

REPORT 2021 Annual Facility Performance Report

Greenhills Operations Tailings Storage Facility

Submitted to:

Teck Coal Limited

Greenhills Operations PO Box 5000 Elkford BC V0B 1H0

Attention: Mr. Patrick Green, P.Eng.

Submitted by:

Golder Associates Ltd.

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

Reference No. 21452085-2021-204-R-Rev1-3000

23 March 2022

Distribution List

Electronic Copy - Teck Coal Limited

Electronic Copy - Golder Associates Ltd.



Executive Summary

This report presents the 2021 annual facility performance report (AFPR) for the Tailings Storage Facility (TSF) at the Teck Coal Limited, Greenhills Operations (GHO) mine site. Available instrumentation data were reviewed for a period between 1 September 2020 and 31 August 2021 (the reporting period).

The site visit was carried out during the week of 16 August 2021. No deficiencies that require immediate action were identified.

Review of Key Hazards

Performance is assessed for each of the following potential failure modes/hazards by comparing the design basis against observed dam performance and available data during the monitoring period:

Instability

- Investigations have confirmed foundation materials. Analysis and design, based on investigated materials, indicate stability measures that meet or exceed design criteria, including design loads up to the maximum credible earthquake.
- 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 embankments, were observed during the 2021 site visit or monthly inspections that would indicate instability.

Overtopping

- The GHO TSF can store storm events up to and including the 72-hour probable maximum flood, when operated at a freeboard of 2 m, which exceeds the guidance of CDA (2013) and requirements of HSRC (EMLI 2021).
- Minimum freeboard requirements, from embankment crest to the main pond, were established based on Canadian Dam Association Guidelines (CDA 2013).
- The design requirements for freeboard were maintained throughout the reporting period.

Internal erosion

- The hydraulic head at the upstream face and hence the till blanket of the Main Tailings Dam and West Tailings Dam is typically equal to the pond elevation. The hydraulic head downstream from the till blanket is near the foundation. As such the hydraulic gradient is sufficient that the potential for internal erosion to occur must be considered.
- Results of material testing and analysis indicate that filter criteria are met between the clay blanket (till) and the CCR (with occasional exception) and between the tailings and clay blanket (till). Constructed conditions are considered to meet design intent.
- No rapid changes in seepage rates, presence of fines in seepage, rapid changes in piezometric readings within embankment fill or foundations or depressions/sinkholes were observed during the 2021 site visit or monthly inspections.

Consequence of Failure

The GHO TSF meets current industry standards and has been reviewed against the extreme loading scenarios. Adopting this approach meets or exceeds any regulatory requirements, aligns with Teck's goal to eliminate any risk for loss of life, and is consistent with the new GISTM which supports evolving beyond the previously used consequence classification system. This approach is consistent with industry-leading best practices and has an added benefit of providing accurate narratives to communities about the safety of tailings facilities that could impact them and who share Teck's approach of one life is one too many to be at risk.

Summary of Significant Changes

There were no significant changes in the operation and performance of the TSF during the reporting period.

Significant Changes in Instrumentation or Visual Monitoring Records

No significant changes were noted during the 2021 site inspection or monthly visual inspections.

Significant Changes to Stability and/or Surface Water Control

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

The volume of free water between April and July 2021 was larger than the target volume. The GHO TSF Water Reduction Plan was implemented in May 2021 which returned the pond volume to within the target range in July 2021.

The facility had sufficient capacity to store the 72-hr PMF throughout the 2020/2021 reporting period.

Operation, Maintenance, and Surveillance Manual and Emergency Preparedness Plan

The OMS manual was reviewed on 21 April 2021 (GHO 2021a).

An EPRP tabletop exercise was performed on 16 December 2020 and action items were identified for incorporation into updates of the emergency preparedness and response plan (EPRP) and Trigger Action Response Plan (TARP). The EPRP and TARP for the TSF were reviewed on 24 June 2021 (GHO 2021b).

Recommendations

There are no Priority 1 and 2 deficiencies or recommendations. Priority 3 and 4 deficiencies and recommendations from the 2020 annual inspection report (Golder 2021b) are presented in Table 14 in Section 6.5.



Abbreviations

Abbreviation	Definition	
AFPR	Annual Facility Performance Report	
CCR	Coarse Coal Refuse (also known as Coarse Refuse/Rejects; CR)	
CDA	Canadian Dam Association	
CRD	Cumulative Relative Displacement	
DSR	Dam Safety Review	
EoR	Engineer of Record	
EMLI	British Columbia Ministry of Energy, Mines and Low Carbon Innovation	
EPP	Emergency Preparedness Plan	
FRO	Fording River Operations	
GHO	Greenhills Operations	
Golder	Golder Associates Ltd. (also known as WSP-Golder)	
GPS	Global Positioning System	
HSRC	Health, Safety and Reclamation Code for Mines in BC	
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)	
MTD	Main Tailings Dam	
OMS	Operation, Maintenance, And Surveillance	
PMF	Probable Maximum Flood	
QPO	Quantifiable Performance Objective	
RTK	Real-time Kinematic	
RTFE	Responsible Tailings Facility Engineer	
TARP	Trigger Action Response Plan	
TSF	Tailings Storage Facility	
Teck	Teck Coal Limited	
TWRS	Tailings and Water Retaining Structures	
VWP	Vibrating Wire Piezometer	
WTD	West Tailings Dam	

Table of Contents

EXE		E SUMMARY	ii
ABE	BREVIA	TIONS	iv
1.0	INTRO	DDUCTION	1
	1.1	Purpose, Scope of Work, and Method	1
2.0	BACK	GROUND	2
	2.1	Greenhills Tailings Storage Facility	2
	2.2	Overview of Operations	2
	2.3	Subsurface Conditions	2
	2.3.1	Main Tailings Dam	3
	2.3.2	West Tailings Dam	3
	2.4	Overview of Design and Construction	4
	2.4.1	Main Tailings Dam	5
	2.4.2	West Tailings Dam	7
	2.5	Site Seismicity	8
	2.6	Key Operational Components	9
	2.7	Key Personnel	10
	2.8	Consequence of Failure	10
	2.9	Quantifiable Performance Objectives	10
	2.9.1	Instability Monitoring	11
	2.9.1.1	Surface Displacement Monitoring	11
	2.9.1.2	Inclinometers	11
	2.9.1.3	Vibrating Wire Piezometers	12
	2.9.2	Tailings Pond Level	13
	2.9.3	Seepage	14
3.0	OPER	ATIONS, MAINTENANCE, AND CONSTRUCTION DURING 2020/2021	15
	3.1	Tailings Storage Facility and Operations	15



	3.2	Maintenance	15
	3.3	Construction	15
4.0	REVIE	EW OF CLIMATE DATA AND WATER BALANCE	16
	4.1	Climatic Review	16
	4.2	Water Balance and Reclaim Water	17
	4.3	Water Discharge	18
5.0	GREE	NHILLS OPERATION TAILINGS STORAGE FACILITY SAFETY ASSESSMENT	19
	5.1	Site Visit	19
	5.2	Review of Background Information	19
	5.3	Documentation Review	20
	5.4	Assessment of Facility Safety Relative to Potential Failure Modes	20
	5.4.1	Instability	20
	5.4.1.1	Design Basis	20
	5.4.1.2	Observed Performance	21
	5.4.1.3	Survey Prisms	21
	5.4.1.4	Inclinometer Surveys	22
	5.4.1.5	Vibrating Wire Piezometers	22
	5.4.2	Overtopping	24
	5.4.2.1	Design Basis	24
	5.4.2.2	Observed Performance	24
	5.4.3	Internal Erosion	25
	5.4.3.1	Design Basis	25
	5.4.3.2	Observed Performance	27
6.0	SUMN	IARY AND RECOMMENDATIONS	29
	6.1	Summary of Activities	29
	6.2	Summary of Climate and Water Balance	29
	6.3	Summary of Performance and Changes	29
	6.4	Consequence of Failure	30
	6.5	Current Deficiencies and Non-conformances	30

7.0	CLOSING	32
REFE	ERENCES	33
STU	DY LIMITATIONS	38

TABLES

Table 1: Main Tailings Dam Construction Summary	5
Table 2: Summary of Main Tailings Dam Instrumentation	6
Table 3: West Tailings Dam Construction Summary	7
Table 4: Summary of West Tailings Dam Instrumentation	8
Table 5: Seismic Hazard Values	9
Table 6: Survey Prism Quantifiable Performance Objectives	.11
Table 7: Vibrating Wire Piezometer Quantifiable Performance Objectives	.12
Table 8: Freeboard Quantifiable Performance Objectives	.13
Table 9: Seepage Weir Quantifiable Performance Objectives	.14
Table 10: Greenhills TSF Water Balance for 1 August 2020 to 31 July 2021	.17
Table 11: HSRC Guidance for Minimum Factors of Safety	.20
Table 12: Maximum and Minimum Vibrating Wire Piezometer Readings	.23
Table 13: Operational Freeboard Details	.24
Table 14: 2021 Recommended Actions for Greenhills Tailings Storage Facility	.31

ILLUSTRATIONS

Illustration 1: Storage Capacity Curve for Elevations Above Surface Surveyed in 2021 Bathymetry Survey	5
Illustration 2: Comparison Between 2020/2021 Total Precipitation and Historical Average for Greenhills Operations	16
Illustration 3: Tailings Pond Elevation Relative to Freeboard Levels	24
Illustration 4: Grain Size Distribution and Specification Envelopes for Till	26
Illustration 5: Grain Size Distribution and Specification Envelopes for Coarse Coal Refuse	26
Illustration 6: Main Tailings Dam (Site C) Weir Discharge	27
Illustration 7: West Tailings Dam Weir Discharge	28

FIGURES

Figure 1: Greenhills Operations Site Plan	40
Figure 2: 2021 Site Visit Photograph Locations	41

Figure 3: Tailings Storage Facility Instrumentation Locations	42
Figure 4: Main Tailings Dam – Cross-Sections A and B	43
Figure 5: West Tailings Dam – Cross-Sections C and D	.44

APPENDICES

APPENDIX A 2021 Site Inspection Photos

APPENDIX B August 2021 Golder Site Inspection Reports

APPENDIX C Survey Prism Data

APPENDIX D Vibrating Wire Piezometer Data



1.0 INTRODUCTION

1.1 Purpose, Scope of Work, and Method

At the request of Teck Coal Limited (Teck), Greenhills Operations (GHO), Golder Associates Ltd. (Golder) has completed the 2021 annual facility performance report (AFPR) for the GHO tailings storage facility (TSF), which includes the Main Tailings Dam (MTD) and West Tailings Dam (WTD).

This report is based on a site visit carried out by the Engineer of Record (EoR) during the week of 16 August 2021, 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 September 2020 through 31 August 2021 (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 TSF inspection.
- Review of:
 - available instrumentation data
 - consequence classification
 - required operational documents
 - climate data
 - water balance
 - TSF safety relative to relevant credible failure modes
- Findings and recommended actions.

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

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

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 Greenhills Tailings Storage Facility

Tailings and process water in the GHO TSF are impounded on the southeast side by the MTD and on the west side by the WTD as shown in Figure 2. Both the Main and West Tailings Dams are designed and permitted to be raised to a crest elevation of 1,735 m. Construction of embankment raises to an elevation of 1,734 m was completed on 1 October 2021; construction record reporting was in progress at the time of this document.

The 2021 bathymetric survey indicates that the deepest point of the impoundment area is approximately 65 m south of the barge at an elevation of approximately 1,723 m, which corresponded to a pond depth of about 6.3 m at the time of the survey.

2.2 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 coal refuse (CCR) and fine refuse tailings. The CCR is unsaturated and comprises 50 mm minus gravel to sand-sized rock and coal particles. CCR 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 D₅₀ (diameter of the particle that 50% of a material by mass is smaller than) of around 0.2 mm. Tailings are transported by gravity to the TSF discharge point located on the north side of the TSF (Figure 2). Tailings in the 2020/2021 monitoring period were discharged at an approximate solids content of between <2% and 39% by mass (Teck 2021a) but typically around 20% solids content, resulting in an approximate dry density of 1.13 t/m³ (GHO 2019).

Approximately 500,000 to 600,000 m³ of tailings solids are deposited annually. 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-mounted pumps to the wash plant for reuse.

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.



2.3.1 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 MTD foundation. Embankment foundation materials generally comprise a surficial layer of colluvium overlying glacial till, which overlies shale bedrock. At the west end of the embankment footprint, muskeg was found overlying the colluvium. The muskeg was observed to be soft, highly compressible, and up to 3 m thick. The colluvium layer beneath the starter embankment 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. Construction records are not available to confirm that soft materials were removed. However, a geotechnical drilling program (Golder 2017d) was conducted in 2016 to assess foundation conditions at the MTD 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 (muskeg or soft colluvium) were removed during construction. The design by Hardy (1980) also 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.

Investigations in 2016 (Golder 2017d) found hard glacial till underling 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. 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.

A geotechnical investigation comprising three boreholes was completed at the Site C CCR stockpile, located immediately downstream of the MTD (Section 2.4) from May to June 2021 (Golder 2021d). The objective was to assess the potential for deformation of the CCR stockpile under static and seismic loading. Standard penetration tests (SPT) were completed through the CCR and within the glacial till. Results indicated the CCR was loose to very dense with SPT N₆₀ values ranging between 6 and 64 (with higher values at increasing depths), and the glacial till was dense to very dense with SPT N₆₀ values with SPT N₆₀ values varying between 37 and 115. The study concluded that calculated deformations of the CCR stockpile of less than 450 mm would not impact the MTD.

A preliminary geohazard assessment was completed in March 2021 (Golder 2021f). Some historic landslides in the area were identified but none were within the embankment footprint and hence were judged to not present a hazard to the integrity of the TSF.

2.3.2 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 the current WTD 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 WTD 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 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 WTD is located in a topographic low area, and peat and buried wood debris was excavated as part of initial embankment 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 embankment construction data indicate that surfaces receiving embankment fill were stripped of deleterious materials and that the upstream clay blanket was keyed into natural ground. Reports also indicate embankment 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 embankment during embankment raise construction in 2014 to expose dense till.

2.4 Overview of Design and Construction

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

A design for the WTD was completed by Golder (Golder 1993) and construction of the embankment 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. The facility is currently permitted to a maximum crest elevation of 1,735 m. During the 2020/2021 reporting period, the minimum crest elevation was approximately 1,732.5 m. Construction of a embankment raise to elevation 1,734 m was completed 1 October 2021.

Based on the 2021 bathymetric survey and topographical data obtained from Skycatch real-time kinematic (RTK) positioning drone mapping completed on 24 August 2021, it is estimated that a total struck level storage volume, without allowance for freeboard or beach angles, of approximately 3.4 million m³ is available to elevation 1,735 m (as shown in Illustration 1).





Illustration 1: Storage Capacity Curve for Elevations Above Surface Surveyed in 2021 Bathymetry Survey

2.4.1 Main Tailings Dam

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

Table 1: Main 7	failings Dam	Construction	Summary
-----------------	--------------	--------------	---------

Year	Construction	Dam Crest Elevation (m)	References
1982–1983	Starter embankment, piezometers installed	1,687.00	Hardy 1980, 1984
1984–1985	Raise	1,695.00	No documentation
1986	Raise, piezometers damage, 10 pneumatic piezometers installed	1,699.00	Hardy 1987
1987	Coarse refuse shell raised, French drains installed beneath shell	1,700.00 Hardy 1988	
1988	Rock drains (French drain) below CCR	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



Year	Construction	Dam Crest Elevation (m)	References
1994	Coarse refuse shell raised	1,710.00	Golder 1995
1995	Raise, three 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 CCR 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	Five VWP locations (two 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 2019
2020	Raise	1,732.50	Golder 2020d
2021	Three VWPs and three slope inclinometer casings installed at three locations within Site C and Site D (one piezometer and inclinometer casing at each location)	No change	Golder 2021d
2021	Raise	1,734.00	Reporting in progress

Table 1: Main Tailings Dam Construction Summary

CCR = coarse coal refuse; VWP = vibrating wire piezometer.

Geotechnical instrumentation installed to monitor the MTD that was operational during the 2020/2021 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
VWPs	21	Each VWP location (Figure 3) has two VWPs except for SD-16-04, which has one. Three additional VWPs were installed at BH21-05, BH21-06, and BH21-07 at Site C and D in May 2021. Data from these VWPs were not available during the reporting period.
GPS units ^(a)	7	Two GPS units (319 and 320) are located on the downstream slope of Site C. Five units are positioned along the crest of the MTD (MD_ROVER series). MD-1 was decommissioned in January 2021.
Survey prisms	8	Prisms A to H are located on the centreline of MTD crest.



6

Instrumentation Type	Number	Comments
V-notch weir	1	One V-notch weir is located at the toe of Site C. The weir was upgraded to an automated system with a pressure transducer in April 2021.
Inclinometer casing	5	Two boreholes were established during 2016 and an inclinometer casing is installed at two locations downstream of the MTD on Sites C and D. The bottom of each casing is anchored in bedrock. Additional inclinometer casings were installed at BH21-05, BH21-06,
		and BH21-07 on Sites C and D in May 2021. The casings at BH21-05 and BH21-07 were anchored in glacial till, while BH21-06 casing is anchored in bedrock. Baselining for these inclinometers were in progress at the time of reporting and data are not presented.

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

VWP = vibrating wire piezometer; MTD = Main Tailings Dam.

2.4.2 West Tailings Dam

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

The WTD 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 40 m crest width to provide access for haul trucks to the adjacent CCR storage facilities. This criterion was revised as part of the 2020 embankment raise construction (Golder 2020d) to reduce the minimum crest 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 2014. The design included an enlarged WTD footprint to support a future raise of the embankment to a crest elevation of 1,735 m (Golder 2014b,c). The construction history of the WTD is summarized in Table 3.

Year	Construction	Elevation (m)	References
1993	Raise as till key trench and cut-off blanket on mine road	1,711.00	Golder 1993
1996	Raise as till key trench and cut-off blanket on mine road	1,714.30	Golder 1997
1998	Foundation preparation of till and bedrock for embankment 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	Five VWPs (two sensors in each of three 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

Table 3: West Tailings Dam Construction Summary



Year	Construction	Elevation (m)	References
2016	Extension of the downstream portion of the WTD	No change	Golder 2017b
2017	Raise	1,728.73	Golder 2017e
2018	Raise; additional instrumentation installed	1,731.14	Golder 2019
2020	Raise	1,732.50	Golder 2020d
2021	Raise	1,734.00	Reporting in progress

Table 3: West Tailings Dam Construction Summary

VWP = vibrating wire piezometer; WTD = West Tailings Dam.

Geotechnical instrumentation, installed to monitor the WTD and operational during the 2020/2021 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		
VWPs	6	Each location has two VWPs (Figure 3).		
GPS units	3	Three GPS monitoring units are located on the crest of the WTD (WD_ROVER series). WD-1 was decommissioned in April 2021.		
Survey prisms	5	Prisms I to M are located on the centreline of the WTD crest.		
V-notch weir	1	One V-notch weir is located at the toe of WTD. The weir was upgraded to an automated system with a pressure transducer in May 2021.		

VWP = vibrating wire piezometer; WTD = West Tailings Dam.

2.5 Site Seismicity

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 5th Generation Seismic Hazard Model, including nine faults and fault segments mapped in northwest Montana. The 5th Generation Seismic Hazard Model was developed by Natural Resources Canada for use in the 2015 National Building Code of Canada (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 embankment foundations. The results of seismic probabilistic analysis from the site hazard model are presented in Table 5.

Table 5: 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
0.5% 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, 2019) is shown.

The stability of the embankments has been checked against and is stable under loading for the maximum credible earthquake (assumed to be represented by a return period of 10,000 years) of 0.3g.

2.6 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
- embankment raise construction

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 regularly and collaboratively identify deficiencies and determine action plans.

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.

The GHO team monitors the pond water elevation using a GPS unit located on the process water reclaim barge 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.



2.7 Key Personnel

Key personnel associated with the GHO TSF during the 2020/2021 operating period were:

- the Responsible Tailings Facility Engineer (RTFE):
 - Andrew Knight, P.Eng., an employee of Teck (September to October 2020, and March to June 2021)
 - Jason Garwood, P.Eng., an employee of Teck (September 2020 to March 2021)
 - Patrick Green, P.Eng., an employee of Teck (from June 2021)
- the GHO Tailings Engineers:
 - David Walker, P.Eng., an employee of Teck
 - Ashley Quashigah, P.Eng., an employee of Teck (from May to September 2021)
- the EoR:
 - Andy Haynes, P.Eng., an employee of Golder

2.8 Consequence of Failure

Teck has advised that they are aligned with the most conservative interpretation of the GISTM which, in turn, is consistent with their safety culture. Commensurately, Teck has advised that the previously used consequence classification is not a part of their tailings management governance and has asked that it not be reported in this AFPR. Instead, they will adopt the extreme consequence case design loading for any facility with a credible flow failure mode. For facilities without a credible failure mode in terms of a life safety issue, Teck will reduce credible risks to As Low As Reasonably Practicable (ALARP). This applies for both earthquake and flood scenarios for all tailings facilities, consistent with the GISTM.

The GHO TSF meets current industry standards and has been reviewed against the extreme loading scenarios. Adopting this approach meets or exceeds any regulatory requirements, aligns with Teck's goal to eliminate any risk for loss of life, and is consistent with the new GISTM which supports evolving beyond the conventional consequence classification system. This approach is consistent with industry best practices and has an added benefit of providing accurate narratives to communities about the safety of tailings facilities that could impact them and who share Teck's approach of one life is one too many to be at risk.

2.9 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 VWPs to monitor piezometric levels within the embankments and groundwater elevations in the foundations.

Quantifiable performance objectives (QPOs) have been developed. 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, where required, updated in 2021 based on recommendations from the EoR (Golder 2021a) and to align with Teck's emergency response protocol categories (Recommendation 2020-06). These revised QPOs were used as the basis for assessing performance in the 2020/2021 reporting period and are included in the operation, maintenance, and surveillance (OMS) manual from April 2021.

QPOs for the VWPs are set based on deviations from historic measurements that may be indicative of changing conditions within the embankment or specified phreatic surface elevations assessed during stability analyses. QPOs for the survey prisms are set based on cumulative relative displacement (CRD), that is, 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 based on historical data and predictions from seepage analyses. Freeboard QPOs are set based on operational considerations for the storage of the 72-hour probable maximum flood (PMF).

The QPOs are provided in Sections 2.9.1 to 2.9.3. A comparison between observed conditions during the reporting period and the QPOs are presented in the following sections:

- Section 5.4.1: instability—prisms and VWPs
- Section 5.4.2: overtopping—freeboard
- Section 5.4.3: internal erosion—V-notch weirs

2.9.1 Instability Monitoring

2.9.1.1 Surface Displacement Monitoring

Surface displacement monitoring of the embankment s, relative to QPOs at the GHO TSF consist of survey prisms (locations presented in Figure 3). Data in this AFPR 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 Embankment crests and are relocated/reset following each embankment raise. Prism QPOs were established in 2017 (Golder 2017a) and last updated in 2021 (Golder 2021a). QPOs for the survey prisms are summarized in Table 6.

Table 6: Survey Prism Quantifiable Performance Objectives

Instrument / Measurement	Cumulative Relative Displacement (m per year)		
	Grey Investigate	Blue Caution	
Main Tailings Dam survey prisms	0.15	0.25	
West Tailings Dam survey prisms	0.10	0.13	

GPS units are also used and were installed at the Site C CCR spoil in October 2012 and additional GPS units were installed on the Main and West Tailings Dams during August 2017. Data from the GPS units are recorded hourly and remotely uploaded to GeoExplorer software. QPOs for the GPS units have not been used since 2020 due to high variability in short-term measurements but continue to be monitored for the purpose of establishing and comparing long-term trends in data for use in determining potential indicators of instability. Two GPS units, MD-1 and WD-1, were decommissioned during the 2020/2021 monitoring period.

2.9.1.2 Inclinometers

Inclinometer casings (SD-16-04 and SD-16-05) were installed in the MTD during the 2016 geotechnical investigation (Golder 2017d).



Golder completed a review of inclinometer data, which were collected monthly from SD-16-04 and SD-16-05 up to February 2020, with the aim of establishing a baseline dataset. 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 2020a). Additional surveys were also recommended, as follows:

- Following Yellow Notification exceedance by survey prisms or VWPs.
- Before and after embankment construction.
- If visual observations indicated signs of slope movement or deformation.

Inclinometer survey data is used as part of an overall assessment of potential conditions at the MTD.

2.9.1.3 Vibrating Wire Piezometers

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 MTD 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 VWPs in 2021 (Golder 2021a). The Blue Caution levels are set based on deviations from historical averages. The Yellow Notifications 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 7.

	Vibroting Wiro	Blue C	Caution	Yellow Notification
Embankment	Piezometer	Minimum Phreatic Surface Elevation	Maximum Phreatic Surface Elevation	Maximum Phreatic Surface Elevation
Main Tailings Dam	VW11-MD-2A	1,691.40	1,695.40	
	VW11-MD-3A	1,686.28	1,690.28	
	VW11-MD-3B	1,687.61	1,691.61	1 724 0
	VW11-MD-4A	1,686.02	1,690.02	1,724.0
	VW11-MD-5A	1,682.23	1,686.23	
	VW11-MD-5B	1,682.71	1,686.71	
	SD-16-01A	1,683.58	1,687.58	1,713.5
	SD-16-02A	1,683.54	1,687.47	1,708.0
	SD-16-03A	1,689.82	1,693.82	1,713.5
	SD-16-04	1,674.37	1,678.37	1,710.0
	SD-16-05A	1,680.99	1,684.99	1,710.5
	SD-16-06A	n/a ^(a)	1,685.55	1,710.0
	SD-16-07A	1,649.56	1,653.56	1,686.5
	SD-16-08A	1,666.12	1,670.12	1,686.5

Table 7: Vibrating Wire Piezometer Quantifiable Performance Objectives



	Vibrating Wiro	Blue C	Yellow Notification	
Embankment	Piezometer	Minimum Phreatic Surface Elevation	Maximum Phreatic Surface Elevation	Maximum Phreatic Surface Elevation
West Tailings Dam	VW11-WD-1A	1,711.39	1,714.86	
	VW11-WD-1B	n/a ^(a)	1,714.39	
	VW11-WD-2A	n/a ^(a)	1,713.59	n/o ^(d)
	VW11-WD-2B	n/a ^(a)	1,716.52	11/a ^{(-/}
	VW11-WD-3A	n/a ^(a)	1,716.11	
	VW11-WD-3B	n/a ^(a)	1,716.91	

Table 7: Vibrating Wire Plezometer Quantifiable Performance Objectiv
--

Note: Piezometric pressures in deeper piezometers considered to be isolated to groundwater flow within bedrock, i.e., are not indicative of the phreatic surface in the embankment.

(a) No lower QPO set - average phreatic surface was recorded as 'dry' in 2020/2021 reporting period

(b) No data or anomalous data triggers the Grey Investigate level

(c) No orange warning or red alarm level is defined; the EoR and GHO's TSF RTFE will be notified when the Blue Caution level is triggered.

The situation would be then evaluated prior to any evacuation or subsequent actions.

(d) No QPO set as no credible phreatic surface results in minimum FOS criterion for stability.

2.9.2 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 8.

Table 8: Freeboard Quantifiable Performance Objectives

Instrument / Measurement	Grey Investigate	Blue Caution	Yellow Notification	Orange Warning	Red Alarm
GPS 313 and Visual Gauge / Freeboard (m)	Freeboard>2.0	2.0 <freeboard<1.3< td=""><td>1.3<freeboard<1.0< td=""><td>1.0<freeboard<0.5< td=""><td>Freeboard<0.5</td></freeboard<0.5<></td></freeboard<1.0<></td></freeboard<1.3<>	1.3 <freeboard<1.0< td=""><td>1.0<freeboard<0.5< td=""><td>Freeboard<0.5</td></freeboard<0.5<></td></freeboard<1.0<>	1.0 <freeboard<0.5< td=""><td>Freeboard<0.5</td></freeboard<0.5<>	Freeboard<0.5

Freeboard QPOs were developed, where required, to be used progressively during a storm event, as follows:

- **Grey Investigate:** Freeboard is at or below normal operating level.
 - TSF can contain the 72-hour PMF storm event with allowance for wave run-up.
- Blue Caution: Freeboard is lower than normal operating level (Grey Investigate QPO exceeded).
- Sellow Notification: During a 72-hour PMF event, approximately 2 days of freeboard is available.
- Orange Warning: During a 72-hour PMF event, approximately 1 day of freeboard is available.
- **Red Alarm:** During a 72-hour PMF event, approximately 0.5 day of freeboard is available.

A visual indicator was installed in 2017 on the crest of the MTD to complement electronic monitoring and provide a basis for visual confirmation of facility freeboard. This indicator is viewable from the crest of the MTD and a camera located on the process plant.



2.9.3 Seepage

V-notch weirs are located downstream of the MTD at the toe of Site C (Site C Weir) and downstream of the WTD (West Dam Weir). Weir locations are shown in Figure 3. Manual measurements were taken monthly, when accessible, until 20 April 2021 and data uploaded to GeoExplorer for notification and tracking. The weirs were upgraded in May 2021 to an automated system, which records measurements using a pressure transducer. Data have been automatically uploaded to GeoExplorer since May 2021.

Seepage from the MTD 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 2019). 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 embankment toe.

QPOs for the weirs were updated in 2021 based on historical data (Golder 2021a) and are summarized in Table 9.

Instrument / Messurement	Grey Investigate		Plue Coution	
instrument / measurement	Minimum	Maximum	Blue Caution	
Site C Weir/flow (L/s)	0.2	5.0	10.0	
West Dam Weir/flow (L/s)	0.0	2.0	4.0	

Table 9: Seepage Weir Quantifiable Performance Objectives



3.0 OPERATIONS, MAINTENANCE, AND CONSTRUCTION DURING 2020/2021

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 on a regular basis.

3.1 Tailings Storage Facility and Operations

GHO tracks in-place tailings volume through bathymetric surveys. These bathymetric surveys, in conjunction with topographic survey data, are used to estimate the volume of tailings deposited in the TSF. The volume of placed material was completed based on the 2021 bathymetry data, in conjunction with available Skycatch RTK positioning drone mapping survey data (24 August 2021), and 2020 bathymetric survey (21 July 2020), in conjunction with 2020 LiDAR data (15 to 26 July 2020). Data indicates that approximately 700,000 m³ of tailings were deposited in the 13-month period between 21 July 2020 and 24 August 2021.

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 embankment s.

Erosion rills, gullies, and minor localized depressions, noted on the MTD and WTD during monthly inspections during the operational period were repaired during the 2021 embankment raise construction.

A downhole camera survey of inclinometer SD-16-04 was completed on 8 June 2021 to assess potential deformation observed in the inclinometer survey data. The survey did not identify a clear cause for the observed deformations. Further discussion is provided in Section 5.4.1.

3.3 Construction

Prior to the 2020/2021 reporting period, the GHO TSF embankments were raised in 2020 to an elevation of approximately 1,732.5 m as reported in the 2020 annual inspection report (Golder 2021b) and the construction record (Golder 2021c). Construction of a embankment raise to an elevation of 1,734 m was completed outside of the reporting period between August and October 2021.

A depression with surface water ponding was identified on the Site E haul road near the east abutment of MTD in 2020 (Recommendation 2019-04). The depression was filled with CCR during the 2020 embankment raise construction to prevent long-term ponding of surface water on the downstream crest of Site C. Additional remediation was completed as part of the 2021 embankment raise construction and closes Recommendation 2019-04.

Additional instrumentation was installed on the Site C CCR facility during the 2021 geotechnical investigation (Golder 2021e). Instrumentation comprised of a VWP and an inclinometer at three new locations, BH21-05, BH21-06, and BH21-07 (Figure 3).

In addition, the Site C and WTD weirs were upgraded with pressure transducers in April and May 2021 for automated and continuous monitoring of seepage flows. (Recommendation 2019-02).

An investigation into the in-situ characteristics of deposited tailings comprising three drilled boreholes was completed on the northern extent of the tailings beach in March 2021 (Okane 2021). Results indicated 12.2 to 20.4 m of tailings overlying glacial till.



4.0 REVIEW OF CLIMATE DATA AND WATER BALANCE

4.1 Climatic Review

Precipitation data collected at the GHO Office climate station were provided by GHO for the 2020/2021 hydrologic reporting period (i.e., August 2020 to July 2021) with the exception of August 2020. Data for August 2020 was infilled from the Fording River Cominco synthetic data that were adjusted to the GHO Office station elevation.

Data was compared to the long-term synthetic precipitation dataset for the period 1970 to July 2020, and a summary of the recorded monthly total precipitation for the hydrologic reporting period (1 August 2020 to 31 July 2021) and the historical monthly averages at the GHO Office station location are presented in Illustration 2.



Illustration 2: Comparison Between 2020/2021 Total Precipitation and Historical Average for Greenhills Operations

Precipitation records from the Fording River Cominco climate station adjusted to GHO Office station elevation are presented for comparison purposes. The data indicate the following:

- Total precipitation in the reporting period (1 August 2020 to 31 July 2021) was approximately 15% lower than the GHO Office synthetic historical average for the same period (1 August to 31 July).
- Seasonal variations in total monthly precipitation in the reporting period were observed in comparison with the historical monthly averages.

- Average monthly precipitation in fall (August 2020 to September 2020) was 48% lower when compared to the historical monthly average.
- Average monthly precipitation in winter (October 2020 to February 2021) was 17% higher when compared to the historical monthly average.
- Average monthly precipitation from late winter to summer (March 2020 to July 2021) was 34% lower when compared to the historical monthly average.

Results indicate lower rainfall and higher snowfall during the monitoring period. These findings are consistent with observed performance during the site inspection, i.e., no observed increase in erosion features on the upstream, crest, or downstream slopes of the embankment s.

4.2 Water Balance and Reclaim Water

A water balance for the GHO TSF for the reporting period of 1 August 2020 to 31 July 2021 was completed using a spreadsheet-based water balance model, based on climate data described in Section 4.1 and measured flow data provided by GHO. The TSF inflows and outflows related to climate conditions during the reporting period were obtained from the GHO site wide Goldsim water balance model.

Estimates of water discharges associated with the water reduction plan were based on recorded pond volume change over the water reduction period (17 May to July 2021) and accounting for TSF inflow-outflow balance over the water reduction period.

Table 10 provides a summary of the TSF water balance for the reporting period and results indicates an overall reduction in TSF water volume, which is consistent with other site recorded data and observations.

INFLOW	Volume (m³)	OUTFLOW	Volume (m³)	Total Inventory Change (m ³)
Direct Precipitation ^(a)	189,370	Direct Evaporation ^(a)	226,530	
Surface Runoff ^(a)	441,300	Seepage ^(a)	144,540	
Water Discharge with Tailings ^(b)	3,723,110	Reclaim Water to Plant ^(b)	3,899,870	
Transfer from Phase 3 and Phase 6 Pits ^(b)	324,730	Water Retained in Tailings ^(c)	250,410	
		Water Reduction Plan Withdrawal ^(d)	285,060	
SUM	4,678,510		4,806,410	-127,900

Table 10: Greenhills TSF Water Balance for 1 August 2020 to 31 July 2021

a) Obtained from GHO site wide water balance model (Goldsim).

b) Measured flow data from GHO.

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

d) Estimated based on recorded pond volume before and after the 2021 water reduction plan.

4.3 Water Discharge

Teck developed and implemented a TSF Water Reduction Plan (Teck 2020) in 2020 as a response framework should tailings pond levels rise above the 2 m operational freeboard limit as well as to reduce the overall volume of water stored within the TSF.

As part of this plan, water is removed from the TSF using the process plant reclaim water barge and transferred 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.

The plan was activated on 17 May 2021 when the pond volume was approximately 480,000 m³ (Teck 2021b) and stopped in July 2021 at a pond volume of roughly 375,000 m³ (Teck 2021c). A total of approximately 105,000 m³ of water was discharged during this period. The pond volume was measured to be approximately 320,000 m³ at the time of 24 August 2021 bathymetric survey.



5.0 GREENHILLS OPERATION TAILINGS STORAGE FACILITY SAFETY ASSESSMENT

This section presents an assessment of the safety of the embankment s 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 16 August 2021 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, P.Eng., of GHO. A close-out meeting was also held and attended by the TSF RTFE Mr. Patrick Green, P.Eng., of GHO.

The 1,734 m embankment raise construction was in progress at the time of the site visit and placement of embankment fill and preparation of previous embankment fill was observed. Appendix A presents a summary of photographs taken during the August 2021 inspection. Photograph locations and directions are presented in Figure 2. A summary of observations made during the August 2021 visit are included in Appendix B.

No deficiencies that required immediate action were identified.

5.2 Review of Background Information

GHO provided the following information for this annual facility inspection:

- survey data
 - Skycatch RTK positioning drone mapping survey and tailings pond bathymetric survey data (24 August 2021)
 - pre-2021 construction tailings embankment survey data (31 July 2021)
- site climate data recorded at the GHO Office station for the reporting period (Section 4.1)
- tailings deposition data July 2021 Streamline workbook (Teck 2021a)
- draft tailings beach investigation report (Okane 2021)
- instrumentation data for the reporting period
 - downloaded from GeoExplorer software
 - VWP data
 - survey prism data
 - seepage weir data (September to May 2021)
 - provided directly by GHO
 - automated weir data (June to August 2021)
- monthly TSF inspection records, including photographs, visual observations, and manual read instrument data



5.3 **Documentation Review**

In addition to the discussion below on operational documentation it is also noted that Teck completed an internal tailings governance review on 15 and 16 September 2020.

The GHO TSF OMS manual was reviewed on 21 April 2021 (GHO 2021a), (Recommendation 2019-07). The OMS manual was updated on the outcomes of this review.

The emergency preparedness and response plan (EPRP) and Trigger Action Response Plan (TARP) for the TSF were reviewed on 24 June 2021 (GHO 2021b). The EPRP was updated on the outcomes of this review.

A dam safety review (DSR) was completed by Klohn Crippen Berger Ltd. in 2017 (KCB 2017). The DSR concluded that the condition and integrity of the TSF met current safety standards. The HSRC (EMLI 2021) specifies that a DSR is to be completed once every five years; the next DSR is therefore required by the end of 2022.

5.4 Assessment of Facility Safety Relative to Potential Failure Modes

A component of the AFPR is a review of key hazards associated with similar structures in the mining 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 embankment performance and available data during the monitoring period for each of the following failure modes / hazards for the Greenhills TSF:

- Instability—a mechanism involving movement of a part of the embankment (either entirely within the embankment or including portions of the foundation materials) as a result of unbalanced forces, which may have potential to compromise the integrity of the embankment to the extent that contents of the impoundment are released.
- Overtopping—a mechanism where the pond level rises above the embankment crest level, resulting in flow over the embankment that may cause progressive erosion of the embankment and loss of the pond and tailings.
- Internal erosion—internal instability of a embankment can be caused by materials migrating out of the embankment via seepage and leaving voids within the embankment. 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 embankment forming a continuous pipe or void within the embankment.

5.4.1 Instability

5.4.1.1 Design Basis

The Main and West Tailings Dams were designed to provide minimum factors of safety which meet adopted design criteria, in consideration of the HSRC guidance document (MEM 2016) as shown in Table 11.

Table 11: HSRC (Guidance for	r Minimum	Factors	of Safety
------------------	--------------	-----------	---------	-----------

Operating Status	Minimum Factor of Safety
Normal operating conditions	1.5
Seismic conditions	1.0



Following the 2016 geotechnical investigation, Golder assessed the stability of the MTD for a crest elevation of 1,735 m (Golder 2017a). The results indicated the following:

- The development of excess pore pressures in the foundation materials is considered unlikely as geotechnical investigations since 2016 indicate soft materials such as Muskeg and clay colluvium were removed from the embankment footprints.
- Glacial till, present in the foundation, was dense to very dense with low liquidity index values.
- The stability of the MTD 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 WTD for a crest elevation of 1,735 m (Golder 2014a). The results indicated the following:

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

An assessment of stability based on loading from a maximum credible earthquake event (assumed to be represented by a return period of 1-in-10,000-year, with a PGA of 0.3g), has been completed and calculated factors of safety were above 1.0.

The density of CCR at the toe of Site C was assessed, based on investigations completed in May 2021 (Golder 2021e), to evaluate the potential for contractive behaviour in saturated portions of uncompacted CCR material. Results indicated that saturated portions of the CCR stockpiles are not susceptible to contractive behaviour.

5.4.1.2 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.

General observations at the time of the 2021 site visit, in relation to instability and not related to the construction work in progress at the time of the site visit, include minor erosion on the upstream slope of the MTD and WTD. These features do not present a risk to embankment safety, and routine maintenance occurred as part of embankment raise construction in 2021.

5.4.1.3 Survey Prisms

Survey prism data for the 2020/2021 reporting period are presented in Appendix C (Figures C-1 to C-26). Data analysis focuses on long-term data trends based on the average annual rate of CRD.

The survey prisms were removed from the Main and West Tailings Dams as part of preparation prior to the 2020 and 2021 embankment raise construction periods. Consequently, prism data were not available between 11 August and 20 October 2020 and from 8 July to 31 August 2021 (end of the monitoring period). Prisms were re-established in October 2020; however, a data processing error was identified by Teck in the first survey completed after re-establishment (28 October 2020). Baselines for the prisms were therefore not established until the next survey on 8 December 2020. Data in this report are therefore presented for the period between 8 December and 7 July 2021.

CRD was trending above the grey investigate level in prisms A, B, C, and D towards the end of the reporting period as a result of a recorded vertical heave (up to 150 mm) observed in all the prisms on the MTD in April 2021. The MTD was inspected during the 2021 site visit and during monthly inspections by Teck; no evidence of significant heave was observed. In addition, data from other instruments do not suggest a similar trend. Observed movements may be related to movements in the survey instrumentation base station or erroneous survey readings.

In addition to CRD, prism data were plotted using the inverse-velocity method (Rose and Hungr 2007; Venter et. al 2013) based on average 3D velocity over an approximately three-month period (Appendix C). No trends of decreasing inverse velocity, which would indicate an increase in displacement rates, were observed in the 2020/2021 reporting period.

Measured deformations were low (less than 150 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 embankment height were small (less than 0.3%) and within the expected range for earthfill embankments.

5.4.1.4 Inclinometer Surveys

Results of inclinometer surveys from instruments SD-16-04 and SD-16-05 in the 2020/2021 reporting period indicate:

- Displacements of up to approximately 70 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) have been indicated in instrument SD-16-04 since 11 August 2020. No increases in readings have been identified in the three surveys since this initial movement was recorded.
 - These data are not considered to be representative of movements within the embankment and are likely a result of displacement in the inclinometer casing itself. A downhole camera survey was completed in June 2021 and did not identify any obvious casing deflection or blockage of the channels.
 - The instrument will be re-baselined for the 2021/2022 monitoring period.
- Displacements were generally less than 4 mm in instrument SD-16-05.

Inclinometer survey data for the 2020/2021 reporting period are not indicative of instability of the MTD.

Baselines for instruments BH21-05, BH21-06, and BH21-07, installed in 2021 (Golder 2021e), were in the process of being established by GHO at the time of this report and are not discussed.

5.4.1.5 Vibrating Wire Piezometers

Maximum and minimum water elevations in the 2020/2021 reporting period for installed piezometers are presented in Table 12. Plots of pressure elevation against time are presented in Appendix D (Figures D-1 to D-4) for data between September 2019 and August 2021. Data from the piezometers installed at Site C in 2021 were not available at the time of this report but are not currently used for tracking against QPOs.

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 VWPs recording negative pressures. Water elevations calculated from negative pressure readings are not presented in the figures in Appendix D.

	Instrument	Range of Water Elevations in 2		
Embankment		Minimum (m)	Maximum (m)	Exceeds QPO
	VW11-MD-2A	1693.22	1693.54	None
	VW11-MD-3A	1688.10 1688.75		None
	VW11-MD-3B	1689.50	1690.14	None
	VW11-MD-4A	1687.63	1688.14	None
	VW11-MD-5A	1684.00 1684.75		None
	VW11-MD-5B	1684.55	1685.26	None
	SD-16-01A	1685.43	1686.01	None
	SD-16-01B ^(a)	1711.01	1711.98	None
	SD-16-02A	1685.33	1685.58	None
Main	SD-16-02B ^(a)	1693.65	1685.58	None
	SD-16-03A	1691.33	1692.49	None
	SD-16-03B ^(a)	1710.57	1712.94	None
	SD-16-04	1675.02	1676.76	None
	SD-16-05A	1682.89	1683.42	None
	SD-16-05B ^(a)	1697.13	1698.47	None
	SD-16-06A	Dry at piezometer tip ^(b)	1685.16	None
	SD-16-06B ^(a)	1704.17	1705.37	None
	SD-16-07A	1651.45	1651.92	None
	SD-16-07B ^(a)	1650.42	1650.92	None
	SD-16-08A	1667.93	1668.24	None
	SD-16-08B ^(a)	1688.29	1688.29	None
West	VW11-WD-1A	1712.89	1713.14	None
	VW11-WD-1B	Dry at piezometer tip ^(b)		None
	VW11-WD-2A	1713.09	1713.60	None
	VW11-WD-2B	1715.99	1716.29	None
	VW11-WD-3A	1715.52	1716.09	None
	VW11-WD-3B	1716.28	1716.87	None

Table 12: Maximum and Minimum Vibrating Wire Piezometer Readings

Note: Piezometers no longer in operation are removed in this report.

a) The readings of the 2016 piezometers 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.

b) Negative pressure readings indicate that the tip is dry and piezometric levels cannot be determined from recorded negative pressures. Negative pressure readings not shown.

QPO = quantifiable performance objective.



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 MTD was generally between 2 and 12 m above the glacial till foundation. The phreatic surface within the WTD was generally within the glacial till foundation. Some VWPs showed an increase in phreatic surface consistent with the increase in pond level. Water levels in select sections of the MTD and WTD are shown in Figures 4 and 5 respectively.

5.4.2 Overtopping

5.4.2.1 Design Basis

The TSF does not have an operational or emergency overflow structure (i.e., spillway) and is therefore designed to contain the 72-hour PMF. Freeboard details are presented in Table 13.

Item	Value (m)	
Lowest crest elevation on Main or West Tailings Dam during 2020/2021 reporting period	1,732.50 (raised to 1,734 in Sep 2021)	
Allowance for 72-hour PMF (621,670 m ³)	1.65	
Allowance for wave run-up due to 1-in-2-year wind	0.35	
Standard operating maximum pond level (distance below embankment crest)	2.0	

IDF = inflow design flood; PMF= probable maximum flood; GHO = Greenhills Operations; TSF = tailings storage facility.

5.4.2.2 Observed Performance

The pond elevation recorded from 1 September 2020 to 31 August 2021 is presented in Illustration 3 relative to QPOs.



Illustration 3: Tailings Pond Elevation Relative to Freeboard Levels



Data indicates that the pond elevation varied between 1,728.3 and approximately 1,730 m during the 2020/2021 reporting period. The minimum freeboard during the reporting period was approximately 2.5 m, and therefore the operating freeboard of 2.0 m was maintained during the 2020/2021 reporting period.

A normal operational pond range of between 200,000 and 400,000 m³ was developed in 2020, in conjunction with the EoR and GHO staff to help support active water management at the facility. Teck has a water reduction plan (Teck 2020) which can be implemented, if required, to reduce the volume of stored water and increase facility freeboard, as described in Section 4.3.

The pond volume at the time of the 2020 bathymetric survey (21 July 2020) was approximately 755,000 m³. This had reduced to approximately 320,000 m³ at the time of 24 August 2021 bathymetric survey. This represents a 435,000 m³ reduction in pond volume during the reporting period.

5.4.3 Internal Erosion

5.4.3.1 Design Basis

The hydraulic head at the upstream face and hence the till blanket of the Main Tailings Dam and West Tailings Dam is typically equal to the pond elevation. The hydraulic head downstream from the till blanket is near the foundation. As such the hydraulic gradient is sufficient that the potential for internal erosion to occur must be considered.

The till blanket on the upstream face of the embankment s and CCR 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 recommend by 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 clay blanket (till) samples. Recent tailings testing (Golder 2021d) confirmed that the gradation of the tailings is consistent with that assumed in the filter compatibility assessment (Golder 2017c).

The CCR has been tested throughout construction of the embankment s and, with occasional exception, found to meet filter criteria. Results from construction in 2021 were pending at the time of this AFPR and will be reported as part of the 2022 AFPR. As CCR is used for the downstream shell, the entire downstream shell acts as a filter to the till blanket.

Grain size distribution tests were performed on five clay blanket (till) and nine CCR samples as part of the 2020 embankment raise (Golder 2021c). Results are presented in Illustration 4 (till sample) and Illustration 5 (CCR samples) along with the construction specification envelopes.



Source: Golder 2021c.





Source: Golder 2021c.

Illustration 5: Grain Size Distribution and Specification Envelopes for Coarse Coal Refuse

Tested till samples were within the specified envelope.

Seven of the nine CCR samples were finer than the specification. CCR 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 recommend a filter D₁₅ for glacial tills of less than or equal to 0.7 mm. All CCR samples met this criterion.

In summary, results indicate that filter criteria are met between the clay blanket (till) and the CCR (with occasional exception) and between the tailings and clay blanket (till). The constructed conditions are considered to be acceptable.

5.4.3.2 Observed Performance

Recorded flow rates at the Site C Weir and WTD Weir in the 2020/2021 reporting period are presented in Illustration 6 and Illustration 7, respectively. Flow rates during the reporting period were recorded as follows:

- manual readings
 - MTD Weir: 1 September 2020 to 27 November 2020
 - readings not available between 27 November 2020 and 7 April 2021 due to difficulties accessing the weir during winter
 - WTD Weir: 1 September 2020 to 20 April 2021
- by pressure transducer
 - MTD: 7 April to 31 August 2021.
 - WTD: 19 May to 31 August 2021

The flows in both weirs were generally low and within the expected range for normal operation. The peaks in the Site C Weir data are due to additional flow from surface water runoff.



Illustration 6: Main Tailings Dam (Site C) Weir Discharge


Illustration 7: West Tailings Dam Weir Discharge

During the 2021 site visit, it was observed that flow in the WTD seepage collection channel and seepage from the MTD was clear and free of visible suspended solids. Seepage rates during the reporting period were within normal operating conditions, and visual observations were not indicative of conditions attributable to internal erosion.

A high-density polyethylene (HDPE) 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 CCR stockpile (Photo 16 and Photo 18 in Appendix A). This flow reports to the Site C Weir and is not measured separately. It is therefore not possible to distinguish whether flow at the Site C Weir is due to increased seepage or surface runoff from the lower bench at Site C. It would be preferable to convey the flow from the HDPE pipe away from the seepage collection channel to allow for more accurate monitoring of seepage from the MTD.



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.
- Instrumentation and data reviews by the EoR team including discussion and action planning with Teck, as required.
- Tailings governance review in September 2020.
- Independent Tailings Review Board meetings in September 2020 and May and August 2021.
- Implementation of Water Reduction Plan (Teck 2020) from May until July 2021 to reduce pond water volume.
- Review and update of QPOs for the TSF in June 2021.
- EPRP tabletop exercise performed on 16 December 2020.
- Updates to TSF operational documents.
 - EPRP and TARP reviewed on 24 June 2021.
 - OMS manual reviewed on 21 April 2021.
- Embankment raise construction to elevation 1,734 m was completed between August and October 2021.

6.2 Summary of Climate and Water Balance

Climate data for the 2021 reporting period (Section 4.1) indicate lower rainfall and higher snowfall during the monitoring period.

TSF water balance results for the reporting period indicate an overall reduction in TSF water volume for the reporting period, which is consistent with other site recorded data and observations.

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 embankment s 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 2021 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 2021 site visit or monthly visual inspections by GHO. Some minor erosion of the upstream slope of the Main and West Tailings Dams was observed that required routine maintenance and was completed during the 2021 embankment raise construction.



6.4 Consequence of Failure

The GHO TSF meets current industry standards and has been reviewed against the extreme loading scenarios. Adopting this approach meets or exceeds any regulatory requirements, aligns with Teck's goal to eliminate any risk for loss of life, and is consistent with the new GISTM which supports evolving beyond the previously used consequence classification system. This approach is consistent with industry best practices and has an added benefit of providing accurate narratives to communities about the safety of tailings facilities that could impact them and who share Teck's approach of one life is one too many to be at risk.

6.5 Current Deficiencies and Non-conformances

Previous deficiencies and recommendations from the 2020 annual inspection report (Golder 2021b) are presented in Table 14. Closed items are shown with grey shading. There are no new deficiencies and/or recommendations based on this 2021 AFPR.



Table 14: 2021 Recommended Actions for Greenhills Tailings Storage Facility

ID Number	Deficiency	Potential Dam Safety Hazard	Priority Level	Recommended Action	Target Date	
2019-02	Seepage weirs: • Weir automation equipment is on site and pending installation.	Potentially unstable condition not measured.	3	Install weir automation equipment.	Q4 2021	Complete recorded Teck to p
2020-02	 Pond against upstream slope of MTD. The pond against the upstream slope of the MTD is consistent with design basis and not a embankment safety concern, but there is an opportunity to improve towards best applicable practice by moving the pond away from the upstream slope of the MTD. 	Increased potential for piping, and potential increased zone of influence if embankment integrity is compromised.	4	Develop and implement strategy to move pond away from upstream slope of the MTD.	Q4 2021	Complet in Q4 202
2019-04	Ponded water on downstream crest of Site C storage facilities at east abutment of MTD (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	Complet
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	 Not curre Desig conse desig requir Existi plann The n
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: 2019-07a: remove non-functioning geotechnical instrumentation and update QPOs. 2019-07b: update based on MAC (2019b) and Teck (2019). 2019-07c: use a single coordinate grid system. 	Q2 2022	In progre June 202
2020-06	QPO actions are not fully aligned with Teck corporate Emergency Preparedness and Response Plan (ERP) categories.	Potential to ineffectively respond to alerts and warnings and take required action.	4	Update QPO categories to consider Teck ERP categories. Also consider and incorporate feedback from desktop exercises /drills.	Q1 2021	Complet Documer

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
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.



Status

ted – Weirs installed in April and May 2021 with data being

provide installation record details.

ted –Tailings pipeline for 1,734 m embankment raise completed 21.

ted – Remediated as part of 2021 construction.

ently required

gn adopts the maximum credible loads/flood event and equence classification does not impact the selection of gn parameters. An inundation study is therefore not red to inform consequence classification.

ing study (Golder 2017c) is suitable for emergency ning.

need for updates to be reviewed in the future

ress – Operational documents for TSF were updated in April and 21 and are being finalized.

ted – QPO reviewed in June 2021.

nt requires formal approval by Teck.

a systematic breakdown of procedures.

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.

Millen

Martyn Willan, P.Eng. *Lead Geotechnical Engineer*

MBW/AJH/hp/ca/ar



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

Golder and the G logo are trademarks of Golder Associates Corporation

https://golderassociates.sharepoint.com/sites/140495/project files/6 deliverables/working/2021-204-r-rev1-3000-annual facility performance review gho tsf/21452085-2021-204-r-rev1-3000gho tsf 2021_tsf annual facility performance review 23mar_22.docx



REFERENCES

- CDA. 2013. Dam safety guidelines, 2007. Original 2007, revised 2013.
- CDA. 2019. Technical bulletin: application of dam safety guidelines to mining dams. October 2019.
- EMLI (Ministry of Energy, Mines and Low Carbon Innovation). 2021. Health, Safety and Reclamation Code for Mines in British Columbia. Under the Mines Act. Victoria, BC: British Columbia Ministry of Energy and Mines. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/mineral-explorationmining/documents/health-and-safety/code-review/health_safety_and_reclamation_code_apr2021.pdf.
- GHO (Teck Coal Limited, Greenhills Operations). 2019. Operation, Maintenance, and Surveillance Manual for Greenhills Tailings Storage Facility. Standard Practices and Procedures No. 1543. Ver. 4. 24 June 2019.
- GHO. 2021a. Operation, Maintenance, and Surveillance Manual for Greenhills Tailings Storage Facility. Standard Practices and Procedures No. 1543. Ver. 5. 21 April 2021.
- GHO. 2021b. Greenhills Operations Tailings Storage Facility Emergency Preparedness and Response Plan. SP&P No. 1583. Ver. 1. Date of revision: 24 June 2021.
- GTR (Global Tailings Review). 2020. Global Industry Standard on Tailings Management. August 2020. https://globaltailingsreview.org/global-industry-standard/
- Golder (Golder Associates Ltd.). 1989. Report on Raising of Upstream Impervious Blanket to El. 1702. Report prepared for Fording Coal Limited, Greenhills Operations. Project No. 882-1406C. October 1989.
- Golder. 1990. Report on Raising of Upstream Impervious Blanket to El. 1704. Report prepared for Fording Coal Limited, Greenhills Operations. Project No. 902-1406B. December 1990.
- Golder. 1992. Report on Raising of Upstream Impervious Blanket to El. 1707. Report prepared for Fording Coal Limited, Greenhills Operations. Project No. 912-1406B. January 1992.
- Golder. 1993. Fine Tailings Lagoon West Dam Construction to 1711 m Elevation. Report prepared for Fording Coal Limited, Greenhills Operations. Project No. 932-2403. August 1993.
- Golder. 1994. Report on Raising Tailings Dams to Elevation 1725 m. Report prepared for Fording Coal Limited, Greenhills Operations. Project No. 932-2416. January 1994.
- Golder. 1995. 1994 Annual Report on Tailings Dams and Settling Ponds. Report prepared for Fording Coal Limited, Greenhills Operations. Project No. 942-2426. May 1995.
- Golder. 1996. 1995 Annual Report on Tailing Dams, Coarse Rejects Stockpiles and Settling Ponds. Report prepared for Fording Coal Limited, Greenhills Operations. Project No. 962-2416. February 1996.
- Golder. 1997. 1996 Annual Report on Tailing Dams, Coarse Rejects Stockpiles and Settling Ponds. Report prepared for Fording Coal Limited, Greenhills Operations. Project No. 962-2416. May 1997.
- Golder. 1998. 1997 Annual Report on Tailing Dams, Coarse Rejects Stockpiles and Settling Ponds. Report prepared for Fording Coal Limited, Greenhills Operations. Project No. 972-2420. March 1998.

- Golder. 1999. 1998 Annual Report on Tailings Dams, Coarse Rejects Stockpiles, Settling Ponds. Report prepared for Fording Coal Limited, Greenhills Operations. Project No. 982-2420. February 1999.
- Golder. 2000. 1999 Annual Report on Tailings Dams, Coarse Rejects Stockpiles, Settling Ponds. Report prepared for Fording Coal Limited, Greenhills Operations. Project No. 992-2420. March 2000.
- Golder. 2004. Geotechnical Construction Monitoring, Main Tailings Dam. Report prepared for Elk Valley Coal Limited, Greenhills Operations. Project No. 03-1321-036. 12 April 2004.
- Golder. 2005. Raising Main Tailings Dam to Elevation 1735 m, Greenhills Operations. Report prepared for Elk Valley Coal Corporation, Greenhills Operations. Project No. 04-1321-021. July 2005.
- Golder. 2010a. 2009 Geotechnical Construction Monitoring, Main Tailings Dam, Greenhills Operations, Elkford, British Columbia. Report prepared for Teck Coal Limited, Greenhills Operations. Project No. 09-1321-0009.2000. 22 April 2010.
- Golder. 2010b. As-built Report on 2010 Geotechnical Construction Monitoring, Main and West Tailings Dam, Greenhills Operations, Elkford, British Columbia. Report prepared for Teck Coal Limited, Greenhills Operations. Project No. 10-1321-0009.2000. 22 December 2010.
- Golder. 2012a. 2011 Annual Report Greenhills Operations: Tailings Dams, Coarse Reject Stockpiles and Settling ponds. Report prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. Number 11-1321-0001.1000. March 2012.
- Golder. 2012b. Teck Tailings Pond Dams and Settling Pond Dam: Dam Breach Flood Inundation Study. Report prepared for Teck Coal Limited, Greenhills Operations. Project No. 11-1321-0001. August 2012.
- Golder. 2014a. Geotechnical Report, Greenhills Operations West Tailings Dam Raise to Elevation 1735 m.
 Report prepared for Teck Coal Limited- Greenhills Operations. Golder Doc. No. 13-1321-0018.
 11 February 2014.
- Golder. 2014b. Greenhills Operations Main and West Tailings Dams Embankment Raise. Issued for construction drawing package prepared for Teck Coal Limited, Greenhills Operations. Project No. 13-1396-0014. Revision 0. 28 May 2014.
- Golder. 2014c. Main and West Tailings Dams Embankment Raise Technical Specifications and Construction Quality Assurance/Quality Control Plan. Specifications prepared for Teck Coal Limited, Greenhills Operations. Project No. 13-1396-0014. Revision 0. 5 June 2014.
- Golder. 2015. 2014 Interim Construction Summary Report. Greenhills Operations Main and West Tailings Dam.
 Report Prepared for Teck Coal Limited, Greenhills Operations. Report No. 13-1396-0014.
 30 January 2015.
- Golder. 2016a. 2015 Construction Report. Greenhills Operations Main and West Tailings Dams. Report prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 1313960014.3000. 26 January 2016.
- Golder. 2016b. Site Specific Probabilistic Seismic Hazard Assessment. Draft report prepared for Teck Coal Limited, Fording River Operations, Greenhills Operations, and Coal Mountain Operations. Golder Doc. No. 1522835-2015-149-R-RevC-4000. 25 January 2016.

- Golder. 2017a. Stability Review and Update of the Quantitative Performance Objectives for the Greenhills Tailings Pond Dams. Technical memorandum prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 1780315-2017-097-TM-Rev0-1000. 19 July 2016.
- Golder. 2017b. 2016 Construction Report Greenhill Tailings Facility West Dam. Report prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 1658561-2016-085-R-Rev0-2000. 21 February 2017.
- Golder. 2017c. 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. 2017d. 2016 Main Tailings Dam Drilling Investigation. Report prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 1658561-2017-021-R-Rev0-3000. 8 May 2017.
- Golder. 2017e. 2017 Construction Report. Greenhills Operations Main and West Tailings Dams. Report prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 1782871_RP0001. 4 December 2017.
- Golder. 2019. 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. 2020a. Tailings Storage Facility Review of Slope Inclinometer Data. Technical Memorandum prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 19133994-2020-077-TM-Rev0-2000. 29 April 2020.
- Golder. 2020b. Tailings and Water Retaining Structures Management Plan. Report prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 18110798-2020-109-L-RevA-5000. 5 May 2020.
- Golder. 2020c. Greenhills Operations Tailings Storage Facility 1,732.5 m Raise of Main and West Tailings Dams Issued for Construction Drawings. Drawings prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 20139437-2020-145-D-Rev0-2000. 12 June 2020.
- Golder. 2020d. Greenhills Tailings Facility Dam Breach Inundation Assessment and Consequence Classification. Report prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 1897134-2000-2020-088-TR-RevA. April 2020.
- Golder. 2020e. Water Balance Model for Greenhills Operations. Report prepared for Teck Coal Limited, Greenhills Operations. Golder. Doc. No. 19124716-2020-080-R-Rev1-2200. 24 July 2020.
- Golder. 2021a. Review and Update of Quantitative/Quantifiable Performance Objectives for Greenhills Tailings Storage Facility and Settling Pond. Report prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 201452085-2021-040-TM-RevA-1000. 30 June 2021.
- Golder. 2021b. 2020 Annual Inspection Report for Greenhills Tailings Facility. Report prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 19133994-2020-150-R-Rev0-3000. 29 March 2021.
- Golder. 2021c. Greenhills Operations Tailings Storage Facility 2020 Construction Record Report.
 Report Prepared for Teck Coal Limited, Greenhills Operations.
 Golder Doc. No. 20139437-2021-033-R-Rev0-5000. 29 March 2021.



- Golder 2021d. Greenhills Operations Site F Mixed Coal Refuse Facility Design Report. Report Prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 20378088-2021-021-R-Rev0-3000.
 4 August 2021.
- Golder 2021e. Greenhills Operations Geotechnical Investigations Site F Mixed Coal Refuse and Site C Coarse Coal Refuse Facilities. Report Prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 21455774-2021-157-R-Rev0-1200. 28 October 2021.
- Golder 2021f. Preliminary Geohazard Assessment for Greenhills Operations Tailings Storage Facility. Technical Memorandum Prepared for Teck Coal Limited, Greenhills Operations. Golder Doc. No. 19133994-2021-013-TM-Rev0-6000. 22 March 2021.
- Hardy. (Hardy Associates 1978 Limited). 1980. Tailings Dam Greenhills Surface Coal Mining Project. Report prepared for Kaiser Resources Ltd. Project No. K5131-013. September 1980.
- Hardy. 1984. Report on the Construction of the Starter Dam. Report prepared for Westar Mining Ltd. Project No. VG-03259. 5 April 1984.
- Hardy. 1987. 1986 Annual Report on Geotechnical Conditions Tailings Disposal Facility Greenhills Colliery. Report prepared for Westar Mining Ltd. Project No. VG-03499. January 1987.
- Hardy. 1988. Year End Report for Greenhills Tailings Dam. Report prepared for Westar Mining Ltd. Project No. VG-03499. 8 June 1988.
- 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.
- Li M, Fannin RJ, Garner SJ. 2009. Application of a New Criterion for Assessing the Susceptibility to Internal Erosion. Canadian Dam Association 2009 Annual Conference, Whistler, BC, Canada. 3–8 October 2009.
- MAC (Mining Association of Canada). 2019a. A Guide to the Management of Tailings Facilities. 3.1 Edition, Ottawa, Ontario. http://mining.ca/sites/default/files/MAC-Tailings-Guide_2019.pdf. February 2019.
- MAC. 2019b. Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities. Second ed. https://mining.ca/documents/oms-guide-second-edition-2019/. 19 March 2019.
- MEM (Ministry of Energy and Mines). 1993. C-137 Permit: Permission to Construct Tailings Pond West Dam Phase I. Issued August 13, 1993. Ministry of Energy, Mines and Petroleum Resources. Victoria, British Columbia.
- MEM. 2010. C-137 Permit: Amendment Approving Reclamation Program. Issued August 30, 2010. Ministry of Energy, Mines and Petroleum Resources. Victoria, British Columbia.
- MEM. 2014a. C-137 Permit: Approving Main and West Dam Raises and Boundary Amendment. Issued April 7, 2014. Ministry of Energy and Mines. Victoria, British Columbia.
- MEM. 2014b. C-137 Permit: Approving Change to Permit Boundary. Issued September 15, 2014. Ministry of Energy and Mines. Victoria, British Columbia.

- Ministry of Energy and Mines (British Columbia Ministry of Energy, Mines). 2016. Guidance Document for Revisions to Part 10 of the Health, Safety and Reclamation Code for Mines in British Columbia. Mining and Minerals Division, Victoria, British Columbia. Effective 20 July 2016.
- NRC (Natural Resources Canada). 2015. Seismic Hazard Calculator. Calculator based on Seismic Hazard Epicentre File used in fifth generation seismic hazard maps of Canada, Open File 6208. http://www.earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/index_2015-en.php.
- NRCC (National Research Council Canada). 2015. National Building Code of Canada 2015. 1 January 2015.
- Okane Consultants Inc. (Okane) 2021. CCR and Tailings Drill Program Installation Report. Report prepared for Teck Coal FRO, GHO, LCO and EVO. Ref. No. 815-171/172. RevB. 2 June 2021.
- Rose and Hungr (2007). Forecasting Potential Rock Slope Failure in Open Pit Mines Using Inverse-velocity Method. International Journal of Rock Mechanics & Mining Sciences 44 (2007) 308–320.
- Sherard JL, Dunnigan LP, Talbot JR. 1984. Basic Properties of Sand and Gravel Filters. Journal of Geotechnical Engineering. ASCE. June 1984.
- Sherard JL, Dunnigan LP. 1989. Critical Filters for Impervious Soils. Journal of Geotechnical Engineering. ASCE. July 1989.
- Teck (Teck Coal Limited). 2017. 2017 Elk Valley Regional Water Quality Model Update Hydrology Modelling (Annex C). Report prepared for Teck Coal Limited. October 2017.
- Teck. 2020. Greenhills Operations Tailings Storage Facility Water Reduction Plan. V1.0. 2 March 2020.
- Teck. 2021a. July Streamline Water Workbook. Excel Spreadsheet. Provided by Teck on 12 October 2021.
- Teck. 2021b. June Monthly Tailings Committee Meeting. 8 June 2021.
- Teck. 2021c. July Monthly Tailings Committee Meeting. 13 July 2021.
- Teck Resources (Teck Resources Limited). 2019. Guideline for Tailings and Water Retaining Structures. Ver. 2. Date of revision: January 2019.
- Venter, J., et. al (2013). An Evaluation of the CUSUM and Inverse Velocity Methods of Failure Prediction. Slope Stability 2013 – P.M. Dight (ed). 2013 Australian Centre for Geomechanics, Perth, ISBN 978-0-9870937-5-2.
- Westar (Weststar Mining Ltd.). 1988. Greenhills Tailings Dam: Estimate of Work Required to be completed in 1988. Plan of sitework. May 1988.
- Wood (John Wood Group PLC). 2018. 2017 Risk Assessment of Tailings Dams Classified as High or Higher: Greenhills Operations – Main and West Dams. TE173054. 12 May 2018.

STUDY LIMITATIONS

Golder Associates Ltd. (Golder) has prepared this document in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this document. No warranty, express or implied, is made.

This document, including all text, data, tables, plans, figures, drawings, and other documents contained herein, has been prepared by Golder for the sole benefit of Teck Coal Limited, Greenhills Operations. All third parties relying on this document do so at their own risk.

This document represents Golder's professional judgement based on the knowledge and information available at the time of completion. The factual data, interpretations, suggestions, recommendations, and opinions expressed pertain to the specific project, site conditions, design objective, development and purpose described to Golder by Teck Coal Limited, Greenhills Operations, and are not applicable to any other project or site location. In order to properly understand the factual data, interpretations, suggestions, recommendations, and opinions expressed in this document, reference must be made to the entire document.

Teck Coal Limited, Greenhills Operations may make copies of the document in such quantities as are reasonably necessary for those parties conducting business specifically related to the subject of this document or in support of or in response to regulatory inquiries and proceedings. Golder is not responsible for any unauthorized use or modification of this document. Electronic media is susceptible to unauthorized modification, deterioration, and incompatibility and therefore no party can rely solely on the electronic media versions of this document.



FIGURES





25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FR









CONSULTANT

NSD GOLDER

YYYY-MM-DD

DESIGNED

PREPARED

REVIEWED

APPROVED

2022-03-11

FA/AF/AW

KA

MBW

AJH

LEGEND	
	AUGUST 2021 BATHYMETRY (SEE REFERENCE 1)
	JULY-AUGUST 2021 SURVEY (SEE REFERENCE 3)
	INFERRED CONTACT
	CLAY BLANKET
	GLACIAL TILL
	BEDROCK
•	VIBRATING WIRE PIEZOMETER TIP ELEVATION (SEE REFERENCE 5)

NOTES

- ALL UNITS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE. MATERIAL BOUNDARIES ARE APPROXIMATE.
- 3. ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.

- REFERENCES
 1. 2021 BATHYMETRY INFORMATION PROVIDED BY TECK COAL LIMITED, FILE NAMES:
 "210824-TailingsPondBathy Sfc.00t" AND "210824-MainTailingsPond Sfc.00t",
- DATED 24 AUGUST 2021, RECEIVED: 17 SEPTEMBER 2021. 2. POND ELEVATION DOWNLOADED FROM TECK COAL'S INSTRUMENT MONITORING SOFTWARE, GEOEXPLORER, FOR GREENHILLS OPERATIONS; FILENAME: "GPS 313.xlsx", OBSERVED: 26 AUGUST 2021.
- 2021 LIDAR TOPOGRAPHY GENERATED FROM DATA PROVIDED BY TECK COAL LIMITED. FILES : "082J02C14.xyz", "082J02F04.xyz", "082J02E01.xyz", "082J02C14.xyz", "082J02C13.xyz", "082J02D16.xyz", "082J02D16.xyz", "082J02D12.xyz", "082J02D09.xyz", DATES FLOWN: 22 JULY, 25 AND 26 AUGUST 2021, RECEIVED : 21 SEPTEMBER 2021.
- 4. 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
- VIBRATING WIRE PIEZOMETER MAXIMUM OBSERVATIONS FROM DATA BETWEEN 1 SEPTEMBER 2020 TO 31 AUGUST 2021.

ISSUED FOR REPORT



PROJEC[®] GREENHILLS TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE MAIN TAILINGS DAM - CROSS-SECTIONS A AND B

PROJECT NO.	PHASE/TASK/DOC	REV.	FIGURE
21452085	3000/3310/204	0	4





LEGEND	
	AUGUST 2021 BATHYMETRY (SEE REFERENCE 1)
	JULY AUGUST 2021 SURVEY (SEE REFERENCE 2)
	APPROXIMATE ORIGINAL GROUND SURFACE (SEE REFERENCE 5)
	INFERRED CONTACT
	CLAY BLANKET
\times	WASTE ROCK
	GLACIAL TILL
	BEDROCK
•	VIBRATING WIRE PIEZOMETER TIP ELEVATION (SEE REFERENCE 6)

NOTES

ALL UNITS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.

- MATERIAL BOUNDARIES ARE APPROXIMATE
- 3. 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, GHO. REPORT NO. 1313960014.3000. SUBMITTED 26 JANUARY 2016.
- 4. ELEVATIONS ARE REFERENCED TO THE ELK VALLEY ELEVATION DATUM.

REFERENCES

- 2021 BATHYMETRY INFORMATION PROVIDED BY TECK COAL LIMITED, FILE NAMES: "210824-TailingsPondBathy Sfc.00t" AND "210824-MainTailingsPond Sfc.00t", DATED 24 AUGUST 2021, RECEIVED: 17 SEPTEMBER 2021.
- 2021 LIDAR TOPOGRAPHY GENERATED FROM DATA PROVIDED BY TECK COAL LIMITED. FILES: "082J02C14.xyz", "082J02F04.xyz", "082J02E01.xyz", "082J02C14.xyz", "082J02C13.xyz",
 "082J02016.xyz", "082J02011.xyz", "082J0201.xyz", "082J0201.xyz", "082J0201.xyz", "082J02012.xyz", "08
- 2018 AS-BUILT INFORMATION PROVIDED BY TECK COAL LIMITED, FILE NAME: "2018-10-02 GHO 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 GHO. REPORT NO. 13-1321-0018. SUBMITTED 11 FEBRUARY 2014
- 6. VIBRATING WIRE PIEZOMETER MAXIMUM OBSERVATIONS FROM DATA BETWEEN 1 SEPTEMBER 2020 TO 31 AUGUST 2021.

ISSUED FOR REPORT



PROJECT GREENHILLS TAILINGS STORAGE FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE WEST TAILINGS DAM - CROSS-SECTIONS C AND D

PROJECT NO.	PHASE/TASK/DOC	REV.	FIGURE
21452085	3000/3310/204	0	5

APPENDIX A

2021 Site Inspection Photos





Photograph 1: Tailings Storage Facility – Looking Southwest, 17 August 2021



Photograph 2: Main Tailings Dam – Looking East, 17 August 2021





Photograph 3: Tailings Pond Looking Northwest, 16 August 2021



Photograph 4: Main Tailings Dam – Reclaim Barge and Upstream Crest; Looking Southwest, 16 August 2021



Photograph 5: Main Tailings Dam – Upstream Crest and Till Blanket; Prepared Placement of Dam Fill; Looking Southwest, 16 August 2021



Photograph 6: Main Tailings Dam – Upstream Crest, Till Blanket and Reclaim Barge; Looking Northeast, 16 August 2021





Photograph 7: Main Tailings Dam - Till Blanket and Upstream Slope; Looking West, 16 August 2021



Photograph 8: Main Tailings Dam – Minor Erosion along Upstream Crest; Looking Northeast, 16 August 2021





Photograph 9: Main Tailings Dam – Compaction of CCR during 2021 Dam Raise Construction; Looking West, 16 August 2021



Photograph 10: Main Tailings Dam – Looking East, 16 August 2021





Photograph 11: Main Tailings Dam – Downstream Slope; Looking Southwest, 16 August 2021



Photograph 12: Main Tailings Dam – Downstream Slope; Looking East, 16 August 2021



Photograph 13: Site C Coarse Coal Refuse Facility – Erosion on Downstream Slope; Looking North, 17 August 2021



Photograph 14: Site D Coarse Coal Refuse Facility – Downstream Slope; Looking East, 17 August 2021





Photograph 15: Site C Coarse Coal Refuse Facility – Rock Drain Discharge and Seepage from Main Tailings Dam; Looking Northeast, 17 August 2021



Photograph 16: Site C Coarse Coal Refuse Facility – Surface Water Runoff to Smart Ditch at Toe; Looking Northeast, 17 August 2021





Photograph 17: Site C Coarse Coal Refuse Facility – Smart Ditch at Toe; Looking Northeast, 17 August 2021



Photograph 18: Site C Weir; Looking Northwest, 17 August 2021





Photograph 19: Site C Coarse Coal Refuse Facility – Sediment Blocking Smart Ditch; Looking North, 17 August 2021



Photograph 20: Site D Coarse Coal Refuse Facility – Site D Culvert; Looking Southeast, 16 August 2021





Photograph 21: West Tailings Dam – Overview; Looking Northwest, Dam Construction in Progress, 17 August 2021



Photograph 22: West Tailings Dam – Dam Crest and Downstream Slope; Looking North, 16 August 2021





Photograph 23: West Tailings Dam – South Abutment, Upstream Slope and Crest; Looking Northwest, 16 August 2021



Photograph 24: West Tailings Dam – Till Blanket and Upstream Crest; Looking North, 16 August 2021





Photograph 25: West Tailings Dam – West Tailings Dam Crest; Looking Southwest, 16 August 2021



Photograph 26: West Tailings Dam – North Abutment and West Tailings Dam Crest; Looking South, 16 August 2021





Photograph 27: West Tailings Dam – Tailings Beach; Looking South, 16 August 2021



Photograph 28: West Tailings Dam – Downstream Slope; Looking North, 16 August 2021



Photograph 29: West Tailings Dam – Downstream Slope and Vibrating Wire Piezometer Datalogger; Looking Northwest, 16 August 2021



Photograph 30: West Dam Seepage Weir; Looking Southwest, 16 August 2021





Photograph 31: West Tailings Dam – Downstream Slope; Looking Southeast, 18 August 2021



APPENDIX B

August 2021 Golder Site Inspection Reports



Client:	Teck Coal Limited	Ву:	Andy Haynes, P.Eng. and Martyn Willan, P.Eng.
Project:	GHO 2021 Annual Facility Performance Review	Date:	16 to 17 August 2021
Location:	Main Tailings Dam		

GENERAL INFORMATION				
Embankment Type: Compacted CCR with till blanket				
Weather Conditions:	Cloudy and rainy	Temp:	13°C	

INSPECTION ITEM	OBSERVATIONS/DATA	РНОТО	COMMENTS & OTHER DATA
1. EMBANKMENT CREST			
1.1 Crest Elevation (Till)	1,732.5 m	5, 6, 7, 9, 10	Crest elevation from as-constructed report (Golder 2021d). 1,734 m dam raise construction in progress.
1.2 Reservoir Level / Freeboard	1729.2 m Approximately 3.3 m freeboard	3, 4, 5, 6, 7,8,10	Pond level from GHO GPS 313 reading on 17 August 2021.
1.3 Distance to Tailings Pond (if applicable)	Water against upstream slope of dam		
1.4 Surface Cracking	None observed		
1.5 Unexpected Settlement	None observed		
1.6 Lateral Movement	None observed		
1.7 Other Unusual Conditions	None observed		
2. UPSTREAM SLOPE			
2.1 Slope Angle	2:1	4, 5, 6, 7, 8	
2.2 Signs of Erosion	Minor erosion along upstream crest	8	
2.3 Signs of Movement (Deformation)	None observed		
2.4 Cracks	None observed		
2.5 Face Liner Condition (if applicable)	n/a		
2.5 Other Unusual Conditions	None observed		


INSPECTION ITEM	OBSERVATIONS/DATA	РНОТО	COMMENTS & OTHER DATA
3. DOWNSTREAM SLOPE			
3.1 Slope Angle	2.5:1	2, 11, 12	
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 observed		
4. DOWNSTREAM TOE AREA		11, 12, 13,14, 15, 16, 17, 18, 19	
4.1 Seepage from Embankment	Seepage/surface water runoff observed in Site C collection channel and in Site D culvert	15, 16, 17, 18	
4.2 Signs of Erosion	Some localized erosion on Site C and Site D	13, 14	No action on erosion required at this time.
4.3 Signs of Turbidity in Seepage Water	None observed		
4.4 Discoloration/Staining	Iron staining in seepage	15	
4.5 Outlet Operating Problem (if applicable)	Sediment blocking Site C collection channel and impeding weir	18, 19	Remove sediment from collection channel.
4.6 Other Unusual Conditions	None		



INSPECTION ITEM	OBSERVATIONS/DATA	РНОТО	COMMENTS & OTHER DATA
5. ABUTMENTS		2, 10	
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 Animal Burrows	None observed		
5.5 Other Unusual Conditions	None observed		Remove water and fill with CCR during embankment construction.
6. RESERVOIR			
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	2, 3, 41	
7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE	n/a		
8. INSTRUMENTATION			
8.1 Piezometers	Yes	12	24 installed
8.2 Settlement Cells	None		
8.3 Thermistors	None		
8.4 Survey Monuments / GPS Units	Yes	2,4,12	7 GPS and 8 Survey Prisms installed. Removed at the time of the 2021 site visit.
8.5 Accelerograph	None		
8.6 Inclinometer	Yes		5 installed
8.7 Weirs and Flow Monitors	Site C weir (2.8 L/s)	18	Weir reading on 17 August 2021.
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 removed during embankment raise construction.

INSPECTION ITEM	OBSERVATIONS/DATA	РНОТО	COMMENTS & OTHER DATA
9. DOCUMENTATION			
9.1 Operation, Maintenance and Surveillance (OMS) Manual 9.1.1 OMS Manual exists	Yes		GHO SP&P No. 1543 (GHO 2021a)
9.1.2 OMS Plan reflects current embankment conditions	No		Update in progress.
9.1.3 Date of last revision	21 April 2021		-
9.2 Emergency Preparedness and Response Plan (EPRP) 9.2.1 EPRP Exists	Yes		GHO SP&P No. 1583 (GHO 2021b)
9.2.2 EPRP Reflects Current Conditions	No		Update in progress.
9.2.3 Date of Last Revision	24 June 2021		-
 9.2 Tailings and Water Retaining Structures (TWRS) Management Plan 9.2.1 TWRS Management Plan Exists 	Yes		Draft issued May 2020. Finalization of this document was on hold at the time of this report.
10. NOTES Embankment raise construction	on to 1,734 m was ongoing during th	nis site visit	
Inspector's Signature	Altanga	Date:	23 March 2022



Client:	Teck Coal Limited	By:	Andy Haynes, P.Eng. and Martyn Willan, P.Eng.
Project:	GHO 2021 Annual Facility Performance Review	Date:	16 to 17 August 2021
Location:	West Tailings Dam		

GENERAL INFORMATION

Embankment Type:	Compacted CCR with till blanket		
Weather Conditions:	Cloudy and rainy	Temp:	13°C

INSPECTION ITEM	OBSERVATIONS/DATA	РНОТО	COMMENTS & OTHER DATA
1. EMBANKMENT CREST			
1.1 Crest Elevation (Till)	1,732.5 m	22,23,25	Crest elevation from as-constructed report (Golder 2021d) 1,734 m embankment raise construction in progress.
1.2 Reservoir Level / Freeboard	No water against upstream face	21,23,24,25,26,27	Pond level from GHO GPS 313 reading on 17 August 2021 below tailings surface.
1.3 Distance to Tailings Pond (if applicable)	>100 m	21,23,24,25,26,27	Only Tailings against upstream face (other than minor channel of surface inflow water).
1.4 Surface Cracking	None observed		
1.5 Unexpected Settlement	None observed		
1.6 Lateral Movement	None observed		
1.7 Other Unusual Conditions	None observed		
2. UPSTREAM SLOPE			
2.1 Slope Angle	2:1	22,23,24,25,26,27	
2.2 Signs of Erosion	Minor erosion along upstream crest	23	Regrade during 2021 embankment raise.
2.3 Signs of Movement (Deformation)	None observed		



INSPECTION ITEM	OBSERVATIONS/DATA	рното	COMMENTS & OTHER DATA
2.4 Cracks	None observed		
2.5 Face Liner Condition (if applicable)	n/a		
2.6 Other Unusual Conditions	None		
3. DOWNSTREAM SLOPE			
3.1 Slope Angle	2.5:1	22,28,29,31	
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		
4. DOWNSTREAM TOE AREA			
4.1 Seepage from Embankment	Seepage observed in West Dam Weir	28,30,31	
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	None observed		
5. ABUTMENTS			
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 Animal Burrows	None observed		
5.5 Other Unusual Conditions	None observed		
6. RESERVOIR			
6.1 Stability of Slopes	Satisfactory		
6.2 Floating Debris	None observed		
6.3 Other Unusual Conditions	None observed		
7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE	n/a		

INSPECTION ITEM	OBSERVATIONS/DATA	рното	COMMENTS & OTHER DATA
8. INSTRUMENTATION			
8.1 Piezometers	Yes	29	6 installed.
8.2 Settlement Cells	None		
8.3 Thermistors	None		
8.4 Survey Monuments / GPS Units	Yes	29	3 GPS units and 5 survey prisms installed.
8.5 Accelerograph	None		
8.6 Inclinometer	None		
8.7 Weirs and Flow Monitors	West Dam Weir (1.0 L/s)	30	Weir reading on 17 August 2021.
8.8 Data Logger(s)	Yes		Installed for various instruments.
8.9 Other	None		
9. DOCUMENTATION			
9.1 Operation, Maintenance and Surveillance (OMS) Manual 9.1.1 OMS Manual exists	Yes		GHO SP&P No. 1543 (GHO 2021a)
9.1.2 OMS Plan reflects current embankment conditions	No		Update in progress.
9.1.3 Date of last revision	21 April 2021		-
9.2 Emergency Preparedness and Response Plan (EPRP)9.2.1 EPRP Exists	Yes		GHO SP&P No. 1583 (GHO 2021b)
9.2.2 EPRP Reflects Current Conditions	No		Update in progress.
9.2.3 Date of Last Revision	24 June 2021		-
 9.3 Tailings and Water Retaining Structures (TWRS) Management Plan 9.3.1 TWRS Management Plan Exists 	Yes		Draft issued May 2020. Finalization of this document was on hold at the time of this report.
10. NOTES 1,734 m embankment raise co	nstruction in progress		
Inspector's Signature		Date:	



APPENDIX C

Survey Prism Data







TECK COAL LIMITED

ELKFORD, BC

CONSULTANT

GREENHILLS OPERATIONS

GOLDER

MEMBER OF WSP

YYYY-MM-DD

PREPARED

APPROVED

DESIGN

REVIEW

2021-03-08

WB

KA

MBW

AJH

Initial Location

Final Location

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

2020/2021 AFPR data (1 September 2020 to 31 August 2021)

Grey Investigate (150 mm) Blue Caution (250 mm)

O

Instrument Location

References: -2021 Aerial photo and topography provided by Teck Coal Limited. Flown 24 August 2021.

-Poism data reset on 8 December 2020 due to error in data processing following the 2020 dam raise construction Institutariose con o Colonitori 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris colonitative constrainte da lottoris de losse processing lottoris de losse accessing lottoris de losse accessing lottoris de losse accessing lottoris de lottoris colonitative constrainte da lottoris de lo





PROJEC 2021 ANNUAL FACILITY PERFORMANCE REPORT

GREENHILLS TAILINGS STORAGE FACILITY

MAIN TAILINGS DAM - PRISM A DISPLACEMENT PLOTS

21452085	3000/3310/2021-204	0	C-1
PROJECT No.	Phase/Task/DOC.	Rev.	FIGURE

	5																																				
	4.5										_	_									_							_	_								
	л																																				
	4																																				
	3.5																																				
(m																																					
//	3			_		-					_	-							_						_	_		-									
day																																					
ty (2.5										_																										
loci																																					
Vel	2							Λ																													
rse	Z							1																													
IVel																																					
elu	1.5							·				_																_		_				\uparrow			
ag G											-																										
vei	1					-				_	_								_							P			-								
4																																					
	0.5												$\left \right\rangle$		~																				V_		
	0.5																																		¥		
	-																																				
	U	15	15	15	15	15	16 16	16	16	16	16	17	1 1	, r	11	17	18	18	18	18	18	10	61	19	19	19	19	20	20	20	70	20	21	21	21	17	
		Dec- Feb-	Иау-	-Inl	Sep-	-vov	Jan- Mar-	May-	-Int	Sep-	-vov	Jan-	Mar- Mav-		-Int Sep-	^ON	Jan-	Mar-	Vay-	Jul	Sep-	-vov	Mar-	May-	Jul	Sep-	-vov	Jan-	Apr-	-unf	Aug-	Dec-	Feb-	Apr-	-unf	-ane-	
			-					-						-					_					-													
							CI		0.0		IMITE	=D											- P 2		T ANN		FAC	דו וו:	ΓΥΡ	ERF				=PO	RT		
							G	REE	ENHI	LS	OPE	RAT	IONS	6									Ć	GREE	ENHI	LLS	TAIL		SS S	TOR	AGE	FAC		Y 1	1 1 1		
2020/2021 AFPR Data	(1 Septemb	er 2020 to	31 Augu	ust 2021	L)		E			, BC					~~~	(Y.M	M-DD		202	1_02_09	2			ITLE													
Historic Data (Before	1 September	2020)	0				C	-							PRE	EPAR	ED		WB	1-03-00	,		— Ň	IAIN	TA	ILIN	GS I	DAN	/ - F	PRIS	MA						
tes: ism data reset on 8 December 2020 di ata gaps present due to survey prisms	ue to error in d	ata processir	ig iring dam i	raise con	struction			ſ		GC) L	DE	ER		DES	BIGN			KA				_ A	VER	RAG	E IN	VEF	RSE	VE	LOC	ITY	PLO	т				
verse velocity calculated in days/millim verse velocity data presented at the en	etre over the p d of the calcula	receding threation period (e-month p i.e. last da	period ay of perio	od)		l			MEME	BER O	FWS	Р		REV	/IEW			MBV	V			_ P	ROJEC	T No.		Pr	nase/T	ask/D0	DC.	4 00			Rev.		FIG	URE
															APF	PROV	/ED		AJH	I			2 '	14920	000		30	000/3	3310	/202	1-20	4		U		(5-2





TECK COAL LIMITED

ELKFORD, BC

CONSULTANT

GREENHILLS OPERATIONS

GOLDER

MEMBER OF WSP

YYYY-MM-DD

PREPARED

DESIGN

REVIEW

APPROVED

2021-03-08

WB

KA

MBW

AJH

Initial Location

Final Location

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

2020/2021 AFPR data (1 September 2020 to 31 August 2021)

Grey Investigate (150 mm)

Blue Caution (250 mm)

O Instrument Location

References: -2021 Aerial photo and topography provided by Teck Coal Limited. Flown 24 August 2021.

-Porta proto and apportantly provided by reck coal Linked. How P August 2021. -Prism data reset on 8 December 2020 due to error in data processing following the 2020 dam raise construction Institutariose con o Colonitori 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris colonitative constrainte da lottoris de losse processing lottoris de losse accessing lottoris de losse accessing lottoris de losse accessing lottoris de lottoris colonitative constrainte da lottoris de lo





PROJEC

2021 ANNUAL FACILITY PERFORMANCE REPORT GREENHILLS TAILINGS STORAGE FACILITY

MAIN TAILINGS DAM - PRISM B DISPLACEMENT PLOTS

PROJECT No. Phase/Task/DOC. Rev. FIGURE	21452085	3000/3310/2021-204	0	C-3
	PROJECT No.	Phase/Task/DOC.	Rev.	FIGURE

5																								
4.5																								
4																								
3.5																								
3 –																								
city (c																								
Velo																								
и 986. 1.5																								
					\land																		\downarrow	
0.5														$\overline{\mathbf{A}}$										
	•						-																	
0 Dec-14	Feb-15 Apr-15 Jun-15	Aug-15 Oct-15 Dec-15	Feb-16 Apr-16	Jun-16 Aug-16	Oct-16 Dec-16	Feb-1/ Apr-17	Jun-17 Aug-17	0ct-17	Dec-17 Mar-18	May-18	Jul-18	Aug-18 Oct-18	Dec-18	Mar-19 May-19	Jul-19	Nov-19	Jan-20	Mar-20	Jul-20	Sep-20	Nov-20	Jan-21 Mar-21	May-21	Jul-21 Sep-21
			CLIENT TECK	 COAL L										PRO.			FAC	II ITY	PER	FOR		CE R	FPOF	RT.
220/2021 AEDD D-12 (1 Sentember 20	200 to 21 August 2021)		GREEI ELKFC	NHILLS DRD, BC	OPERA	TIONS								GR	EENH	IILLS	TAIL	INGS	STO	RAG	E FA	CILIT	Y	
storic Data (Before 1 September 2020))		CONSUL		חור	ED	PF	REPARI	И-DD ED	2	2021-03 WB	-08		- MA - AVI	IN TA	AILIN Ge in	GS E) AM SE V	- PRI /ELO		B Y PL(эт		

REVIEW

APPROVED

MBW

AJH

PROJECT No.

21452085

Phase/Task/DOC

3000/3310/2021-204

Rev. 0

FIGURE

C-4

MEMBER OF WSP

-Prism data reset on 8 December 2020 due to error in data processing -Data gaps present due to survey prisms being offline or removed during dam raise construction -Inverse velocity calculated in days/millimetre over the preceding three-month period -Inverse velocity data presented at the end of the calculation period (i.e. last day of period)





Initial Location

Final Location

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

2020/2021 AFPR data (1 September 2020 to 31 August 2021)

Grey Investigate (150 mm)

Blue Caution (250 mm)

Instrument Location

O

References: -2021 Aerial photo and topography provided by Teck Coal Limited. Flown 24 August 2021.

-Poism data reset on 8 December 2020 due to error in data processing following the 2020 dam raise construction Institutariose con o Colonitori 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris colonitative constrainte da lottoris de losse processing lottoris de losse accessing lottoris de losse accessing lottoris de losse accessing lottoris de lottoris colonitative constrainte da lottoris de lo





PROJEC

2021 ANNUAL FACILITY PERFORMANCE REPORT GREENHILLS TAILINGS STORAGE FACILITY

MAIN TAILINGS DAM - PRISM C DISPLACEMENT PLOTS

PROJECT No.	Phase/Task/DOC.	Rev.	FIGURE
21452085	3000/3310/2021-204	0	C-5



TECK COAL LIMITED

ELKFORD, BC

GREENHILLS OPERATIONS





2021-03-08

WB

YYYY-MM-DD

2020/2021 AFPR Data (1 September 2020 to 31 August 2021)

Historic Data (Before 1 September 2020)

Notes: -Prism data reset on 8 December 2020 due to error in data processing -Data gaps present due to survey prisms being offline or removed during dam raise construction -Inverse velocity calculated in days/millimetre over the preceding three-month period -Inverse velocity data presented at the end of the calculation period (i.e. last day of period)









MEMBER OF WS

	YYYY-MM-DD	2021-03-08
	PREPARED	WB
R	DESIGN	KA
P	REVIEW	MBW
	APPROVED	AJH

PROJEC

2021 ANNUAL FACILITY PERFORMANCE REPORT GREENHILLS TAILINGS STORAGE FACILITY

MAIN TAILINGS DAM - PRISM C AVERAGE INVERSE VELOCITY PLOT

TITI

-			
PROJECT No.	Phase/Task/DOC. 3000/3310/2021 204	Rev.	FIGURE
21452005	3000/3310/2021-204	0	U-6







TECK COAL LIMITED

ELKFORD, BC

CONSULTANT

GREENHILLS OPERATIONS

GOLDER

MEMBER OF WSP

YYYY-MM-DD

PREPARED

DESIGN

REVIEW

APPROVED

2021-03-08

WB

KA

MBW

AJH

Initial Location

Final Location

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

2020/2021 AFPR data (1 September 2020 to 31 August 2021)

Grey Investigate (150 mm)

Blue Caution (250 mm)

Instrument Location

O

References: -2021 Aerial photo and topography provided by Teck Coal Limited. Flown 24 August 2021.

-Poism data reset on 8 December 2020 due to error in data processing following the 2020 dam raise construction Institutariose con o Colonitori 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris colonitative constrainte da lottoris de losse processing lottoris de losse accessing lottoris de losse accessing lottoris de losse accessing lottoris de lottoris colonitative constrainte da lottoris de lo





PROJEC

2021 ANNUAL FACILITY PERFORMANCE REPORT GREENHILLS TAILINGS STORAGE FACILITY

MAIN TAILINGS DAM - PRISM D DISPLACEMENT PLOTS

PROJECT No.	Phase/Task/DOC.	Rev.	FIGURE
21452085	3000/3310/2021-204	0	C-7

	_																																						
	5																																						
	4.5																																						
	4													_	_					_								_	_	_					_			_	
Ê	3.5				_	_								_	_					_								_	_						_			_	
m/m																																							
(da	3																																			-		-	
ocity	25																																						
Velc	2.J																																						
erse	2																																		_			_	
Inve																																							
age	1.5				_	_								_	_		_			_	_							_	_	_		-			_			_	
Ver								1				\wedge																											
4	1							1					\setminus																										
	0.5																								٨											\mathbf{n}	•		
	0.5																							-			-			-	-	-					\mathbf{V}		
	0																																						
		ec-14 ah-15	or-15	ın-15	Jg-15	ct-15	ec-15	eb-16	01-16	11-16 16-16	ct-16	ec-16	-17	pr-17	un-17	Jg-17	ct-17	ec-17	a r-18	ay-18	ul-18	Jg-18	ct-18	ec-18	ar-19	ul-19	ep-19	ov-19	an-20	a r-20	ay-20	ul-20	02-de	02-70 n-21	ar-21	ay-21	ul-21	ep-21	
	1	Ďů	Ā	JL	AI	0	Ō	ц, ,	¥ -	n A	0	õ	Ρ	A	٦٢	Al	0	Ó	Σ	Σ		AI O	0	Ō	ΣÏ		Š	Ň	Ĵ	Σ	Σ	(л Z		Σ	Š	ſ	Š	
											Lim S Of	ITED PER/) ATIO	NS											PRO 202 GR	JECT 1 AN EEN	NNU/ HILL	AL F .S T/	'ACII AILIN	_ITY \GS	PEF STC	RFOF RAC	RMA GE F	NCE ACII	E RE	POF	RT		
2020/2021 AFPR Data ((1 Septembe	r 2020 to	o 31 Aug	gust 202:	1)			CONS	BULTA	NT						YYY	Y-MN	1-DD		20	21-03-	08					• • • • •	NG	<u>م</u> ک	ΔΜ -	. PP	ISM	П						
IISTOLIC DALA (RELOLE 1	september 4	2020)	son bata (before 1 september 2020)																																				

Notes: -Prism data reset on 8 December 2020 due to error in data processing -Data gaps present due to survey prisms being offline or removed during dam raise construction -Inverse velocity calculated in day-millimetre over the preceding three-month period -Inverse velocity data presented at the end of the calculation period (i.e. last day of period)

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-03-08
PREPARED	WB
DESIGN	KA
REVIEW	MBW
APPROVED	AJH

PROJECT No.	Phase/Task/DOC.	Rev.	FIGURE
21452085	3000/3310/2021-204	0	C-8





TECK COAL LIMITED

ELKFORD, BC

CONSULTANT

GREENHILLS OPERATIONS

GOLDER

MEMBER OF WSP

YYYY-MM-DD

PREPARED

APPROVED

DESIGN

REVIEW

2021-03-08

WB

KA

MBW

AJH

Initial Location

Final Location

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

2020/2021 AFPR data (1 September 2020 to 31 August 2021)

Grey Investigate (150 mm)

Blue Caution (250 mm)

Instrument Location

O

References: -2021 Aerial photo and topography provided by Teck Coal Limited. Flown 24 August 2021.

-Poism data reset on 8 December 2020 due to error in data processing following the 2020 dam raise construction Institutariose con o Colonitori 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris colonitative constrainte da lottoris de losse processing lottoris de losse accessing lottoris de losse accessing lottoris de losse accessing lottoris de lottoris colonitative constrainte da lottoris de lo





PROJEC

2021 ANNUAL FACILITY PERFORMANCE REPORT GREENHILLS TAILINGS STORAGE FACILITY

MAIN TAILINGS DAM - PRISM E DISPLACEMENT PLOTS

PROJECT No.	Phase/Task/DOC.	Rev.	FIGURE
21452085	3000/3310/2021-204	0	C-9







TECK COAL LIMITED

ELKFORD, BC

CONSULTANT

GREENHILLS OPERATIONS

GOLDER

MEMBER OF WSP

YYYY-MM-DD

PREPARED

DESIGN

REVIEW

APPROVED

2021-03-08

WB

KA

MBW

AJH

Initial Location

Final Location

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

2020/2021 AFPR data (1 September 2020 to 31 August 2021)

Grey Investigate (150 mm)

Blue Caution (250 mm)

Instrument Location

O

References: -2021 Aerial photo and topography provided by Teck Coal Limited. Flown 24 August 2021.

-Poism data reset on 8 December 2020 due to error in data processing following the 2020 dam raise construction Institutariose con o Colonitori 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris colonitative constrainte da lottoris de losse processing lottoris de losse accessing lottoris de losse accessing lottoris de losse accessing lottoris de lottoris colonitative constrainte da lottoris de lo





2021 ANNUAL FACILITY PERFORMANCE REPORT

GREENHILLS TAILINGS STORAGE FACILITY

MAIN TAILINGS DAM - PRISM F DISPLACEMENT PLOTS

PROJEC

PROJECT No.	Phase/Task/DOC.	Rev.	FIGURE
21452085	3000/3310/2021-204	0	C-11

										-						-																	l
	5			1					1			1				1					1			1					1				
	4.5							_																			_				_		
	4																																
	4																																
2																																	
۲	2.5																																
<u>ب</u>	3.5																																
ay																																	
P)																																	
t v	3		_																														
oci																																	
>	2.5														-																		
se																																	
ēr																																	
2	2							_						_								_					_						
e _																																	
ы БО С																																	
e c	1.5													_	_							_					_						
Ň						$ \Lambda$																											
						/ `																											
	1									\mathbf{A}				_						_				\frown			_				_		
	_					/		/														•											
							¥													1											Ι		
	0.5										\mathbf{N}																						
	0.5																		•											- ¥			
	0																																
	4	5 2	ы.	νī	S C	0.0	9	9	ى و					5	8 0	x, x	00	00	00	61	6 61	6	<u>б</u>	0		20	0	0 5	1 1	1	12	-	
	ec-1	sb-1 or-1	un-1	tg-1 ct-1		or-1	un-1	18-1	ct-1		or-1	un-1 ue-1	ct-1	ec-1	ar-1	۲-1 1-1	- 1- ⁵	ct-1	ec-1	ar-1	ul-1	sp-1		n-2	α-7 Ε	nl-7	sp-2	2-2 2	ar-2	γ-2	nl-2	7-d	
	õ	A Fe	JL S	O A		e d	٦٢	AL		ů Ľ	A .	JL JL	0	õ	\geq	ž –	, AL	0	õ	Σ	Š	Se	ž	f Z	Š	_	S	ž í	ŗΣ	Š		N N	
					-																OJEOT												
					T	ECK	СОА		IITED)										20	21 AN	INUA	L FA	ACILI	TY F	PERF	ORM	ANC	E RE	EPO	RT		
					G	REE	NHIL	LS O	PER	ATION	١S									G	REEN	HILLS	S TA	ILIN	GS S	TOR	AGE	FAC	CILITY	(
					E	LKFC	DRD,	BC												_													
2020/2021 AFPR Data (1	September 2020	to 31 August 1	2021)		С	ONSUL	TANT					ΥY	YY-MM	-DD		2021-	-03-08			TIT		A II II			м -	סוסס							
Historic Data (Before 1 Se	eptember 2020)						_					PR	EPARE	D		WB							SOF		IVI - - \/				-				
Notes: -Prism data reset on 8 December 2020 due to -Data gaps present due to supply priems being	o error in data proces	sing during dam roise	e constructi	ion			0	50	LD) E F	2	DE	DESIGN KA							AVERAGE INVERSE VELOCITY PLOT													
-Data gaps present due to survey prisms being values of tendeved during dan hase constitution -Inverse velocity calculated in days/millimetre over the preceding three-month period -Inverse velocity data presented at the end of the calculation period (i.e. last day of period)			м	IEMBE	ROF	WSP		RE	VIEW			MBW				PROJECT No. Phase/Task/DOC. Rev.										FIGURE							
-inverse velocity data presented at the end of the calculation period (i.e. last day of period)			APPRC									APPROVED AJH							21452085 3000/3310/2021-204 0										C-12				





TECK COAL LIMITED

ELKFORD, BC

CONSULTANT

GREENHILLS OPERATIONS

GOLDER

MEMBER OF WSP

YYYY-MM-DD

PREPARED

APPROVED

DESIGN

REVIEW

2021-03-08

WB

KA

MBW

AJH

Initial Location

Final Location

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

2020/2021 AFPR data (1 September 2020 to 31 August 2021)

Grey Investigate (150 mm)

Blue Caution (250 mm)

Instrument Location

O

References: -2021 Aerial photo and topography provided by Teck Coal Limited. Flown 24 August 2021.

-Poism data reset on 8 December 2020 due to error in data processing following the 2020 dam raise construction Institutariose con o Colonitori 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris colonitative constrainte da lottoris de losse processing lottoris de losse accessing lottoris de losse accessing lottoris de losse accessing lottoris de lottoris colonitative constrainte da lottoris de lo





PROJEC

2021 ANNUAL FACILITY PERFORMANCE REPORT GREENHILLS TAILINGS STORAGE FACILITY

MAIN TAILINGS DAM - PRISM G DISPLACEMENT PLOTS

PROJECT No.	Phase/Task/DOC.	Rev.	FIGURE
21452085	3000/3310/2021-204	0	C-13

5 4.5 4 3.5 Average Inverse Velocity (day/mm) 3 2.5 2 1.5 1 0.5 0 May-18 Jul-18 0ct-18 Mar-20 May-20 Jul-20 Oct-16 Mar-18 Aug-18 Mar-19 May-19 Jul-19 Sep-19 Jan-20 Dec-14 Feb-15 Apr-15 Jun-15 Aug-15 Oct-15 Dec-15 Feb-16 Apr-16 Jun-16 Aug-16 Dec-16 Feb-17 Apr-17 Jun-17 Aug-17 Oct-17 Dec-17 Dec-18 Nov-19 Sep-20 Nov-20 Jan-21 Mar-21 May-21 Jul-21 Sep-21 PROJEC CLIENT TECK COAL LIMITED 2021 ANNUAL FACILITY PERFORMANCE REPORT **GREENHILLS OPERATIONS** GREENHILLS TAILINGS STORAGE FACILITY ELKFORD, BC 2020/2021 AFPR Data (1 September 2020 to 31 August 2021) CONSULTANT TITI YYYY-MM-DD 2021-03-08 MAIN TAILINGS DAM - PRISM G Historic Data (Before 1 September 2020) PREPARED WB Notes: -Prism data reset on 8 December 2020 due to error in data processing -Data gaps present due to survey prisms being offline or removed during dam raise construction -Inverse velocity calculated in days/millimetre over the preceding three-month period -Inverse velocity data presented at the end of the calculation period (i.e. last day of period) GOLDER AVERAGE INVERSE VELOCITY PLOT DESIGN KA MEMBER OF WSP REVIEW MBW PROJECT No. Rev. FIGURE Phase/Task/DO0 21452085 3000/3310/2021-204 0 C-14 APPROVED AJH





TECK COAL LIMITED

ELKFORD, BC

CONSULTANT

GREENHILLS OPERATIONS

GOLDER

MEMBER OF WSP

YYYY-MM-DD

PREPARED

APPROVED

DESIGN

REVIEW

2021-03-08

WB

KA

MBW

AJH

Initial Location

Final Location

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

2020/2021 AFPR data (1 September 2020 to 31 August 2021)

Grey Investigate (150 mm)

Blue Caution (250 mm)

O Instrument Location

References: -2021 Aerial photo and topography provided by Teck Coal Limited. Flown 24 August 2021.

-Porta proto and apportantly provided by reck coal Linked. How P August 2021. -Prism data reset on 8 December 2020 due to error in data processing following the 2020 dam raise construction Institutariose con o Colonitori 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris colonitative constrainte da lottoris de losse processing lottoris de losse accessing lottoris de losse accessing lottoris de losse accessing lottoris de lottoris colonitative constrainte da lottoris de lo





2021 ANNUAL FACILITY PERFORMANCE REPORT

GREENHILLS TAILINGS STORAGE FACILITY

MAIN TAILINGS DAM - PRISM H DISPLACEMENT PLOTS

PROJEC

PROJECT No.	Phase/Task/DOC	Rev.	FIGURE
21452085	3000/3310/2021-204	0	C-15

	5																																				
	4.5					_														_		_	_					_	_	_		_					
	4																																				
	2.5																																				
ਿ	3.5																																				
/mn/	3																																				
(day																																					
city	2.5					-								-																-			-				
Velo																																					
rse	2										8																										
Inve	1.5										Δ																										
age																														۲.							
Aver	1					_		-		4				-												•	-			$\left \right $		_	-		1		
								_																													
	0.5						/																												¥		
	0																																				
	0	c-14 b-15	r-15	n-15 2 1 F	6-10 t-15	c-15	0-16	r-16	-10 2-16	t-16	c-16	0-17	r-17	n-17	9-17 1	t-17	C-1/	r-18	у-то 1-18	18	t-18	c-18	r-19	y-19	1 T G	v-19 v-19	n-20	r-20	y-20	II-20	p-20	v-20	n-21	r-21	1-2-V	n	
		De Fel	Ap	Inl	OC OC	De	Fel	Ap	inr Bud	, 0 0	De	Fel	Ap	ınr .	βηξ	0				Aug	0	De	Ма	Ma	n öy	No.	Ja	Ma	Ma	Ju	Sel	No	Ja	Ma		Sel	
										1 114														PROJE	CT ANII		E/		ITV	DED		RMA					
							GR	REEN		S OI	PER	RATIC	NS											GRE	ENF	HLLS	TA	ILIN	GS	STO	RA	GE F	ACIL			NI	
2020/2021 AFPR Data	(1 Septembe	r 2020 to 3	1 August	: 2021)			CON	NSULT.	ANT						YYY	Y-MM	DD		202	21-03-0)8				J T /				м	ססו	GW	ы					
Historic Data (Before : tes:	L September 2	2020)							C	0			D		PRE	PARE	D		WE	3					RAC	GE IN	VVF	RS		ELO		'' 'Y PI	LOT				
ism data reset on 8 December 2020 d ata gaps present due to survey prisms verse velocity calculated in days/millim	te to error in dat being offline or r stre over the pre	a processing emoved duri ceding three	ng dam rais -month per	se constru riod	ction			5	ME	мве	R OF	WSP	R		REVI	IGN			KA MB	w									- · ·						0.17		
verse velocity data presented at the en	d of the calculati	ion period (i.e	e. last day o	ot period)											APP	ROVE	D		AJH	4			- :	21452	2085	J.	;	Phase 3000	/1ask/)/331	DOC. 10/20)21-:	204		0	lev.		C-16

AJH





TECK COAL LIMITED

ELKFORD, BC

CONSULTANT

GREENHILLS OPERATIONS

GOLDER

MEMBER OF WSP

YYYY-MM-DD

PREPARED

APPROVED

DESIGN

REVIEW

2021-03-08

WB

KA

MBW

AJH

Initial Location

Final Location

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

2020/2021 AFPR Data (1 September 2020 to 31 August 2021)

Grey Investigate (100 mm)

Blue Caution (130 mm)

Instrument Location

O

References: -2021 Aerial photo and topography provided by Teck Coal Limited. Flown 24 August 2021.

-Porta proto and apportantly provided by reck coal Linked. How P August 2021. -Prism data reset on 8 December 2020 due to error in data processing following the 2020 dam raise construction Institutariose con o Colonitori 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris colonitative constrainte da lottoris de losse processing lottoris de losse accessing lottoris de losse accessing lottoris de losse accessing lottoris de lottoris colonitative constrainte da lottoris de lo





PROJEC

2021 ANNUAL FACILITY PERFORMANCE REPORT GREENHILLS TAILINGS STORAGE FACILITY

WEST TAILINGS DAM - PRISM I DISPLACEMENT PLOTS

PROJECT No	Phase/Task/DOC	Rev	FIGURE
21452085	3000/3310/2021-204	0	C-17

ec-14 b-15 ln-15 lg-15 l	ec-15 eb-16	pr-16 1n-16	ug-16 ct-16	ec-16	eb-17 or-17	in-17	Jg-17	ct-17	ec-1/ ar-18	ay-18	ul-18	ug-18 ct-18	ec-18	ar-19	11-19	ep-19	ov-19	an-20	ar-20 ay-20	ul-20	ep-20	ov-20	an-21	ar-21	ul-21	22 20-21
ÅK 1													•	-9												
1.5 1.5																									*	
2 cerse X																	•									
A 2.5																									-	•
u//u																										
E 3.5																										
4.5																										
4.5																										

MEMBER OF WSP

REVIEW

APPROVED

MBW

AJH

PROJECT No.

21452085

Phase/Task/DOC

3000/3310/2021-204

Rev. 0 FIGURE

C-18

-Prism data reset on 8 December 2020 due to error in data processing -Data gaps present due to survey prisms being offline or removed during dam raise construction -Inverse velocity calculated in days/millimetre over the preceding three-month period -Inverse velocity data presented at the end of the calculation period (i.e. last day of period)





TECK COAL LIMITED

ELKFORD, BC

CONSULTANT

GREENHILLS OPERATIONS

GOLDER

MEMBER OF WSP

YYYY-MM-DD

PREPARED

DESIGN

REVIEW

APPROVED

2021-03-08

WB

KA

MBW

AJH

Initial Location

Final Location

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

2020/2021 AFPR Data (1 September 2020 to 31 August 2021)

Grey Investigate (100 mm)

Blue Caution (130 mm)

Instrument Location

O

References: -2021 Aerial photo and topography provided by Teck Coal Limited. Flown 24 August 2021.

-Porta proto and apportantly provided by reck coal Linked. How P August 2021. -Prism data reset on 8 December 2020 due to error in data processing following the 2020 dam raise construction Institutariose con o Colonitori 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris colonitative constrainte da lottoris de losse processing lottoris de losse accessing lottoris de losse accessing lottoris de losse accessing lottoris de lottoris colonitative constrainte da lottoris de lo





2021 ANNUAL FACILITY PERFORMANCE REPORT

GREENHILLS TAILINGS STORAGE FACILITY

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

PROJEC

PROJECT No.	Phase/Task/DOC	Rev.	FIGURE
21452085	3000/3310/2021-204	0	C-19

age Invers	1.5	\land			1	
e Se	2					
Velocity (d	2.5					
ay/mm)	3					
З	3.5					
4	4.5					

MEMBER OF WSP

REVIEW

APPROVED

MBW

AJH

PROJECT No.

21452085

Phase/Task/DOC

3000/3310/2021-204

FIGURE

C-20

Rev.

0

Notes: -Prism data reset on 8 December 2020 due to error in data processing -Data gaps present due to survey prisms being offline or removed during dam raise construction -Inverse velocity calculated in days/millimetre over the preceding three-month period -Inverse velocity data presented at the end of the calculation period (i.e. last day of period)

File Path: https://golderassociates.sharepoint.com/f./r/sites/118622/Project%20Files/5%20Technical%20Work/3000%20-%20DS1%20[Dams /2020%20DS1%20Analysis%20Golder/2020%20DS1%20Reporting%20Period?csf=1&web=1&e=ioUtsR





Initial Location

Final Location

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

2020/2021 AFPR Data (1 September 2020 to 31 August 2021)

Grey Investigate (100 mm)

Blue Caution (130 mm) O

Instrument Location

References: -2021 Aerial photo and topography provided by Teck Coal Limited. Flown 24 August 2021.

-Poism data reset on 8 December 2020 due to error in data processing following the 2020 dam raise construction Institutariose con o Colonitori 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris colonitative constrainte da lottoris de losse processing lottoris de losse accessing lottoris de losse accessing lottoris de losse accessing lottoris de lottoris colonitative constrainte da lottoris de lo





PROJEC 2021 ANNUAL FACILITY PERFORMANCE REPORT

GREENHILLS TAILINGS STORAGE FACILITY

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

21452085	3000/3310/2021-204	0	C-21
	Phase/Teal//DOC	Pov	FICURE

CLIENT TECK COAL LIMITED **GREENHILLS OPERATIONS**

ELKFORD, BC

CONSULTANT

GOLDER MEMBER OF WSP



2021-03-08

YYYY-MM-DD

4.5	
3.5	
citA (da/ mm 2.5	
2 2 4 6 0 1.5 2 6 0 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	
Acrage	
Dec-14 Pec-14 Apr-15 Jun-15 Aug-15 Oct-15 Oct-15	Feb-16 Apr-16 Jun-16 Jun-16 Jun-16 Jun-17 Dec-16 Dec-16 Dec-16 Jun-17 Apr-17 Jun-17 Apr-16 Dec-16 Dec-16 Jun-17 Apr-17 Jun-17 Apr-18 Jun-17 Aug-19 Jul-18 Jul-18 Jul-19 Jul-19 Jul-19 Jul-19 Jul-20 Jul-20 Jul-20 Jul-20 Jul-21 Jul-21
	CLIENT TECK COAL LIMITED GREENHILLS OPERATIONS

Historic Data (Before 1 September 2020)

Notes: Prism data reset on 8 December 2020 due to error in data processing Data gaps present due to survey prisms being offline or removed during dam raise construction Inverse velocity calculated in days/millimetre over the preceding three-month period Inverse velocity data presented at the end of the calculation period (i.e. last day of period)



CONSULTANT

YYYY-MM-DD	2021-03-08	
PREPARED	WB	
DESIGN	KA	
REVIEW	MBW	
APPROVED	AJH	_

WEST TAILINGS DAM - PRISM K AVERAGE INVERSE VELOCITY PLOT

-	PROJECT No.	Phase/Task/DOC.	Rev.	FIGURE
	21452085	3000/3310/2021-204	O	C-22





TECK COAL LIMITED

ELKFORD, BC

CONSULTANT

GREENHILLS OPERATIONS

GOLDER

MEMBER OF WSP

YYYY-MM-DD

PREPARED

APPROVED

DESIGN

REVIEW

2021-03-08

WB

KA

MBW

AJH

Initial Location

Final Location

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

2020/2021 AFPR Data (1 September 2020 to 31 August 2021)

Grey Investigate (100 mm)

Blue Caution (130 mm)

Instrument Location

O

References: -2021 Aerial photo and topography provided by Teck Coal Limited. Flown 24 August 2021.

-Poism data reset on 8 December 2020 due to error in data processing following the 2020 dam raise construction Institutariose con o Colonitori 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris colonitative constrainte da lottoris de losse processing lottoris de losse accessing lottoris de losse accessing lottoris de losse accessing lottoris de lottoris colonitative constrainte da lottoris de lo





PROJEC

2021 ANNUAL FACILITY PERFORMANCE REPORT GREENHILLS TAILINGS STORAGE FACILITY

WEST TAILINGS DAM - PRISM L **DISPLACEMENT PLOTS**

21452085	3000/3310/2021-204	0	C-23
PROJECT No.	Phase/Task/DOC.	Rev.	FIGURE

5		
4.5		
4		
3.5		
E 3		
2.5		
A		
0.5		
O Dec-14 Feb-15 Apr-15 Jun-15 Aug-15 Oct-15	Dec-15 Feb-16 Jun-16 Jun-16 Aug-16 Oct-16 Dec-16 Jun-17 Jun-17 Jun-17 Jun-17 Dec-17 May-18 Jul-18 Jul-18 Jul-18 Jul-18 Jul-18 Dec-13	Mar-19 May-19 Jul-19 Sep-19 Jan-20 Jul-20 Jul-20 Jul-21 Jul-21 Jul-21 Sep-21 Sep-21 Sep-21 Sep-21
	CLIENT TECK COAL LIMITED GREENHILLS OPERATIONS FL KEORD, BC	PROJECT 2021 ANNUAL FACILITY PERFORMANCE REPORT GREENHILLS TAILINGS STORAGE FACILITY
)20/2021 AFPR Data (1 September 2020 to 31 August 2021) istoric Data (Before 1 September 2020)	CONSULTANT YYYY-MM-DD 2021-03-08	TITLE WEST TAILINGS DAM - PRISM L

AVERAGE INVERSE VELOCITY PLOT

Phase/Task/DOC

3000/3310/2021-204

FIGURE

C-24

Rev.

0

PROJECT No.

21452085

GOLDER

MEMBER OF WSP

DESIGN

REVIEW

APPROVED

KA

MBW

AJH

Notes: Prism data reset on 8 December 2020 due to error in data processing Data gaps present due to survey prisms being offline or removed during dam raise construction Inverse velocity calculated in day/millimetre over the preceding three-month period Inverse velocity data presented at the end of the calculation period (i.e. last day of period)





Initial Location

Final Location

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

2020/2021 AFPR Data (1 September 2020 to 31 August 2021)

Grey Investigate (100 mm)

Blue Caution (130 mm)

Instrument Location

O

References: -2021 Aerial photo and topography provided by Teck Coal Limited. Flown 24 August 2021.

-Poism data reset on 8 December 2020 due to error in data processing following the 2020 dam raise construction Institutariose con o Colonitori 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris il losse processing lottoring tais 2000 dos lottoris colonitative constrainte da lottoris de losse processing lottoris de losse accessing lottoris de losse accessing lottoris de losse accessing lottoris de lottoris colonitative constrainte da lottoris de lo





2021 ANNUAL FACILITY PERFORMANCE REPORT GREENHILLS TAILINGS STORAGE FACILITY

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

PROJEC

PROJECT No. Phase/Task/DOC	Rev.	FIGURE
----------------------------	------	--------

CLIENT TECK COAL LIMITED

GREENHILLS OPERATIONS ELKFORD, BC

CONSULTANT

GOLDER MEMBER OF WSP

DESIGN	KA
REVIEW	MBW
APPROVED	ΔIH

2021-03-08

WB

YYYY-MM-DD

PREPARED

	0	Pec-14 Feb-15	Apr-15	Jun-15	ct-115	Dec-15	Feb-16	Apr-16	Jun-16	Aug-16	0ct-16	Abr-17	71-911A	Oct-17	Dec-17	Mar-18	May-18	Jul-18	Aug-18	OCT-18	Mar-19	May-19	Jul-19	Sep-19	Nov-19	Jan-20	Mar-20	Jul-20	Sep-20	Nov-20	Jan-21	Mar-21	Jul-21	Sep-21
Average	1 0.5												~															\checkmark	•					
Inverse	1.5																																	
Velocity (2.5							\wedge	\bigvee																									
day/mm]	3									/																								
	3.5																																	
	4																																	
	4.5																																	

MEMBER OF WSP

REVIEW

APPROVED

MBW

AJH

PROJECT No.

21452085

Phase/Task/DOC

3000/3310/2021-204

FIGURE

C-26

Rev.

0

-Prism data reset on 8 December 2020 due to error in data processing -Data gaps present due to survey prisms being offline or removed during dam raise construction -Inverse velocity calculated in days/millimetre over the preceding three-month period -Inverse velocity data presented at the end of the calculation period (i.e. last day of period)

APPENDIX D

Vibrating Wire Piezometer Data





MEMBER OF WSP

REVIEW

APPROVED

MBW

AJH

PROJECT No.

21452085

Phase/Task/DO(

3000/3310/2021-204

Rev.

0

FIGURE

D-1

- Malfunctioning data loggers or instruments --
- Intermittent data signal from instrument



- "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



File Path: https://golderassociates.sharepoint.com/f:/r/sites/118622/Project%20Files/5%20Technical%20Work/3000%20-%20DSI%20(Dams)/2020%20DSI%20Analysis%20Golder/2020%20DSI%20Reporting%20Period?csf=1&web=1&e=214QjQ



YYY-MM-DD	2021-03-08
REPARED	KA
ESIGN	KA
REVIEW	MBW
APPROVED	AJH

GREENHILLS STORAGE TAILINGS FACILITY 2021 ANNUAL FACILITY PERFORMANCE REPORT

TITLE MAIN TAILINGS DAM SD SERIES B (Lower) PIEZOMETERS PROJECT No. Rev. FIGURE Phase/Task/DO(21452085 3000/3310/2021-204 0 D-2






golder.com