

Construction Quality Management Plan (CQMP) Dry Stack Tailings Facility – Phase 2 Keno Hill Mine, YT



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Appendix A Tetra Tech’s Limitations on the Use of this Document

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Hecla Mining Company and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Hecla Mining Company, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

This document presents the Construction Quality Management Plan (CQMP) for construction of the Phase 2 Dry Stacked Tailings Facility (DSTF P2) at the Keno Hill Silver District Mining Operations (Keno Hill) near Keno City, Yukon. Keno Hill is an underground silver, lead, and zinc mine owned and operated by Hecla Mining Company (Hecla).

The CQMP outlines quality requirements and objectives for construction of the DSTF P2 facility. Key components of the plan include:

- Define roles and responsibilities for construction and engineering team
- Specify requirements for documenting and reporting quality assurance and quality control activities
- Define performance specifications for project materials
- Outline the process control measures including inspection and testing protocols (including inspection hold points) to verify compliance with the design
- Detail testing procedures necessary to verify quality, including frequency, sampling methods, and acceptance criteria

The CQMP is living document that will be updated as required to reflect design updates, construction works, field directives, organizational changes, or other factors impacting CQMP execution.

The CQMP should be referenced in conjunction with the DSTF Phase 2 Construction Drawings (revision in progress) and DSTF Phase 2 Construction Specifications (revision in progress). References to the DSTF in this document include the tailings deposition area, perimeter ditching, sumps, conveyances and any other components indicated in the Construction Drawings and Specifications.

2.0 ROLES AND RESPONSIBILITIES

2.1 Key Roles

Construction works will be completed by Hecla's Contractor or Subcontractor (referred to collectively as Contractor for this document). Hecla's internal project team will include a Construction Manager to oversee daily operations, and a Project Manager to provide overall project coordination.

Quality control (QC) and quality assurance (QA) testing will not be completed by separate organizations on this project. QA/QC testing will be completed concurrently by Hecla's construction monitoring team, comprising personnel from Tetra Tech Canada Inc. (Tetra Tech).

Construction activities will be supported by Tetra Tech's Engineer, who is familiar with the design and northern construction, and will review construction works for compliance with the design and specifications. The Engineer will liaise with Hecla's project team on work progress, construction issues, and deviations from design.

The DSTF P2 design has been completed under the oversight of Tetra Tech's Engineer of Record (EoR). Deviations from design must be reviewed and authorized by the EoR prior to implementation.

The roles and responsibilities of the construction team are summarized in Table 2-1. It should be noted that one individual may perform multiple functions depending on specific site requirements and the number of technical staff on site.

Table 2-1: Construction Team Responsibilities

Team Member	Organization	Overview of Duties
Contractor (or Subcontractor)	Various	- Execute construction activities in accordance with the design and specifications - Adhere to the CQMP and other guiding documents - Monitor construction activities and report non-conformances to Construction Supervisor - Plan and execute survey services of completed construction activities
Project Manager	Hecla	- Provide overall project oversight and coordination on behalf of Hecla - Audit consultant QA/QC reporting
Construction Supervisor	Hecla	- Oversee daily construction activities and monitor compliance with design - Monitor Contractor safety, environmental management, schedule and other contract related matters - Coordinate with Hecla operations staff to support construction as required - Distribute and track formal communications and responses
Engineer	Tetra Tech	- Review construction reporting and QA/QC results - Provide direction on design related issues and design modifications approved for construction - Inform Hecla project team of any potentially required design modifications - Complete site visits as required to review work progress and confirm compliance with design - Review construction surveys - Report non-conformances to Construction Supervisor
Construction Monitor	Tetra Tech	- Monitor and document construction activities, noting work progress, design/construction issues and deviations from design - Complete QA/QC testing - Report non-conformances to Construction Supervisor
Engineer of Record	Tetra Tech	Review non-conformances and approve design modifications

2.2 RACI Chart

A RACI matrix, identifying responsibility for key tasks is presented in Table 1, attached. The RACI table categorizes the positions into the following categories for each task:

- R – Responsible:** Those who do the work to achieve the task. At least one role must be Responsible for each task, although others can be delegated to assist in the work required.
- A – Accountable:** The one ultimately answerable for the correct and thorough completion of the deliverable or task, and the one who delegates the work to those responsible. In other words, an Accountable individual must sign off (approve) on work that Responsible personnel provide.
- C – Consulted:** Those whose opinions are sought, typically subject matter experts; and with whom there is two-way communication.

- **I – Informed:** Those who are kept up to date on progress, often only on completion of the task or deliverable; and with whom there is just one-way communication.

3.0 ON-SITE COMMUNICATION AND REPORTING

3.1 Submissions

All formal communications will be submitted digitally via email through Hecla's Construction Supervisor. The Construction Supervisor will review and action submissions and distribute to the required parties.

Documents requiring formal communication include the following:

- **Design Change Notice (DCN):** DCN's will be provided by the Engineer and distributed the Contractor for implementation. The DCN will be reviewed and approved by the Hecla project team prior to implementation.
- **Request for Information (RFI):** RFI's will be submitted by the Contractor and responded to by Construction Supervisor with support from the Engineer as required.
- **Non-Conformance Report (NCR):** NCR's may be submitted by any member of the construction team. Additional details on NCR's are provided in the follow sections.

3.2 Daily Summary Reports

Daily summary reports documenting work progress, safety incidents, test results, and other details relevant to the work will be submitted to the Construction Supervisor by the Contractor and Construction Monitor. Summary reports will include photo documentation of the construction activities.

3.3 Request for Concessions and Change Management

A concession is written authorization to use or release an item(s) that do not conform to contractual, scope, design, or specified requirements. Concessions can be requested using an RFI request. The response will be provided in writing, utilizing the RFI and DCN processes as necessary.

3.4 Construction Coordination Meetings

Construction coordination meeting will be held between the Contractor and Hecla's project team. Specific meeting requirements will be established for each phase of the work; however, as a minimum the following should be implemented:

- **Daily Coordination Meeting:** Held daily to review planned construction activities, progress from the day before, requirements for QAQC testing and any safety or environmental concerns. These meetings should be attended by the Contractor, the Construction Supervisor and Construction Monitor
- **Weekly Project Review Meeting:** Weekly meeting to review overall project schedule and forecast, budget and pay items, project safety and environment concerns, design and construction issues and other project related matters. This meeting would be attended by the Contractor, Hecla's Construction Supervisor and Project Manager, the Engineer and Construction Monitor if required. The Engineer of Record is not required to attend but should be provided with minutes from the meeting and be informed of any potential design modifications.

3.5 Construction Records Reporting

The Contractor will maintain a set of red line drawings, documenting all changes and modifications to the design. A final as-built report will be submitted by the Contractor to the Construction Supervisor that provides the following:

- Construction photos;
- Quality Assurance test results;
- As-built drawings;
- Executed DCNs, RFIs, and NCRs; and
- Completed inspection test plan (ITP) with sign offs from all required parties.

The Engineer will submit all compiled Daily Field Reports, Lab Testing Reports, and Site Inspection Reports to the Project Manager and Construction Supervisor.

4.0 NON-CONFORMANCE REPORTS (NCR)

A non-conformance can be identified by any member of the project team. Non-conformances will be identified through the QA/QC process of this CQMP and can be identified at any time throughout the project. All non-conformances will be logged for appropriate trending and analysis of such events.

Prior to initiating a formal NCR, effort will be made by the on-site personnel to correct minor non-conformances. In the event appropriate resolution cannot be reached, a non-conformance report (NCR) must be completed and submitted to the Construction Supervisor. Verbal notification of the non-conformance will be issued that day and included in the daily field report. The Construction Supervisor will determine the completeness and appropriateness of the NCR and, if warranted, will submit the NCR to the appropriate personnel.

Specific non-conformance requirements for construction tasks are provided in the following sections.

5.0 QUALITY MANAGEMENT

This section outlines QA/QC procedures and process control measures. These measures are intended to verify compliance with design and specifications. QA/QC activities will be completed by the Construction Monitors and Contractor and overseen by Hecla's Construction Supervisor. The Engineer will review QA/QC test results and reporting and provide support for any design modifications or corrective action. An overview of QA/QC services and documentation requirements is summarized in Table 5-1 and additional details provided in the following sections.

Table 5-1: QA/QC Services Overview

Service	Documentation
Construction Monitoring (General)	Daily field report, site photographs and site inspection reports at critical stages defined in ITP
Granular Material Processing	Daily field report and lab test report as required
Foundation Preparation and Excavation	Daily field report, site photographs, As-built survey, foundation approval
Granular Material Placement	Daily field report, lab test reports as required, site inspection reports at critical stages defined in ITP, approval for liner placement, As-built survey

Liner System	Daily field report, site photographs and site inspection reports at critical stages defined in ITP, As-built survey
Culverts	Daily field report, site photographs and site inspection reports at critical stages defined in ITP, As-built survey
Instrumentation	Daily field report, site photographs and site inspection reports at critical stages defined in ITP

Periodic Quality Management Audits will be performed during construction by Hecla's Project Manager or Construction Supervisor. The purpose of the audit will be to determine whether the quality management activities conform to the planned arrangements and the requirements of this CQMP; and are being effectively documented. The results of the audit shall be documented and provided to the required parties so that any steps necessary to ensure conformance can be taken.

5.1 Construction Monitoring General

Construction monitoring will be completed during all phases of construction work. As a minimum this will include visual observation of construction activities by the Construction Supervisor and Construction Monitor. Periodic inspections will be provided by the Engineer and Project Manager as required.

On-site QA/QC tasks relate to verifying compliance with construction specifications, completing laboratory and in situ testing and collecting samples to verify compliance with the specifications. The testing occurrences and frequencies will depend on the rate of production and/or placement of material. Construction activities will be documented as part of the daily report. This will include a written description of work tasks as well as photo documentation.

Hold points (a predetermined stopping point in the construction process at which time the work must be inspected) on the site occur after a series of tests have been completed and a change in the work is about to commence. An inspection test plan (ITP) detailing construction activity and hold points is provided in Table 2, attached. The ITP shall be reviewed and signed off by the Contractor, Construction Supervisor and Construction Monitor at identified hold points to denote approval of construction and authorization to proceed.

5.2 Granular Material Processing

5.2.1 Construction Works

Granular materials are required for construction and will require processing (crushing and/or screening) to achieve the desired gradation. Granular materials for the Phase 2 DSTF include the following:

- 50 mm Minus Granular Fill – Granular fill will be used for drainage blanket and liner cover material. It comprises a 50 mm minus sand and gravel having less than 5 percent fines.
- 20 mm Minus Granular Fill – Used for road surfacing and culvert backfill. It comprises a 20 mm minus sand and gravel having less than 10 percent fines.
- Coarse Bulk Fill – Used for buttress and berm construction and general fill. It may be sourced from natural sources, processed sources, waste rock piles, or other sources approved by the Project Manager. It comprises well graded sand and gravel having a maximum particle size of 500 mm, and a D₅₀ of 100 mm

All granular materials will be sourced or produced from waste rock piles, naturally occurring deposits, or alternate sources, as approved by the Construction Supervisor.

All granular materials must be non-acid generating or metal leaching (N-AML) as defined in Hecla's Waste Rock Management Plan (Ensero Solutions, 2021).

Granular material shall be stockpiled in locations approved by the Construction Supervisor. Stockpile locations are to be level and well drained and sufficiently separated to prevent intermixing of materials. Granular material shall be stockpiled in uniform layers with a maximum thickness of 1 m, to reduce segregation potential.

Additional details related to material processing are provided in the Construction Specifications.

5.2.2 QA/QC Testing and Procedures

5.2.2.1 50 mm Minus Granular Fill

Particle size analyses will be completed in accordance with ASTM D7928 and C136 at the following minimum frequencies:

- 1 test per 500 m³ of material produced.

Moisture density relationship shall be completed in accordance with ASTM D698 at the following minimum frequency:

- 1 test per 5,000 m³ of material produced.

The following measures will be implemented as part of inspection and QA/QC Procedures:

- The Construction Monitor shall witness the source material and stockpiled material to ensure product is free of organics, garbage, unsuitable or other deleterious materials, and provide daily production summaries for the Engineer to review.
- The Construction Monitor shall complete on-site material testing and visually inspect the particle size distribution of the produced materials.
- The Engineer shall review all QAQC testing results, daily field reports, and lab test reports and provide feedback as necessary.

5.2.2.2 20 mm Minus Granular Fill

Particle size analyses will be completed in accordance with ASTM D7928 and C136 at the following minimum frequencies:

- 1 test per 500 m³ of material produced.

Moisture density relationship shall be completed in accordance with ASTM D698 at the following minimum frequency:

- 1 test per 5,000 m³ of material produced.

The following measures will be implemented as part of inspection and QA/QC Procedures:

- The Construction Monitor shall witness the source material and stockpiled material to ensure product is free of organics, garbage, unsuitable or other deleterious materials, and provide daily production summaries for the Engineer to review.

- The Construction Monitor shall complete on-site material testing and visually inspect the particle size distribution of the produced materials.
- The Engineer shall review all QAQC testing results, daily field reports, and lab test reports and provide feedback as necessary.

5.2.2.3 Coarse Bulk Fill

Coarse Bulk Fill shall be monitored visually for compliance with the requirements in Section 5.1.2. The material will be photographed with reference markers to confirm appropriate gradation visually.

The following measures should be implemented as part of the inspection and engineering review process:

- The Construction Monitor shall witness the source material and stockpiled material to ensure product is free of organics, garbage, unsuitable or other deleterious materials, and provide daily production summaries for the Engineer to review.
- The Construction Monitor shall visually inspect the particle size distribution of the produced materials.
- The Engineer shall review all QAQC testing results, daily field reports, and lab test reports and provide feedback as necessary.

5.2.3 Non-Conformance

Non-conforming material comprises granular material that does not meet the Technical Specifications as evaluated through QA/QC testing. Non-conforming material should be prevented from unintentional use or installation. Protocol outlined below will be followed in the case of non-conforming material:

- Construction Monitor to Inform the Engineer and Construction Supervisor immediately of test results that do not meet the Technical Specifications.
- Adjust stockpile location or place produced material in a reject stockpile, to isolate the material in question.
- Construction Monitor, Construction Supervisor and Contractor will coordinate to determine potential cause of non-conforming material. If necessary operating adjustments will be made to eliminate non-conforming material.
- Complete duplicate testing of the sample to confirm results.
- The Construction Monitor will complete a visual inspection of the material gradation and the sampling area.
- If the duplicate testing and the Construction Monitor's inspection indicate conforming material, continue production and stockpiling.
- If the duplicate testing and the Construction Monitor inspection indicate non-conforming material, segregate non-conforming material in a reject stockpile as directed by the Engineer. Prepare and submit a non-conformance report (NCR). Notify the Construction Supervisor and provide directions to the Contractor as required to obtain conforming material.
- Irrespective of compliance or non-compliance with the gradation and physical property requirements of this specification, aggregates may be accepted or rejected based on field performance, as determined by the Engineer.

The Engineer and Construction Supervisor shall be notified of the non-conforming material after efforts to correct non-conformance through an NCR using the form provided by the Engineer.

5.3 Foundation Preparation and Excavation

5.3.1 Construction Works

The Phase 2 DSTF footprint overlies discontinuous permafrost. Subsurface conditions generally consist of a thin organic layer, underlain by frozen silt or sand till, underlain by bedrock. Sands and gravels were noted in some locations. Site investigation identified ice-rich ground conditions, particularly in the northwest portion of the facility.

The organic mat underlying the tailings containment footprint should generally be left in place and traffic over the ground surface minimized to reduce potential for excessive differential thaw settlement under the facility. Exceptions to this, if any, will be delineated and communicated by the Engineer, and may include sump excavation and ditching.

Foundation preparation and construction consists of:

- Hand cutting and removal of all trees and vegetation larger than 50 mm in diameter with minimal disturbance to the organic surface. Vegetation smaller than 50 mm in diameter can be left in place. Vegetation removal will be in accordance with Specifications.
- Note that some areas may allow for use of equipment to remove vegetation, as approved by the Engineer and Construction Supervisor.
- Excavation for sumps (permanent and temporary) and conveyance systems, as required.
- When working within existing road and/or pad footprint(s), the Construction Monitor will assess that ground conditions are in accordance with the Specifications.

5.3.2 QA/QC Testing and Procedures

The following measures will be implemented as part of inspection and QA/QC Procedures:

- The Construction Monitor shall witness the completed site clearing, and verify it is completed in accordance with the Specifications.
- The Construction Monitor shall inspect subgrades and/or excavated surfaces to verify suitability of subgrade conditions.
- The following survey requirements shall be implemented:
 - The Contractor shall provide survey layout for all work areas.
 - The Contractor shall provide as-built surveys for the cleared ground surface prior to and after placement of the drainage blanket.
 - The Construction Monitor, in consultation with the Engineer, shall review all as-built surveys to verify compliance with the Construction Drawings.
- The Engineer shall review all daily field reports, site photographs, and survey data and provide feedback as necessary.

5.3.3 Non-Conformance

Non-conformances for foundation preparation and excavation shall include but are not limited to the following:

- Excavations or placed granular material that is not completed to the lines and dimensions shown on the Construction Drawings.
- Excavation or removal of organic material during clearing and drainage blanket material placement.
- Inadequate removal of trees and vegetation with the DSTF footprint.

The protocol outlined below shall be followed in the case of non-conforming foundations or excavation:

- The Engineer and Construction Supervisor shall be notified of the non-conformance through an NCR using the form provided by either the Construction Monitor, Engineer or client.
- Non-conformance to be reviewed by the Engineer and direction provided to Construction Supervisor.
- Work related to non-conformance should be paused until direction given by the Construction Supervisor.

5.4 Granular Material Placement

5.4.1 Construction Works

Earthworks and material placement is required at several stages of construction, including but not limited to:

- Upstream diversion berm – consists of 50 mm Minus Granular Fill. Placed in lifts and compacted in accordance with the Specifications. Berm extends along the uphill side of the facility to intercept and direct non-contact water away from the facility.
- Drainage Blanket - Construction and placement of a 0.6 m thick granular drainage blanket of 50 mm Minus Granular Fill throughout the Phase 2 East footprint. This layer will allow for drainage of water generated from near-surface permafrost thaw out of the footprint, if required, and provide a stable bearing surface for liner system placement. The material should be placed in a “pad-out” construction method to prevent equipment from travelling directly on the organic surface. It should be compacted with a smooth drum roller.
- Toe buttress – consists of Coarse Bulk Fill. Placed in lifts and compacted in accordance with the Specifications. The toe buttress is necessary for facility geometry and physical stability.
- Sump and conveyance system – consists of 50 mm Minus Granular Fill, as required. Placed in lift thicknesses and compacted in accordance with the Specifications. Conveyance systems and sumps will convey contact water from surface runoff within the facility or from seepage to the Mill Pond for treatment.
- Liner cover material – consists of 50 mm Minus Granular Fill. Placed in lift thicknesses and track packed in accordance with the Specifications. This cover material is intended as a ballast for the liner system. Tailings will be deployed directly onto this layer.
- Culvert and/or buried pipe bedding/backfill – consists of 20 mm Minus Granular Fill Placed in lift thicknesses and compacted in accordance with the Specifications.

As-built surveys will be completed after structure completion as defined in ITP. Survey data will be reviewed and confirmed prior to authorizing subsequent material placement or construction.

5.4.2 QA/QC Testing and Procedures

The following measures will be implemented as part of inspection and QA/QC Procedures:

- The Construction Monitor shall observe placement of the granular drainage blanket, including lift thickness and compaction effort, and verify it is completed in accordance with the Specifications.
- The Construction Monitor shall complete field density testing for 20 mm and 50 mm minus granular fill, and coarse bulk fill
- The Construction Monitor shall complete proof rolls coarse bulk fill as required in areas of concern, or to establish rolling patterns for the material.
- The following survey requirements shall be implemented:
 - The Contractor shall provide survey layout for all work areas
 - The Contractor shall provide as-built surveys for completed structures and material interfaces
 - The Construction Monitor, in consultation with the Engineer, shall review all as-built surveys to verify compliance with the Construction Drawings
- The Engineer shall review all daily field reports, site photographs, and survey data within two working days and provide feedback as necessary.

Field density testing shall be conducted in accordance with ASTM D2922. The Specifications detail target compaction and moisture content for each material type. Testing shall be completed at the following frequencies:

- A minimum of 1 test per 500 m², per lift, for granular material within the DSTF footprint.
- A minimum of 2 tests per 100 m of linear infrastructure, with a minimum of 3 tests per lift.

5.4.3 Non-Conformance

Non-conformances for granular material placement shall include but are not limited to the following:

- Granular material that does not meet compaction requirements.
- Granular material that has been placed in lifts exceeding specified thickness.
- Granular material that has not been placed to the designated linework as shown on the Construction Drawings.

The protocol outlined below shall be followed in the case of non-conformance related to granular material placement:

- The Engineer and Construction Supervisor shall be notified of the non-conformance through an NCR using the form provided by either the Construction Monitor, Engineer or client.
- Non-conformance to be reviewed by the Engineer and direction provided to Construction Supervisor.
- Areas not meeting compaction requirements shall be recompact and tested. Excavation and material replacement may be required in areas where specified compaction cannot be met.
- Work related to non-conformance should be paused until direction given by the Construction Supervisor.

5.5 Liner System

5.5.1 Construction Works

A liner system is required to be deployed under the DSTF footprint and perimeter ditches. In order from bottom to top, this comprises:

- Lower Non-Woven Geotextile – intended as cushion layer for overlying geosynthetics.
- Geosynthetic Clay Liner – A geosynthetic clay liner (GCL) is to be installed above the drainage blanket to intercept any seepage from the DSTF and prevent tailings seepage from infiltrating the drainage layer and underlying foundation soils. The GCL consists of a layer of bentonite clay between layers of woven geotextile and nonwoven geotextile. The nonwoven geotextile should be oriented upwards.
- Geonet and Non-Woven Geotextile Drain - A geonet topped with non-woven geotextile is placed above the GCL. This drain will aid in alleviating porewater pressure build-up and allow transport of seepage, if necessary.
- Liner Cover Material – A 300 mm thick layer of cover liner / ballast material is to be placed directly on the liner system. The cover material will be comprised of 50 mm Minus Granular material and will be placed in a “pad-out” method, similar to the Drainage Blanket, to prevent tracked equipment from damaging the GCL and Geonet layers and maintain minimum required liner coverage. Tailings will be deposited directly onto this layer.

This liner system is also required in sumps and ditches not along the facility perimeter, with the exception that the geonet material is not required for these structures.

5.5.2 QA/QC Testing and Procedures

The following measures will be implemented as part of inspection and QA/QC Procedures:

- The Construction Monitor will:
 - Visually assess foundation as per Specifications prior to liner deployment;
 - Visually assess condition of liner system components prior to deployment; and
 - Visually monitor liner placement, including minimum overlaps, orientations, and bentonite seams.
- The following survey requirements shall be implemented:
 - The Contractor shall provide survey layout for all work areas;
 - The Contractor shall provide as-built surveys for all liner system components and should clearly indicate minimum overlaps have been achieved; and
 - The Construction Monitor, in consultation with the Engineer, shall review all as-built surveys to verify compliance with the Construction Drawings.
- The Engineer shall review all daily field reports, site photographs, and survey data and provide feedback as necessary.

5.5.3 Non-Conformance

Non-conformances for liner installation and deployment shall include but are not limited to the following:

- Placement of damaged liner or liner components;
- Damaging liner or liner components during installation;
- Insufficient liner overlap or bentonite in GCL seams; and
- Failure to place Liner Cover Material within one day of placement of GCL or Geonet.

The protocol outlined below shall be followed in the case of non-conformance related to Liner System deployment:

- The Engineer and Construction Supervisor shall be notified of the non-conformance through an NCR using the form provided by either the Construction Monitor, Engineer or client;
- Non-conformance to be reviewed by the Engineer and direction provided to Construction Supervisor;
- Work related to non-conformance should be paused until direction given by the Construction Supervisor; and
- If pausing the work creates a risk to the deployed liner, the liner should be adequately protected.

5.6 Culverts

5.6.1 Construction Works

Culvert installation is required under crusher/mill conveyor to convey contact water from the DSTF sump to the Mill Pond under existing infrastructure. Key construction activities include:

- Excavation along culvert alignment;
- Placement and compaction pipe bedding;
- Placement of culvert and vault to permit de-icing;
- Granular fill placement around backfill envelope; and
- Placement of general fill in excavation and road surface as required.

5.6.2 QA/QC Testing and Procedures

The following measures will be implemented as part of inspection and QA/QC Procedures:

- The Construction Monitor shall observe culvert excavation, pipe placement, and backfill to verify it is completed in accordance with the Specifications.
- The Construction Monitoring shall complete field densities of the culvert bedding and backfill
- The following survey requirements shall be implemented:
 - The Contractor shall provide survey layout for all work areas
 - The Contractor shall provide as-built surveys for culvert excavation, culvert bedding, culvert inverts, backfill envelope, road crossing and final grade.
 - The Construction Monitor, in consultation with the Engineer, shall review all as-built surveys to verify compliance with the Construction Drawings

- The Engineer shall review all daily field reports, site photographs, and survey data and provide feedback as necessary.

5.6.3 Non-Conformance

Non-conformances for culvert installation shall include but are not limited to the following:

- Poor compaction and grade control
- Installation of damaged culvert or components

The protocol outlined below shall be followed in the case of non-conformance related to culvert installation:

- The Engineer and Construction Supervisor shall be notified of the non-conformance through an NCR using the form provided by either the Construction Monitor, Engineer or client.
- Non-conformance to be reviewed by the Engineer and direction provided to Construction Supervisor.
- Work related to non-conformance should be paused until direction given by the Construction Supervisor.

5.7 Instrumentation

5.7.1 Construction Works

Construction works related to instrumentation are expected to include:

- Protection of existing instrumentation as shown in the Construction Drawings
- Extension, and/or rerouting of instrumentation leads as shown in the Construction Drawings
- Installation of new instrumentation is not expected to be completed under the earthworks Contractor's scope.

5.7.2 QA/QC Testing and Procedures

The following measures will be implemented as part of inspection and QA/QC Procedures:

- Visually monitor to confirm existing instrumentation is protected.
- Monitor the extension and/or rerouting of instrumentation leads as shown in the Construction Drawings.
- Confirmation that all instrumentation is functioning prior to and after construction.

5.7.3 Non-Conformance

Non-conformances for instrument installation shall include but are not limited to the following:

- Damage to instrumentation
- Installation of extensions not as shown in Construction Drawings
- Improper grading surrounding instrument monuments

The protocol outlined below shall be followed in the case of non-conformance related to instrumentation:

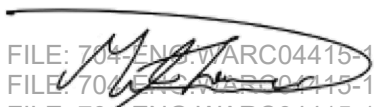
- The Engineer and Construction Supervisor shall be notified of the non-conformance through an NCR using the form provided by either the Construction Monitor, Engineer or client.
- Non-conformance to be reviewed by the Engineer and direction provided to Construction Supervisor.

Work related to non-conformance should be paused until direction given by the Construction Supervisor.

6.0 CLOSURE

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

Respectfully submitted,
Tetra Tech Canada Inc.



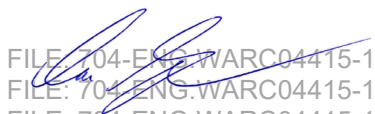
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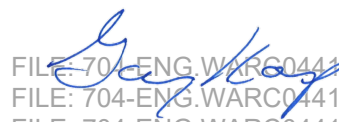
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Ensero Solutions, 2021. Keno Hill Silver District Mining Operations, Waste rock Management Plan - Revision 6.5.
Prepared for Alexco Keno Hill Mining Corp., October 2021.

TABLES

Table 1 CQMP RACI Chart
Table 2 Inspection Test Plan

Table 1: CQMP RACI Chart - DSTF Phase 2, Keno Hill Mine

QA/QC Task	Project Team						Comments
	Contractor	Project Manager	Construction Supervisor	Engineer	Construction Monitor	Engineer of Record	
Communication and Reporting							
Design Change Notice	I	I	C	A/R	I	R	
Request for Information	R	I	A/R	R	I	I	RFI submitted by contractor, Engineer and Supervisor provide responses
Non-Conformance Report (Contractor)	R	I	A	I	I	I	
Non-Conformance Report (Engineer)	I	I	A/R	R	R	I	NCR may be submitted by Engineer or Supervisor
Progressing Reporting (Contractor and Engineer)	R	I	A	C	R	I	Daily reports provide by Contractor and Construction Monitor
Inspection Test Plan	I	I	A	R	C	I	ITP developed by engineering team, to be implemented by Contractor
Material Processing							
Provide Weekly Production Volume Summaries	R	I	A	I	I	I	Contractor provide production volume summaries based on throughput, confirmed by survey
QAQC Material Testing and Submission	I	I	A	C	R	I	
Review QAQC Material Testing Reports	I	I	A	R	C	I	
QAQC Material Testing and Submission	I	I	A/R	I	I	I	
Foundation Preparation and Excavation							
Survey Layout and As-Built Survey	R	I	A	R	C	I	Contractor responsible for completing surveys, Engineer responsible for survey review and approval
Visual Inspection During Construction and at Completion	I	I	A	C	R	I	
Granular Material Placement							
Survey Layout and As-Built Survey	R	I	A	R	C	I	Contractor responsible for completing surveys, Engineer responsible for survey review and approval
Compaction Monitoring	I	I	A	C	R	I	
Visual Inspection During Construction and at Completion	I	I	A	C	R	I	
Liner System							
Survey Layout and As-Built Survey	R	I	A	R	C	I	Contractor responsible for completing surveys, Engineer responsible for survey review and approval
Review and Acceptance of Material	I	I	A	C	R	I	
Liner Deployment	R	I	A	C	R	I	Liner deployed according to deployment plan. Contractor responsible for executing; Construction Monitor responsible for approval

- **R – Responsible:** Those who do the work to achieve the task. At least one role must be Responsible for each task, although others can be delegated to assist in the work required.
- **A – Accountable:** The one ultimately answerable for the correct and thorough completion of the deliverable or task, and the one who delegates the work to those responsible. In other words, an Accountable individual must sign off (approve) on work that Responsible personnel provide.
- **C - Consulted:** Those whose opinions are sought, typically subject matter experts; and with whom there is two-way communication.
- **I - Informed:** Those who are kept up to date on progress, often only on completion of the task

Table 2: Inspection Test Plan - DSTF Phase 2, Keno Hill Mine

Activity No.	Activity Description	Acceptance Criteria / Specification / Drawing No.	Document Certification Required	Hold Category	Contractor		Hecla		Tetra Tech	
					Sign	Date	Sign	Date	Sign	Date
Material Processing										
1	Produce 50 mm minus granular fill	Gradation Limits	Test Results	R						
2	Produce Coarse Bulk Fill	Gradation Limits	Construction Monitoring Reports	R						
3	Produce 20 mm minus granular fill	Gradation Limits	Test Results	R						
Foundation Preparation and Excavation										
1	Site clearing	Adherence to Design	Construction Monitoring Reports	H						
2	As-built of cleared foundation surface	Adherence to Design	Engineer Review	H						
Granular Material Placement										
1	Upstream Diversion Berm Construction	Compaction Specification	Construction Monitoring Reports, compaction test results	R						
2	Upstream Diversion Berm As-built	Adherence to Design	Engineer Review	H						
3	Drainage Blanket Construction	Compaction Specification	Construction Monitoring Reports, compaction test results	R						
4	Drainage Blanket As-built	Adherence to Design	Engineer Review	H						
5	Toe Buttress Construction	Compaction Specification	Construction Monitoring Reports, compaction test results	R						
6	Toe Buttress As-built	Adherence to Design	Engineer Review	H						
7	Sump and Conveyance System Construction	Compaction Specification	Construction Monitoring Reports, compaction test results	R						
8	Sump and Conveyance System As-built	Adherence to Design	Engineer Review	H						
9	Liner Cover Material Construction	Compaction Specification	Construction Monitoring Reports	R						
10	Liner Cover Material As-built	Adherence to Design	Engineer Review	H						
11	Culvert and/or Pipe Bedding Construction	Compaction Specification	Construction Monitoring Reports	R						
12	Culvert and/or Pipe Bedding As-built	Adherence to Design	Engineer Review	H						
Liner System Deployment										
1	Condition of Liner Materials	Construction Specification	Construction Monitoring Reports	H						
2	Deployment of Liner Materials	Construction Specification	Construction Monitoring Reports	R						
3	Liner System As-built	Adherence to Design	Engineer Review	H						
Culverts										
1	Culvert Excavation and Foundation	Adherence to Design	Construction Monitoring Report, As-Built Survey	H						
2	Culvert Bedding	Compaction Specification	Compaction Test Results	H						
3	Culvert Backfill	Compaction Specification	Construction Monitoring Reports	R						
4	Culvert/Pipe As-built	Adherence to Design	Engineer Review	H						
Instrumentation										
1	Protect and Maintain Existing Instrumentation	Adherence to Design	Construction Monitoring Reports	M						
2	Extension and/or Rerouting of Leads	Adherence to Design	Construction Monitoring Reports	M						

Hold Categories

- H: A mandatory hold until release by inspector or official waiver from client.
- M: Inspection stage by inspecftor on a spot basis, but not a mandatory hold point.
- HR: A mandatory review and acceptance/approval of specified document.
- W: To be informed and invited to inspect. Construction to continue if inspector does not attend.
- R: Review of test report / certifications.
- A: Audit (Review at Random)

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

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Where TETRA TECH has expressly authorized the use of the Professional Document by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these Limitations on Use of this Document as well as any limitations on liability contained in the Contract with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these Limitations on Use of this Document and the Contract prior to making any use of the Professional Document. Any use made of the Professional Document by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

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Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this document, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to explore, address or consider and has not explored, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems, methods and standards employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.9 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historical environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional exploration and review may be necessary.

1.11 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

Construction activity can impact structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques, and construction sequence are known.

1.14 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, and the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.15 DRAINAGE SYSTEMS

Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function. Where temporary or permanent drainage systems are installed within or around a structure, these systems must protect the structure from loss of ground due to mechanisms such as internal erosion and must be designed so as to assure continued satisfactory performance of the drains. Specific design details regarding the geotechnical aspects of such systems (e.g. bedding material, surrounding soil, soil cover, geotextile type) should be reviewed by the geotechnical engineer to confirm the performance of the system is consistent with the conditions used in the geotechnical design.

1.16 DESIGN PARAMETERS

Bearing capacities for Limit States or Allowable Stress Design, strength/stiffness properties and similar geotechnical design parameters quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition used in this report. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions considered in this report in fact exist at the site.

1.17 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.18 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

This document has been prepared based on the applicable codes, standards, guidelines or best practice as identified in the report. Some mandated codes, standards and guidelines (such as ASTM, AASHTO Bridge Design/Construction Codes, Canadian Highway Bridge Design Code, National/Provincial Building Codes) are routinely updated and corrections made. TETRA TECH cannot predict nor be held liable for any such future changes, amendments, errors or omissions in these documents that may have a bearing on the assessment, design or analyses included in this report.