument Location

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
Notes:  
-Data gaps present due to intermittent data signal, erroneous readings, or instrument or data logger malfunctions

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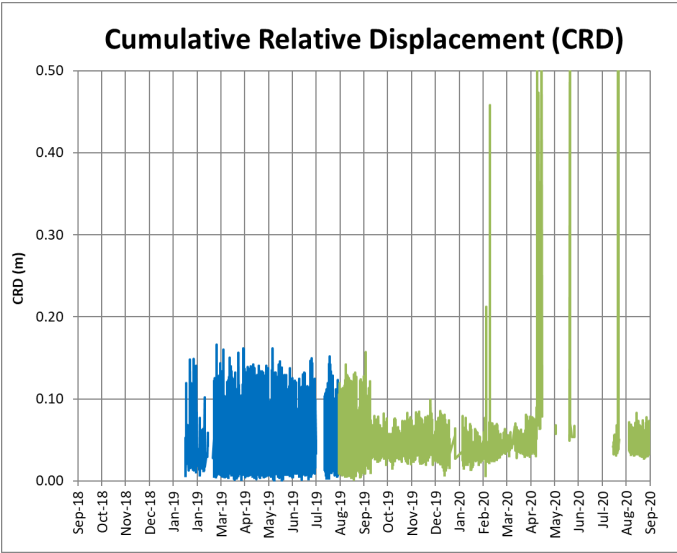
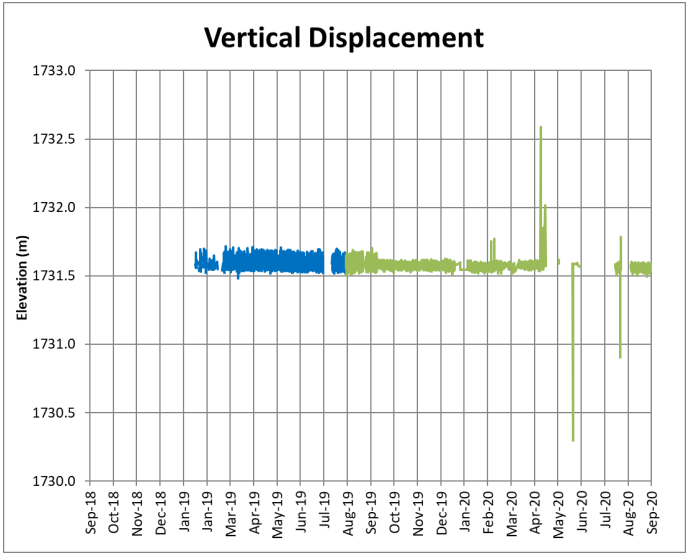
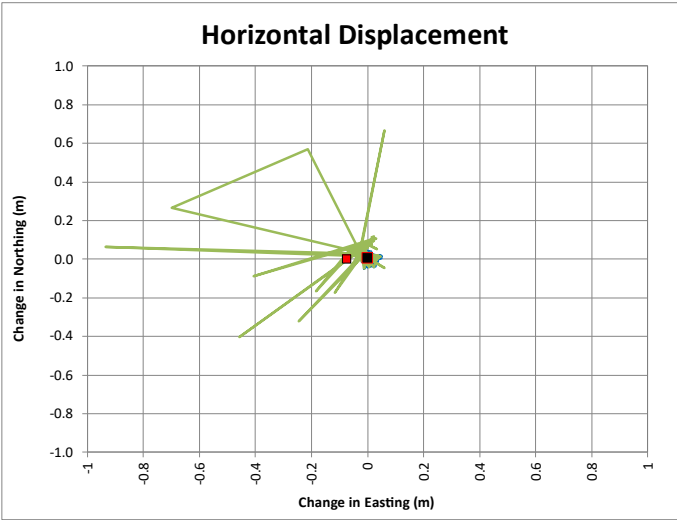
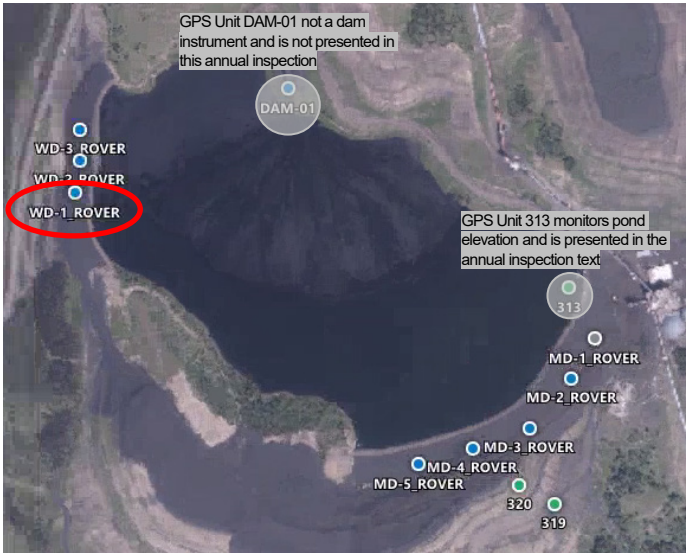
TITLE  
**MAIN TAILINGS DAM - GPS UNIT MD-5 ROVER**

PROJECT No.  
**19133994**

Phase/Task/DOC.  
**3000/3003/2020-150**

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FIGURE  
**D-33**



■ Initial Location  
■ Final Location  
— 2019/2020 DSI Monitoring Data (1 August 2019 to 31 August 2020)  
— Historical Data Prior to 2019/2020 DSI Reporting Period  
○ Instrument Location

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
Notes:  
-Data gaps present due to intermittent data signal, erroneous readings, or instrument or data logger malfunctions

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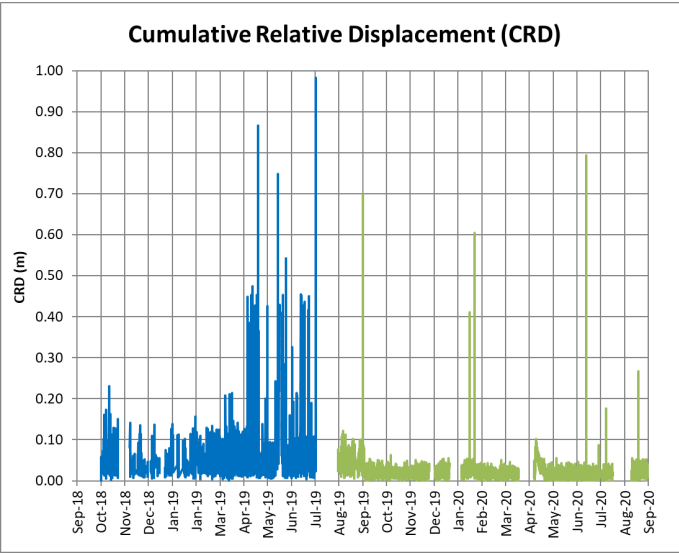
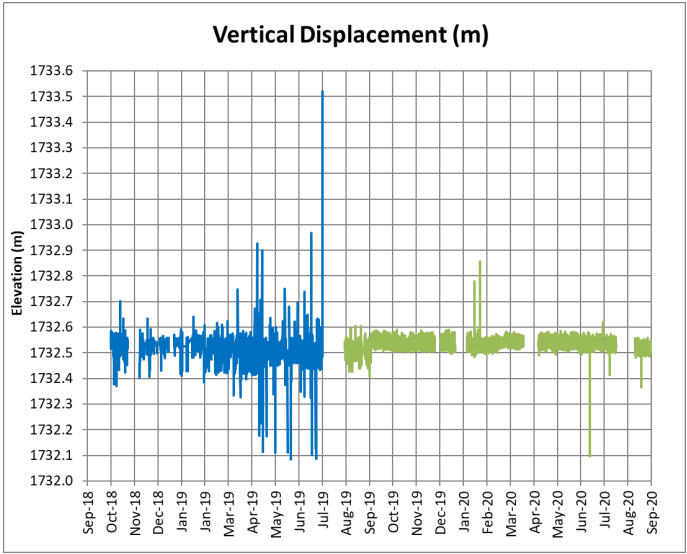
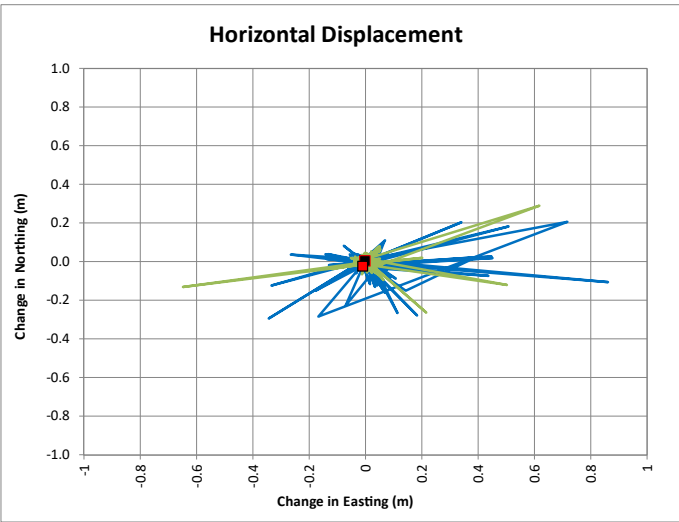
PROJECT  
GREENHILLS TAILINGS STORAGE FACILITY  
2020 ANNUAL FACILITY REPORT

TITLE  
**WEST TAILINGS DAM - GPS UNIT WD-1 ROVER**

PROJECT No. <b>19133994</b>	Phase/Task/DOC. <b>3000/3003/2020-150</b>	Rev. <b>0</b>
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FIGURE  
**D-34**





Initial Location

Final Location

2019/2020 DSI Monitoring Data (1 August 2019 to 31 August 2020)

Historical Data Prior to 2019/2020 DSI Reporting Period

Instrument Location

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
Notes:  
-Data gaps present due to intermittent data signal, erroneous readings, or instrument or data logger malfunctions

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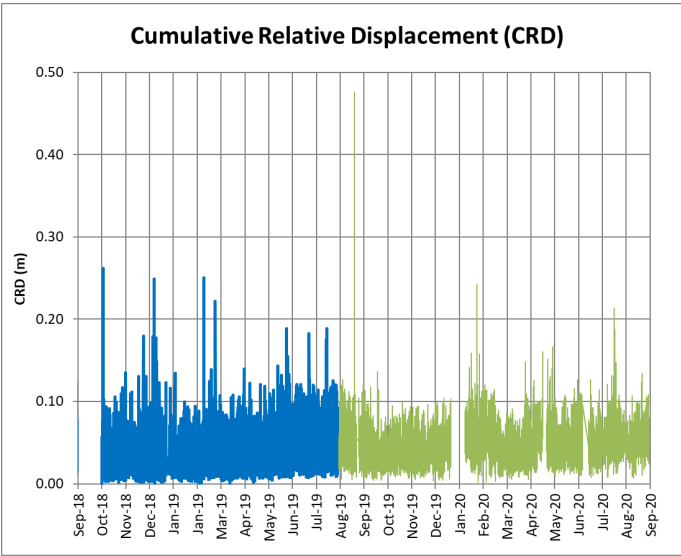
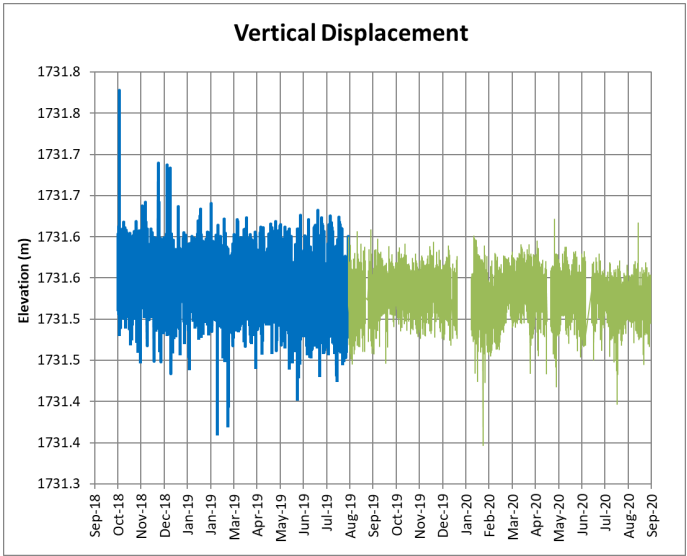
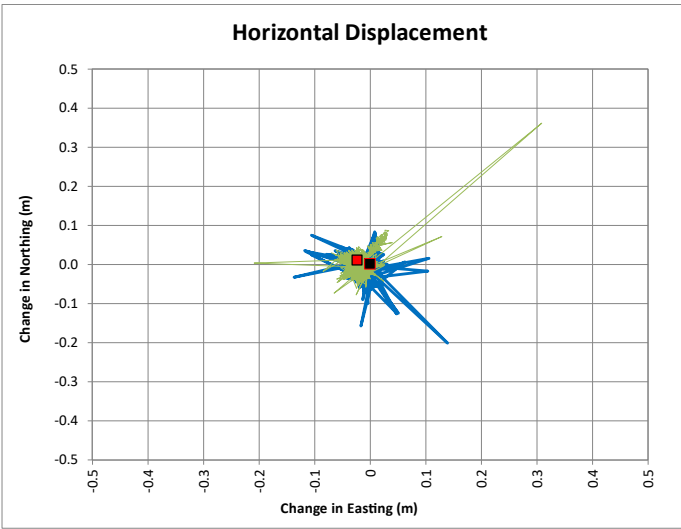
TITLE  
WEST TAILINGS DAM – GPS UNIT WD-2\_ROVER

PROJECT No. 19133994

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FIGURE  
D-35



Initial Location

Final Location

2019/2020 DSI Monitoring Data (1 August 2019 to 31 August 2020)

Historical Data Prior to 2019/2020 DSI Reporting Period

Instrument Location

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
Notes:  
-Data gaps present due to intermittent data signal, erroneous readings, or instrument or data logger malfunctions

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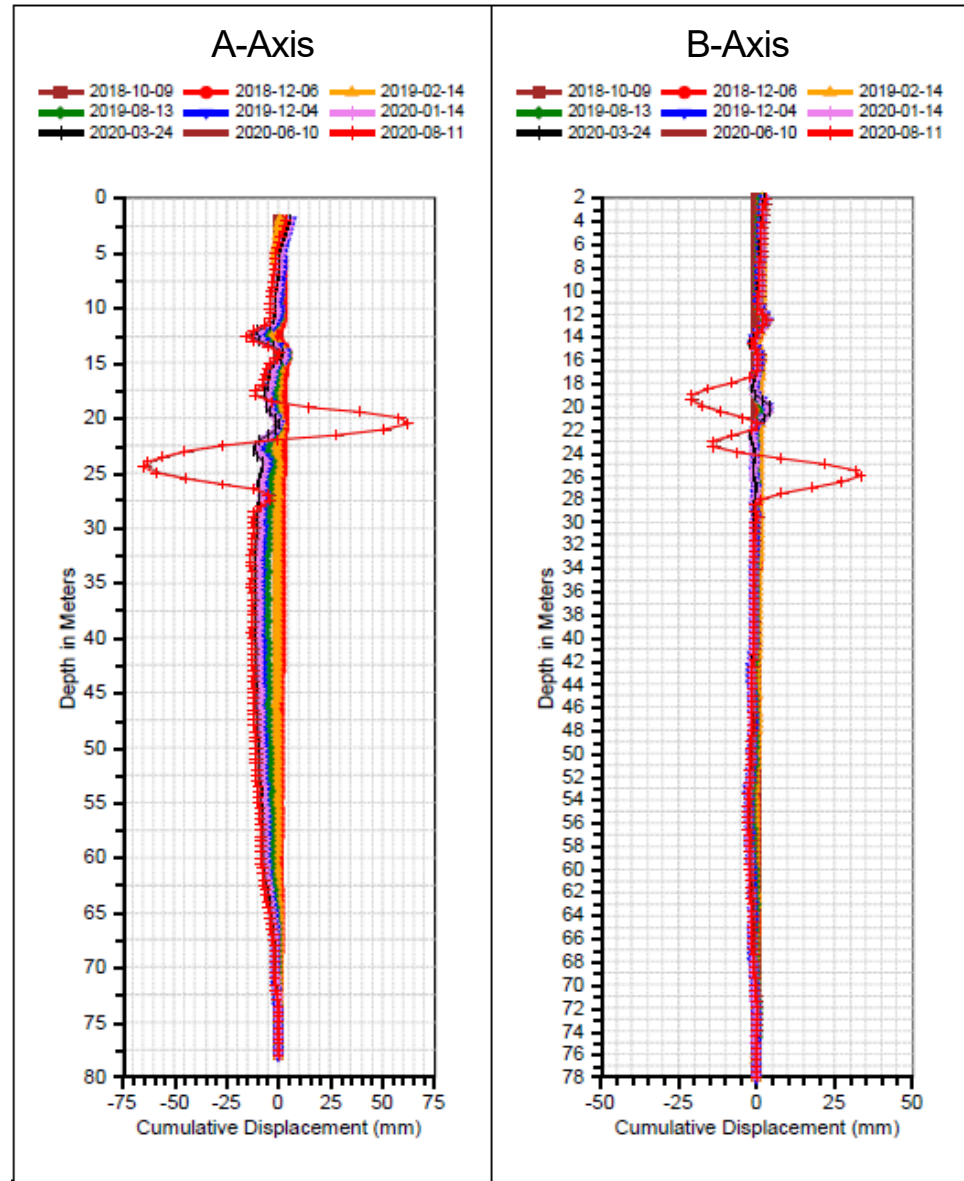
TITLE  
WEST TAILINGS DAM - GPS UNIT WD-3\_ROVER

PROJECT No.  
19133994

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FIGURE  
D-36



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TITLE  
**MAIN TAILINGS DAM - INCLINOMETER SD 16-04**

PROJECT No.  
**19133994**

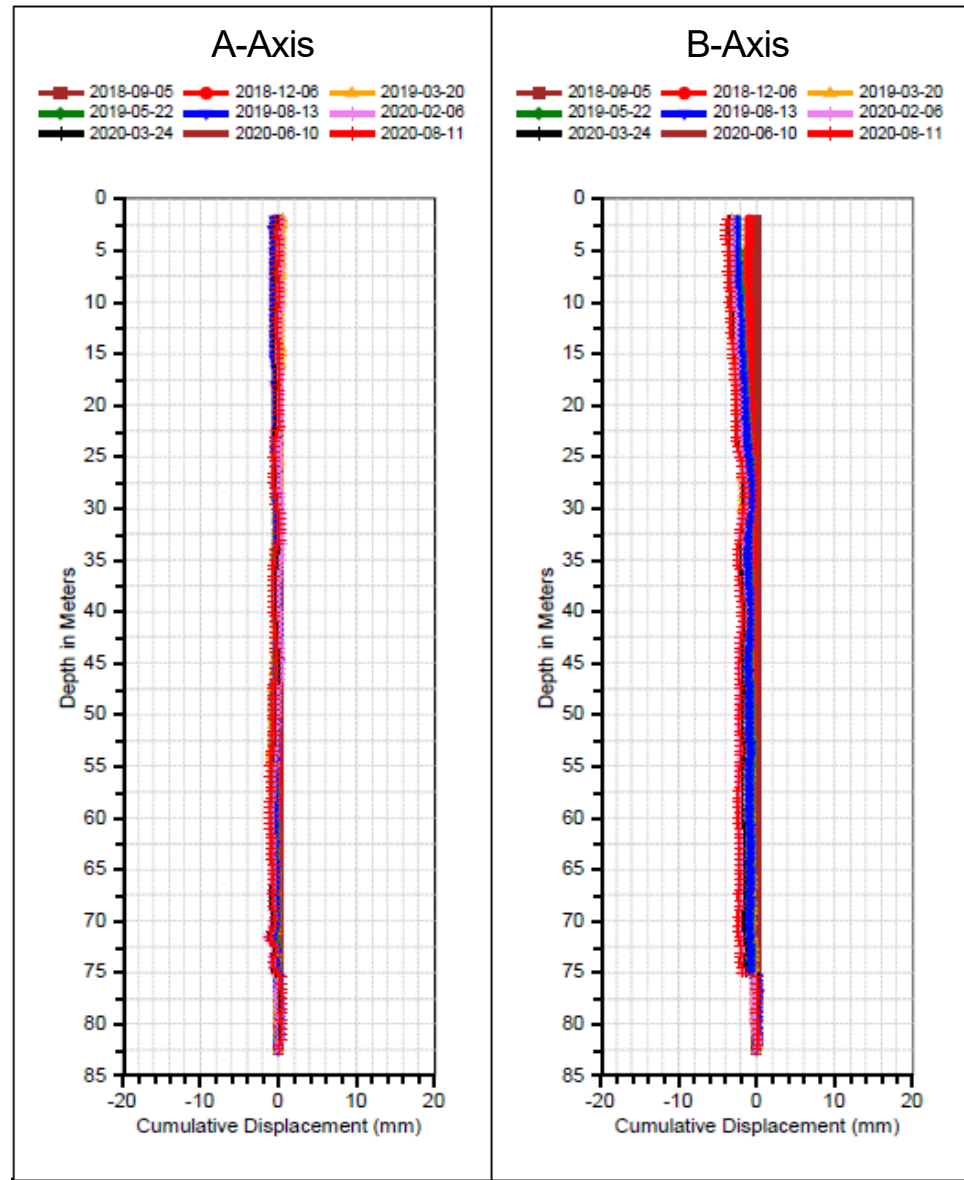
Phase/Task/DOC.  
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FIGURE  
**D-37**

Instrument Location

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
Notes:



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TITLE  
**MAIN TAILINGS DAM - INCLINOMETER SD 16-05**

PROJECT No.  
**19133994**

Phase/Task/DOC.  
**3000/3003/2020-150**

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FIGURE  
**D-38**

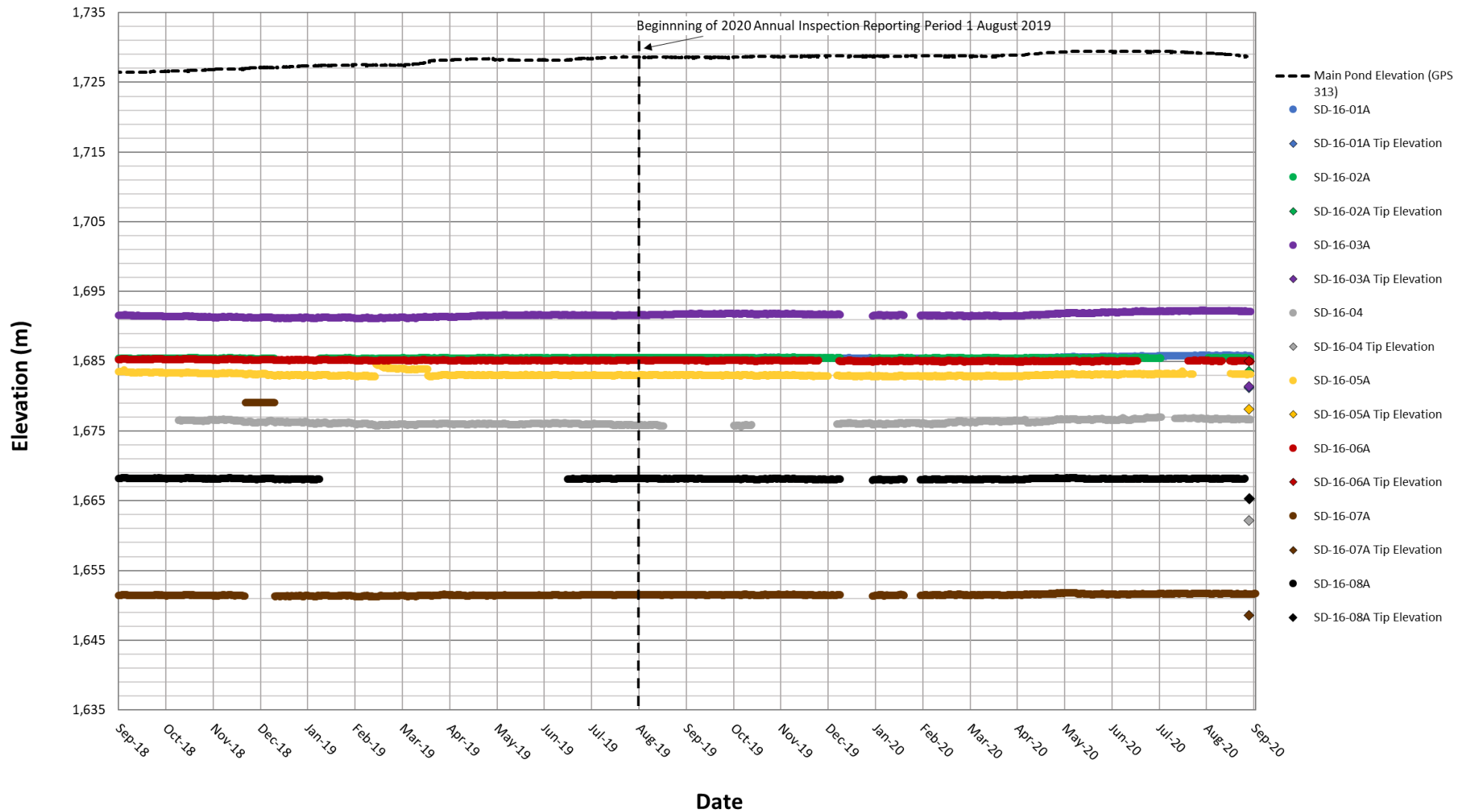
Instrument Location

References:  
-2018 Aerial photo and topography provided by Teck Coal Limited. Flown 16 to 16 July 2018.  
Notes:



**APPENDIX E**

# Vibrating Wire Piezometer Data



Data gaps present due to:

- Data being considered erroneous
- Negative pressure readings recorded indicating piezometer tip is dry. Piezometric levels cannot be determined from negative pressures
- Malfunctioning data loggers or instruments
- Intermittent data signal from instrument

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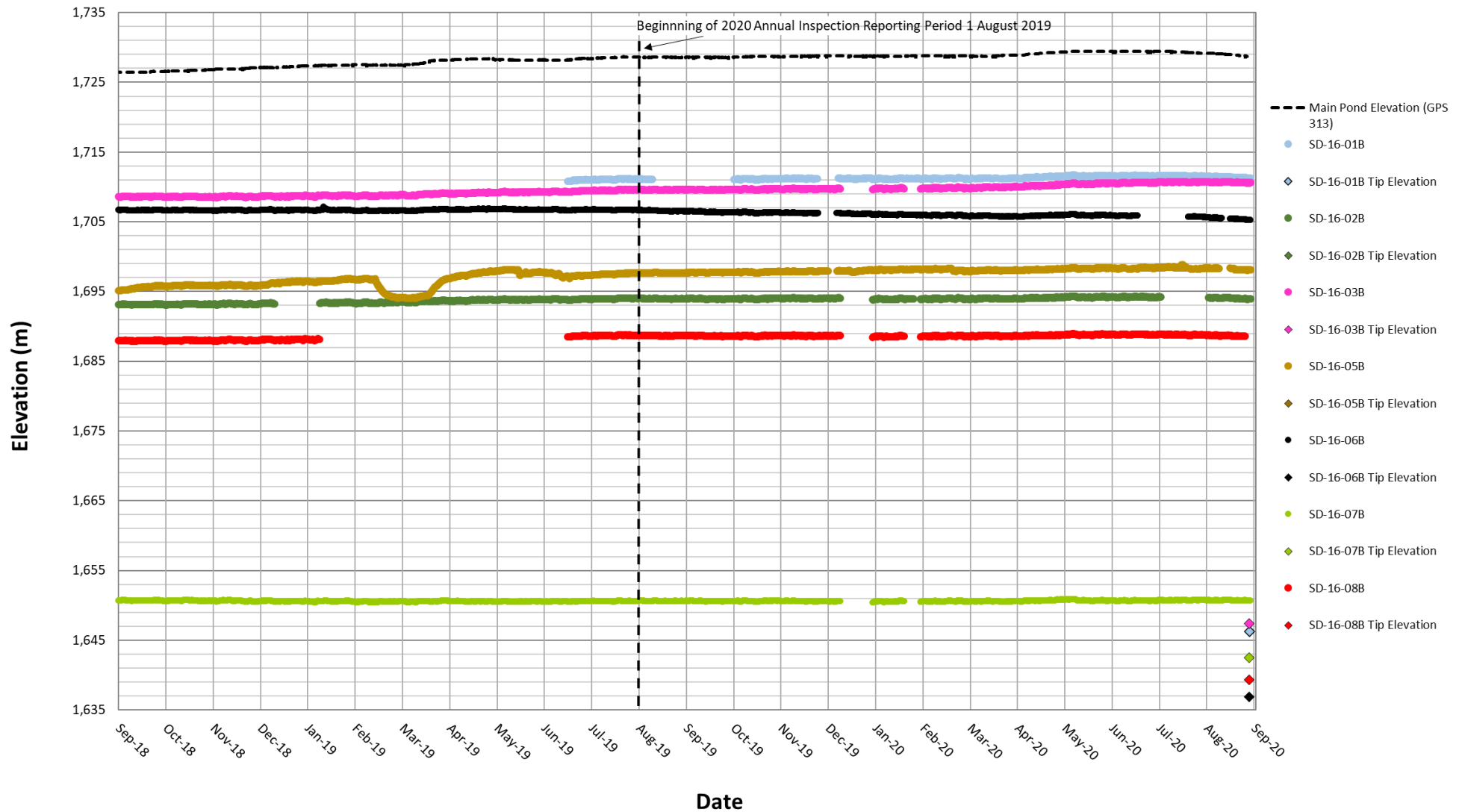


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TITLE  
**MAIN TAILINGS DAM**  
**SD SERIES A (Lower) PIEZOMETERS**

PROJECT No. <b>19133994</b>	Phase/Task/DOC. <b>3000/3003/2020-150</b>	Rev. <b>0</b>	FIGURE <b>E-1</b>
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#### Notes:

- "B" piezometers installed in bedrock or deep till on average have higher piezometric levels than shallow piezometers due to artesian conditions

#### Data gaps present due to:

- Data being considered erroneous
- Negative pressure readings recorded indicating piezometer tip is dry. Piezometric levels cannot be determined from negative pressures
- Malfunctioning data loggers or instruments
- Intermittent data signal from instrument

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#### TITLE

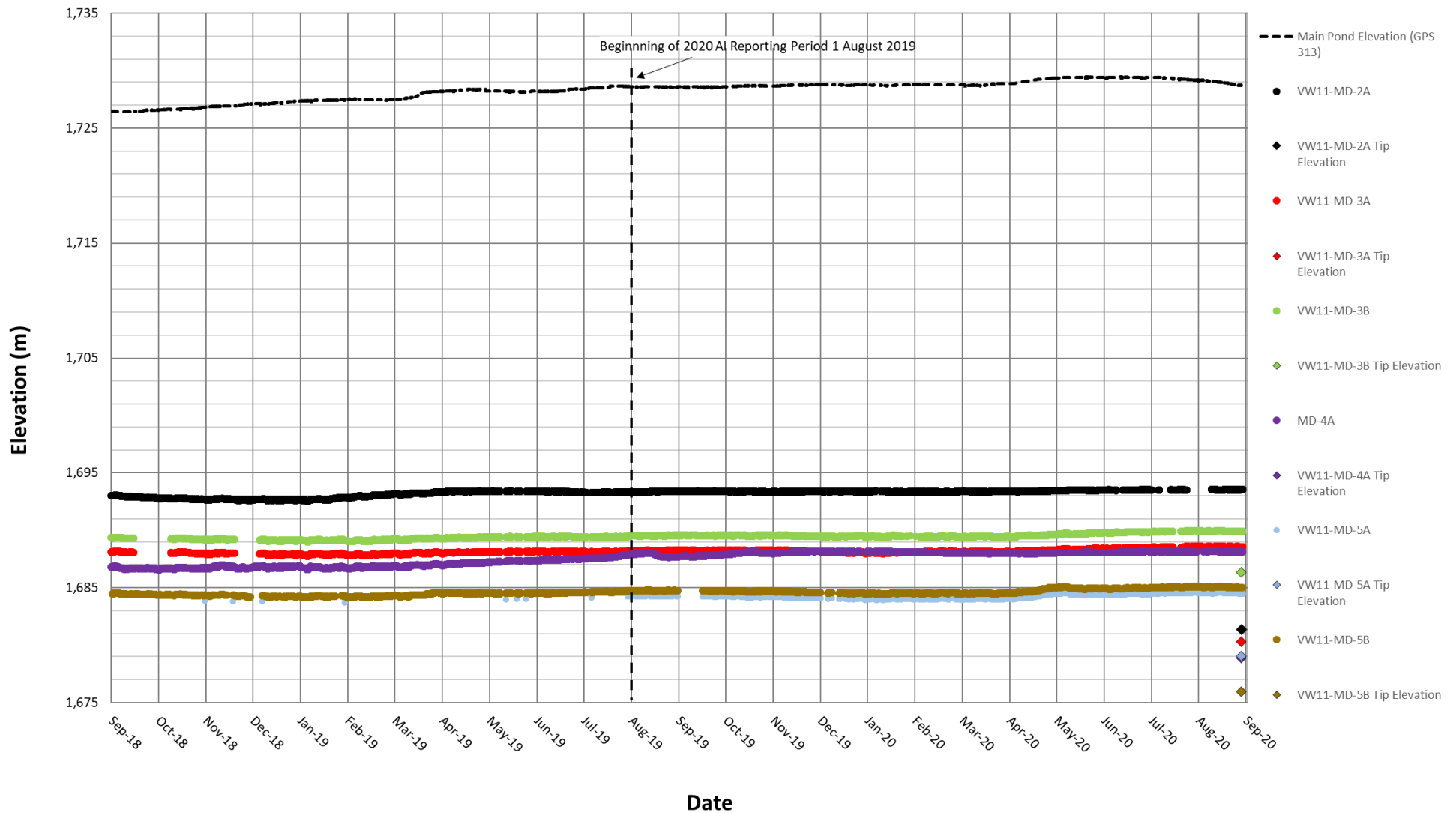
**MAIN TAILINGS DAM**  
**SD SERIES B (Upper) PIEZOMETERS**

PROJECT No.  
**19133994**

Phase/Task/DOC.  
**3000/3003/2020-150**

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FIGURE  
**E-2**



Data gaps present due to:

- Data being considered erroneous
- Negative pressure readings recorded indicating piezometer tip is dry. Piezometric levels cannot be determined from negative pressures
- Malfunctioning data loggers or instruments
- Intermittent data signal from instrument

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TITLE  
**MAIN TAILINGS DAM – MD SERIES PIEZOMETERS**

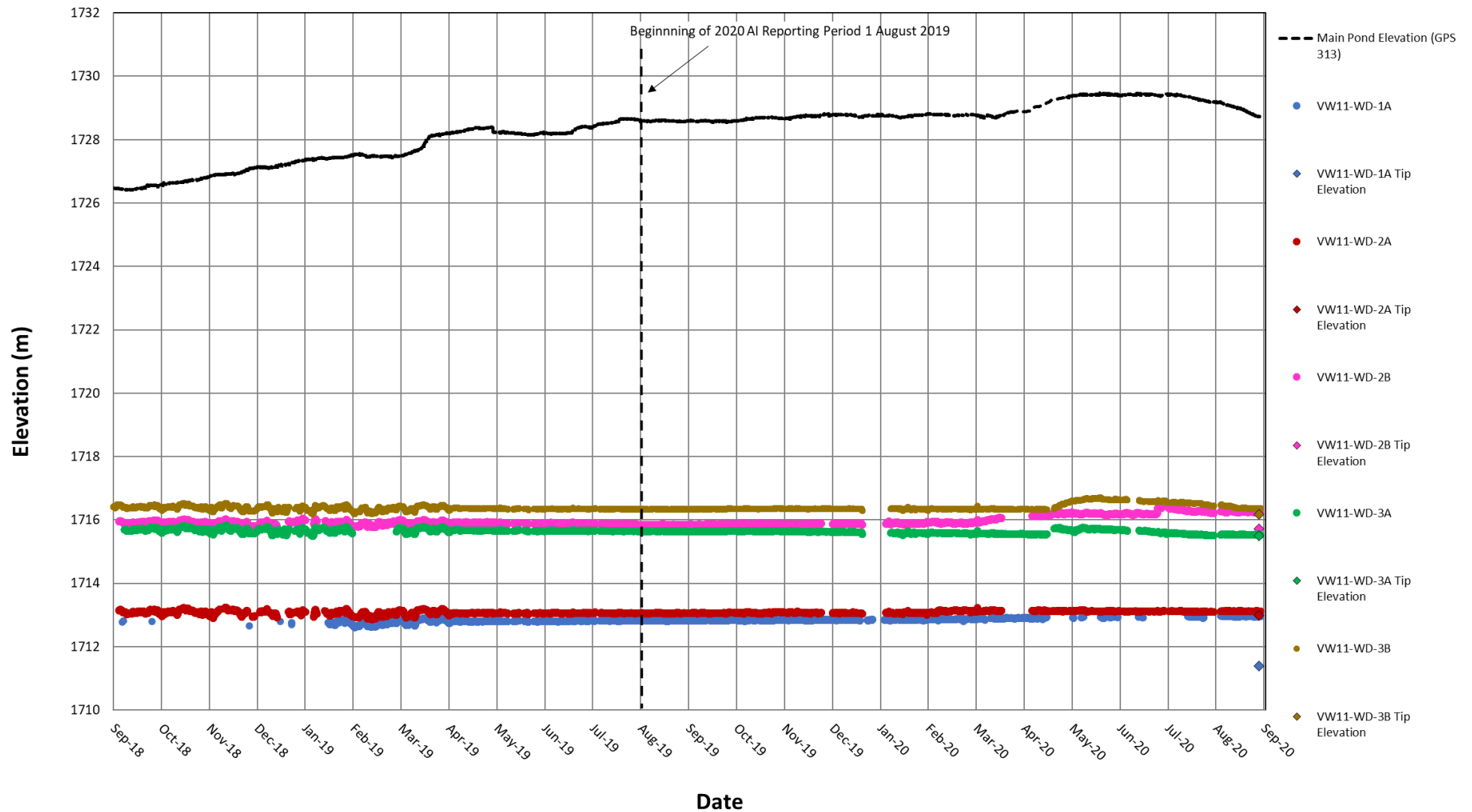
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**19133994**

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**3000/3003/2020-150**

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FIGURE  
**E-3**





Data gaps present due to:

- Data being considered erroneous
- Negative pressure readings recorded indicating piezometer tip is dry. Piezometric levels cannot be determined from negative pressures
- Malfunctioning data loggers or instruments
- Intermittent data signal from instrument

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TITLE  
**WEST TAILINGS DAM – WD SERIES PIEZOMETERS**

PROJECT No.  
**19133994**

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FIGURE  
**E-4**



**[golder.com](http://golder.com)**