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August 12, 2015

Robert Holmes, Director, Mineral Resources  
Government of Yukon  
Department of Energy, Mines & Resources  
P.O. Box 2703  
Whitehorse, Yukon Y1A 2C6

Dear Mr. Holmes:

**Regarding:** Dry Stack Tailings Facility Construction and Operation Plan Revision 3, QML-0009

This submission (revision 3) of the Dry Stack Tailings Facility (DSTF) Construction and Operation Plan incorporates the deposition of tailings generated by milling Flame and Moth ore. Ore from the Flame and Moth, Onek, Lucky Queen and Bellekeno deposits will be processed through the District Mill generating composite tailings to be deposited in the existing DSTF.

Attachment A, *EBA Opinion on Geotechnical Properties of Flame and Moth Tailings Dry Stack Tailings Facility (DSTF) – Keno Hill District Mill Site*, provides confirmation that the physical and chemical properties of the tailings that will be produced from the two new ore zones are expected to be very similar to the geological and geotechnical properties of the Bellekeno, Onek and Lucky Queen ore zone tailings. Attachment B provides geochemical characterization of the Flame and Moth tailings, showing they are geochemically similar to the Bellekeno, Onek and Lucky Queen tailings.

The previously submitted and approved *Detailed Design Dry-Stacked Tailings Facility Report* and the approved *Operations, Maintenance, and Surveillance Manual for the DSTF*, prepared for Alexco by EBA Engineering Consultants Ltd, outline the detailed design and operations of the DSTF phase I (existing). The preliminary DSTF phase II expansion design is provided in Attachment C, *Dry Stacked Tailings Facility Phase II Expansion Preliminary Design – Revision 1 Keno Hill District Mill Site, YT*. Additional geotechnical investigation will be completed for Phase II prior to providing a final design and the DSTF construction and operation plan will be subsequently revised as required.

Sincerely,

**ALEXCO KENO HILL MINING CORP.**

A handwritten signature in blue ink, appearing to read 'Kai Woloshyn', is written over a light blue horizontal line.

Kai Woloshyn  
Environmental Manager

**Attachments:**

- A. EBA Opinion on Geotechnical Properties of Flame and Moth Tailings Dry Stack Tailings Facility (DSTF) – Keno Hill District Mill Site
- B. Geochemical Characterization of Flame and Moth Tailings
- C. Dry Stacked Tailings Facility Phase II Expansion Preliminary Design – Revision 1 Keno Hill District Mill Site, YT.

# **Attachment A**

Geotechnical Properties of Flame and Moth Tailings Dry Stack Tailings Facility (DSTF) -

Keno Hill District Mill Site, EBA 2015

July 28, 2015

Alexco Resource Corp  
3 – 151 Industrial Road  
Whitehorse, YT Y1A 2V3

ISSUED FOR USE  
FILE: W14103485-01

Via Email: [kwoloshyn@alexcoresource.com](mailto:kwoloshyn@alexcoresource.com)

**Attention:** Kai Woloshyn – Environmental Manager

**Subject:** Geotechnical Properties of Flame and Moth Tailings  
Dry Stack Tailings Facility (DSTF) – Keno Hill District Mill Site

The properties of the tailings that will be produced from the Flame and Moth ore zone are expected to be very similar to the geological and geotechnical properties of the Bellekeno ore zone tailings. Experience gained from thorough geological review of deposits throughout the Keno Hill Silver District indicates there are minor variations in ore mineralogy and deposit configuration, but all deposits discovered to date fall within a relatively narrow and well understood geological range.

Within that range, the geotechnical properties of the tailings produced from milling these variations are expected to be very similar. All ore from the Flame and Moth deposit will be processed in the same mill, with the same mill process flow sheet, therefore producing tailings with nearly identical physical properties to that of the Bellekeno ore zone. Tetra Tech EBA has confirmed this by comparing particle size curves from monthly laboratory testing completed on the existing tailings with Flame and Moth test milling data provided by Alexco. As part of the ongoing DSTF operations, maintenance, and surveillance protocol and procedures, the above assumptions will be further confirmed through implementation of the Tailings Characterization Plan.

If there are any minor variations in the nature of the tailings generated from the Flame and Moth ore zone as compared to the Bellekeno ore zone, they are not expected to affect the geotechnical performance of the DSTF.

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

Sincerely,  
Tetra Tech EBA Inc.



Justin Pigage, P.Eng.  
Geotechnical Engineer, Arctic Region  
Direct Line: 867.668.9213  
[Justin.Pigage@tetrattech.com](mailto:Justin.Pigage@tetrattech.com)

# **Attachment B**

Geochemical Characterization of Flame and Moth Tailings, Access Consulting 2015

# Memorandum

**To:** Kai Woloshyn, Alexco Resource Corp.

**From:** Andrew Gault, Alexco Environmental Group

**Date:** August 6, 2015

**Re:** Summary of Geochemical Characterization of Flame & Moth Tailings

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## 1 INTRODUCTION

Ore from the Flame & Moth deposit will be processed at the existing Keno District Mill Site, currently licenced for processing ore from the Bellekeno, Lucky Queen and Onek mines. Tailings generated from Flame & Moth ore processing will be deposited in one of the following locations:

1. Areas of the previously assessed and licenced Dry Stack Tailings Facility (DSTF);
2. Expansion areas of the DSTF (described in section C of the Application); and
3. Cement paste backfilled as composite into the Bellekeno, Onek, Lucky Queen, or Flame & Moth underground workings.

Past metallurgical and geochemical testing of the composite tailings produced from processing of ore from the unmined Onek and Lucky Queen deposits has indicated they are geochemically similar to those produced from the Bellekeno mine and are suitable for co-disposal (Access, 2012). This memorandum summarizes the geochemical testing data collected from composite tailings produced from Flame & Moth ore, particularly with respect to metal leaching and/or acid rock generation (ML/ARD), and places it in the context of the Bellekeno tailings geochemistry.

## 2 FLAME & MOTH GEOCHEMICAL TESTING

The tailings produced from the metallurgical testing that showed optimal metal recovery (tests F4 and F5) were used for geochemical characterization since these represented the material that would remain following the most likely metal recovery process employed at the District Mill. These tailings were combined into a composite sample (F4+F5) and submitted to ALS Chemex Labs for static and kinetic testing. Acid base

accounting (ABA) testing was conducted using the Sobek method with siderite correction. Aqua regia digestion followed by ICP-MS and ICP-AES analysis was used to determine the metals content of the tailings composite, whereas the mineralogical makeup of the sample was determined by Rietveld X-ray diffraction (XRD) (latter work performed at the Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia). A standard 24 hour shake flask extraction (SFE) test was also performed using a 3:1 liquid to solid ratio using deionized water as the extracting fluid according to the procedure described in Price (2009). Kinetic testing was also performed on this composite sample; a humidity cell of the F4&F5 composite was established in July, 2013 and is still in operation at the time of writing.

### **3 RESULTS**

#### **3.1 METALS CONTENT**

The ICP metals composition of the Flame & Moth F4+F5 composite tailings is shown in Table 3-1, alongside the average of monthly ICP analyses of composite tailings samples produced from Bellekeno ore between July 2012 and August 2013 (when Bellekeno mining and milling operations were suspended). The concentration of a number of minor and trace metals and metalloids of main geoenvironmental interest (arsenic, lead, cadmium, zinc, and selenium) were lower in the Flame & Moth F4+F5 tailings composite sample than the Bellekeno monthly tailings composite average (Table 3-1). Other parameters that were higher in the Flame & Moth composite included chromium, copper, iron, manganese, nickel, and molybdenum.

**Table 3-1: Elemental composition of Flame & Moth and Bellekeno composite tailings**

| Element         | Unit | Flame & Moth<br>F4+F5 Composite | Bellekeno Tailings Monthly Composite<br>Jul 12 - Aug 13 |
|-----------------|------|---------------------------------|---------------------------------------------------------|
| Aluminum (Al)   | %    | 0.2                             | 0.2                                                     |
| Antimony (Sb)   | ppm  | 41                              | 120.6                                                   |
| Arsenic (As)    | ppm  | 699                             | 2147                                                    |
| Barium (Ba)     | ppm  | 11.5                            | 16.4                                                    |
| Beryllium (Be)  | ppm  | 0.14                            | <0.2                                                    |
| Bismuth (Bi)    | ppm  | 6.59                            | 2.1                                                     |
| Cadmium (Cd)    | ppm  | 7.19                            | 165.8                                                   |
| Calcium (Ca)    | %    | 0.59                            | 1.52                                                    |
| Chromium (Cr)   | ppm  | 185.5                           | 5.5                                                     |
| Cobalt (Co)     | ppm  | 2.7                             | 9.9                                                     |
| Copper (Cu)     | ppm  | 565                             | 242.4                                                   |
| Iron (Fe)       | %    | 16.25                           | 10.09                                                   |
| Lead (Pb)       | ppm  | 789                             | 6359                                                    |
| Lithium (Li)    | ppm  | 1.2                             | <5.0                                                    |
| Magnesium (Mg)  | %    | 0.31                            | 0.31                                                    |
| Manganese (Mn)  | %    | 4.28                            | 3.22                                                    |
| Mercury (Hg)    | ppm  | 0.055                           | 0.191                                                   |
| Molybdenum (Mo) | ppm  | 3.74                            | 1.16                                                    |
| Nickel (Ni)     | ppm  | 86.6                            | 19.5                                                    |
| Phosphorus (P)  | %    | 0.01                            | 0.02                                                    |
| Potassium (K)   | %    | 0.03                            | 0.04                                                    |
| Selenium (Se)   | ppm  | 0.1                             | 0.52                                                    |
| Silver (Ag)     | ppm  | 12.35                           | 50.1                                                    |
| Sodium (Na)     | %    | 0.006                           | 0.014                                                   |
| Strontium (Sr)  | ppm  | 4.81                            | 24.0                                                    |
| Thallium (Tl)   | ppm  | 0.652                           | 0.129                                                   |
| Tin (Sn)        | ppm  | 32.9                            | 17.6                                                    |
| Titanium (Ti)   | %    | 0.001                           | 0.002                                                   |
| Uranium (U)     | ppm  | 0.406                           | 1.052                                                   |
| Vanadium (V)    | ppm  | 9.4                             | 5.18                                                    |
| Zinc (Zn)       | ppm  | 1265                            | 12623                                                   |

### 3.2 ABA

The ABA characteristics of the Flame & Moth F4+F5 composite tailings are displayed in Table 3-2 alongside the average of monthly ABA analyses of Bellekeno tailings between January 2011 and July 2013. Both the Flame & Moth and Bellekeno tailings exhibited a slightly alkaline paste pH and high carbonate and bulk neutralization potential (NP). The carbonate-NP was significantly higher than the bulk NP in both samples due to the presence of a large proportion of siderite ( $\text{FeCO}_3$ ), which does not contribute to acid neutralization under oxidizing conditions.

Sulphide-sulphur comprised the bulk of total sulphur in both tailings; the Flame & Moth composite sample had a much lower sulphur content than the Bellekeno tailings (Table 3-2). Indeed, although the Flame & Moth tailings had a lower bulk NP, its neutralization potential ratio (NPR; 7.1), derived by dividing the bulk NP by the acid potential (AP), was much higher than that of the Bellekeno tailings (1.9). The lower sulphide-sulphur (and hence low AP, which is calculated from the sulphide-sulphur concentration) accounts for the higher NPR for the Flame & Moth sample. An  $\text{NPR} > 2$  typically indicates that acid generation is not expected (Price, 2009), suggesting that the Flame & Moth tailings will not give rise to acid generation following disposal.

**Table 3-2: ABA characteristics of Flame & Moth and Bellekeno tailings**

| Sample                                           | Fizz Rating | pH    | S <sub>total</sub> | S <sub>sulphide</sub> | S <sub>SO4</sub> | C    | CO <sub>2</sub> | CO <sub>3</sub> -NP     | Bulk NP | AP   | NNP | NPR   |
|--------------------------------------------------|-------------|-------|--------------------|-----------------------|------------------|------|-----------------|-------------------------|---------|------|-----|-------|
| Unit                                             | Unity       | Unity | %                  | %                     | %                | %    | %               | kg CaCO <sub>3</sub> /t |         |      |     | Unity |
| Flame & Moth F4+F5 Composite Tailings            | 3           | 8     | 0.45               | 0.43                  | 0.02             | 4.66 | 17.1            | 389                     | 100     | 14.1 | 86  | 7.1   |
| Bellekeno Tailings, Jan 11- July 13 Monthly Avg. | 3           | 8.1   | 2.30               | 2.21                  | 0.02             | 3.30 | 12.0            | 273                     | 132     | 71.7 | 61  | 1.9   |

### 3.3 MINERALOGY

XRD analysis of the Flame & Moth tailings composite indicated it was dominated by equal parts of quartz ( $\text{SiO}_2$ ; 45 wt. %) and siderite ( $\text{FeCO}_3$ ; 45 wt. %) (Table 3-3). Both these phases also dominated the mineralogy of the Bellekeno tailings (53 wt. % quartz, 30 wt. % siderite). Notably, the main base metal sulphides in both ores, sphalerite ( $\text{ZnS}$ ) and galena ( $\text{PbS}$ ), were below the limit of detection for the Flame & Moth sample, but present in the Bellekeno composite tailings at 2.4 wt. % and 0.6 wt. % abundance, respectively (Table 3-3). Pyrite ( $\text{FeS}_2$ ) was also present at a higher concentration in the Bellekeno tailings (2.3 wt. %) than in the Flame & Moth tailings composite (0.7 wt. %). Conversely, the calcite ( $\text{CaCO}_3$ ) content of the Bellekeno tailings (3.2 wt. %) was higher than that of the Flame & Moth tailings composite (1.2 wt. %).

The XRD data corroborate the ABA and ICP metals results, showing that within the Flame & Moth composite, the lower bulk NP is due to lower calcite content, the lower AP is due to lower pyrite content, and the lower base metals (Pb and Zn) are due to lower galena and sphalerite content. The overall balance of contained minerals is primarily due to higher siderite content in the Flame & Moth composite, which is reflected in the higher manganese shown in the ICP metals results; manganese often substitutes for iron in siderite.

**Table 3-3: Mineralogy of Flame & Moth and Bellekeno composite tailings as determined by XRD**

| Mineral      | Flame & Moth F4 + F5 Composite | Bellekeno Tailings Monthly Composite July 12 - Aug 13 |
|--------------|--------------------------------|-------------------------------------------------------|
| Quartz       | 45.20                          | 52.62                                                 |
| Siderite     | 45.30                          | 29.81                                                 |
| Muscovite    | 2.50                           | 6.56                                                  |
| Calcite      | 1.20                           | 3.20                                                  |
| Sphalerite   | 0                              | 2.42                                                  |
| Pyrite       | 0.70                           | 2.27                                                  |
| Galena       | 0                              | 0.58                                                  |
| Plagioclase  | 0                              | 0.81                                                  |
| Ankerite     | 0                              | 0.41                                                  |
| Gahnite      | 0                              | 0.17                                                  |
| Chalcopyrite | 0                              | 0.08                                                  |
| Clinocllore  | 1.30                           | 0.35                                                  |
| Rutile       | 0                              | 0.31                                                  |
| Wurtzite     | 0                              | 0.16                                                  |
| K-Feldspar   | 0                              | 0.26                                                  |
| Dravite      | 3.2                            | 0                                                     |
| Cassiterite  | 0.5                            | 0                                                     |
| Total        | 100                            | 100                                                   |

### 3.4 SFE

SFE provides a measure of the soluble metals in the sample that may be mobilized upon flushing. SFE data for both the Flame & Moth tailings composite and the Bellekeno tailings composite are shown in Table 3-4. Many metals of geoenvironmental interest were leachable in the Flame & Moth composite sample at similar or lower concentrations than the Bellekeno composite, including arsenic, cadmium, lead, selenium, and zinc. Similar to the contained trace metal content measured by ICP, several elements showed higher leachable concentrations

in the Flame & Moth composite compared with the Bellekeno monthly composite, including copper, manganese, and nickel. Elements with elevated ICP contained metal concentrations were generally reflected in the element's leachability, although the relationship was not necessarily directly proportional. For example, although ICP contained zinc in the Bellekeno composite was an order of magnitude higher than the Flame & Moth composite, SFE leachable zinc was higher in the Flame & Moth SFE leachate.

**Table 3-4: SFE leachable metals from Flame & Moth and Bellekeno tailings composites**

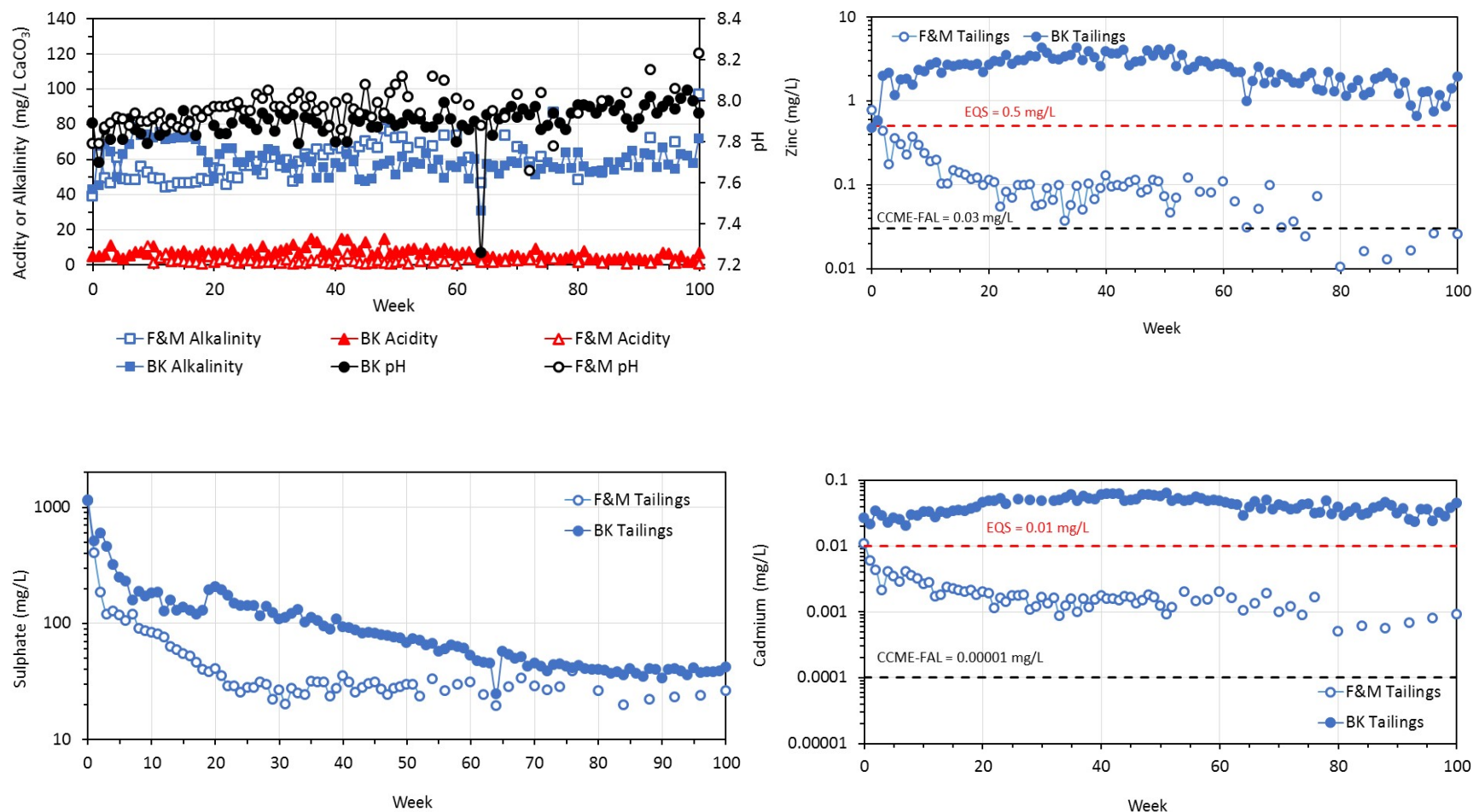
| Leachable Metals          | Unit | Flame & Moth F4+F5 Composite | Bellekeno Tailings Monthly Composite July 12 - Aug 13 |
|---------------------------|------|------------------------------|-------------------------------------------------------|
| Aluminum (Al)-Leachable   | mg/L | 0.0109                       | 0.0282                                                |
| Antimony (Sb)-Leachable   | mg/L | 0.0217                       | 0.0387                                                |
| Arsenic (As)-Leachable    | mg/L | 0.0061                       | 0.0072                                                |
| Barium (Ba)-Leachable     | mg/L | 0.0253                       | 0.0234                                                |
| Beryllium (Be)-Leachable  | mg/L | <0.00050                     | <0.00050                                              |
| Bismuth (Bi)-Leachable    | mg/L | <0.00050                     | <0.00050                                              |
| Boron (B)-Leachable       | mg/L | 0.0710                       | 0.0942                                                |
| Cadmium (Cd)-Leachable    | mg/L | 0.0024                       | 0.00318                                               |
| Calcium (Ca)-Leachable    | mg/L | 105                          | 138                                                   |
| Chromium (Cr)-Leachable   | mg/L | <0.00050                     | <0.00050                                              |
| Cobalt (Co)-Leachable     | mg/L | 0.0004                       | 0.00031                                               |
| Copper (Cu)-Leachable     | mg/L | 0.0271                       | 0.0096                                                |
| Iron (Fe)-Leachable       | mg/L | <0.030                       | <0.030                                                |
| Lead (Pb)-Leachable       | mg/L | 0.0144                       | 0.0593                                                |
| Lithium (Li)-Leachable    | mg/L | 0.0071                       | 0.0339                                                |
| Magnesium (Mg)-Leachable  | mg/L | 6.9000                       | 6.01                                                  |
| Manganese (Mn)-Leachable  | mg/L | 1.9500                       | 0.797                                                 |
| Mercury (Hg)-Leachable    | mg/L | 0.0001                       | <0.000050                                             |
| Molybdenum (Mo)-Leachable | mg/L | 0.0024                       | 0.0108                                                |
| Nickel (Ni)-Leachable     | mg/L | 0.0012                       | 0.0009                                                |
| Phosphorus (P)-Leachable  | mg/L | <0.30                        | <0.30                                                 |
| Potassium (K)-Leachable   | mg/L | 2.0400                       | 10.6                                                  |
| Selenium (Se)-Leachable   | mg/L | 0.0009                       | 0.00106                                               |
| Silicon (Si)-Leachable    | mg/L | 1.5500                       | 3.4                                                   |
| Silver (Ag)-Leachable     | mg/L | 0.0009                       | 0.0018                                                |

|                          |      |          |          |
|--------------------------|------|----------|----------|
| Sodium (Na)-Leachable    | mg/L | 2.3600   | 24.1     |
| Strontium (Sr)-Leachable | mg/L | 0.3800   | 0.515    |
| Thallium (Tl)-Leachable  | mg/L | 0.0001   | 0.0002   |
| Tin (Sn)-Leachable       | mg/L | <0.00050 | <0.00050 |
| Titanium (Ti)-Leachable  | mg/L | 0.0100   | 0.012    |
| Uranium (U)-Leachable    | mg/L | 0.0000   | 0.00162  |
| Vanadium (V)-Leachable   | mg/L | <0.0010  | <0.0010  |
| Zinc (Zn)-Leachable      | mg/L | 0.1560   | 0.051    |

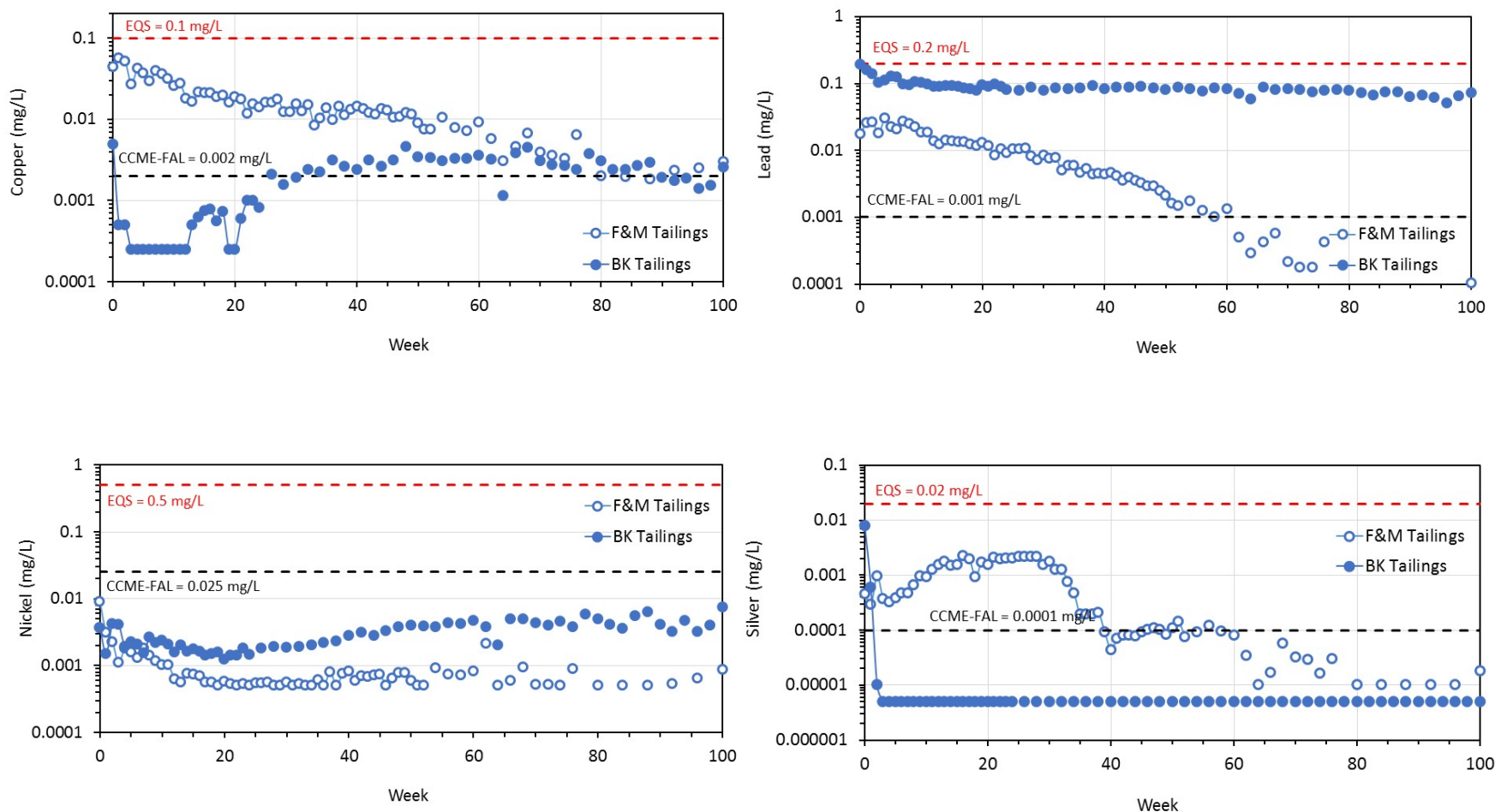
### 3.5 HUMIDITY CELL

At the time of writing, 100 weeks of data were available for the Flame & Moth F4+F5 tailings composite humidity cell. The Bellekeno tailings humidity cell is also ongoing, with 200 weeks of data available. Data from both humidity cells over the first 100 weeks of their operation is plotted for comparison in Figure 3-1 to Figure 3-3. Where appropriate, the QZ09-092 water licence effluent quality standard (EQS) and Canadian Council of Ministers of the Environment Freshwater Aquatic Life (CCME-FAL) thresholds are also shown for context.

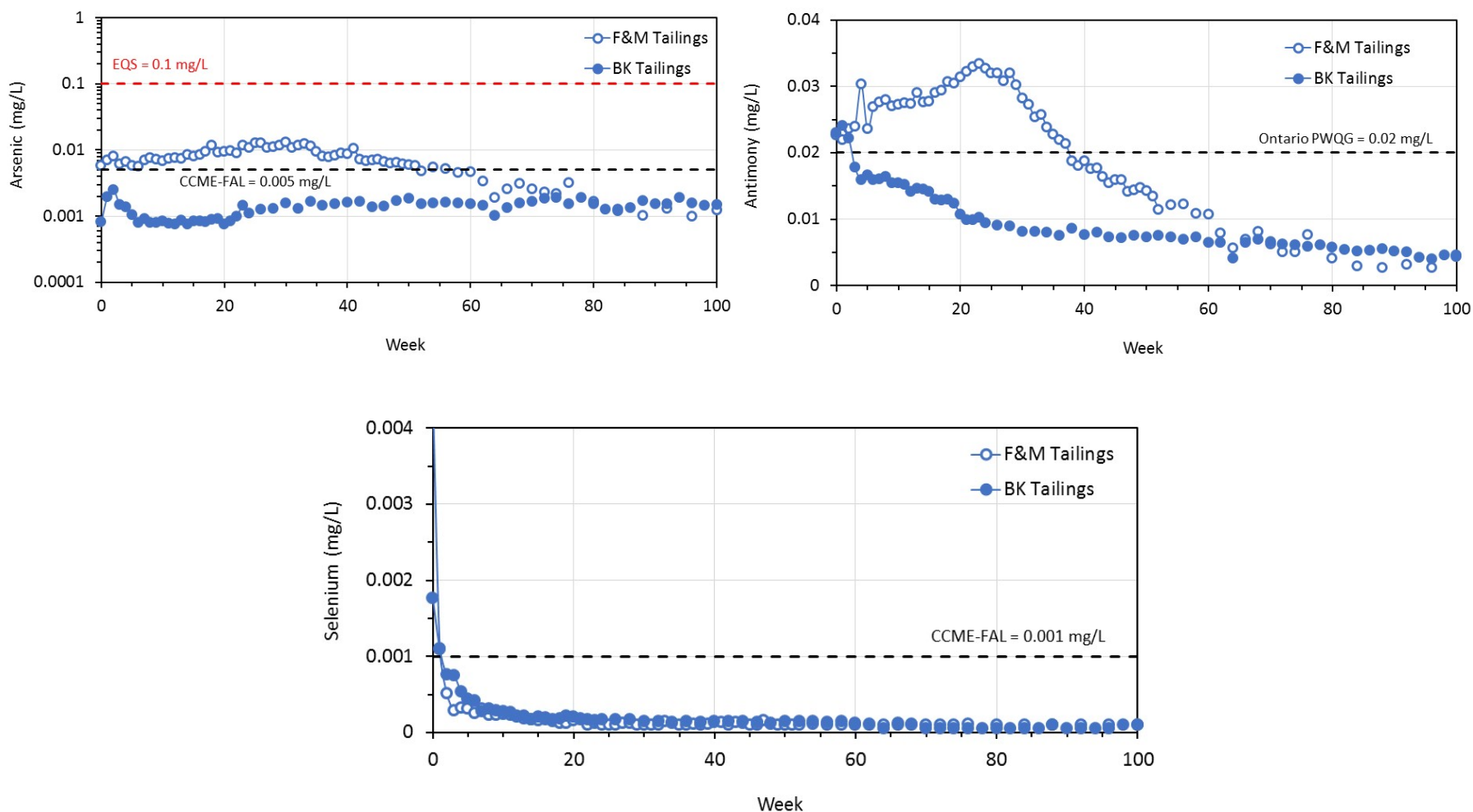
Both the Flame & Moth and Bellekeno tailings humidity cell leachates have shared similar stable pH, alkalinity and acidity levels (Figure 3-1). The Bellekeno tailings showed higher dissolved sulphate levels over the first 100 weeks of operation, likely due to the higher sulphide content of these tailings. Both dissolved zinc and cadmium concentrations were approximately an order of magnitude higher in the Bellekeno humidity cell leachate. Indeed, following the initial flush of soluble material in the first few weeks of operation of the Flame & Moth humidity cell, the concentration of both zinc and cadmium remained below their respective EQS (Figure 3-1). Similar behaviour was observed for copper, nickel, lead, and silver with all four of these elements remaining below their EQS for both of the composite tailings samples (Figure 3-2). Arsenic and antimony concentrations were highest in the Flame & Moth humidity cell effluent for the first 60 weeks of operation, before they declined to similar levels as those measured in the Bellekeno tailings humidity cell leachate (Figure 3-3). The leachate from both humidity cells was always well below the arsenic EQS, and after 60 weeks, below CCME-FAL. Indeed, sub-CCME-FAL concentrations were observed for the longer term (>60 weeks) Flame & Moth humidity cell leachate samples for lead, nickel, silver, arsenic, antimony (Ontario provincial water quality objective used in absence of CCME-FAL guideline), and selenium (Figure 3-2 and Figure 3-3).



**Figure 3-1: Change in pH, alkalinity, acidity (top left), sulphate (bottom left), zinc (top right), and cadmium (bottom right) in humidity cell leachate from Flame & Moth and Bellekeno tailings. Note log scale.**



**Figure 3-2: Change in copper (top left), nickel (bottom left), lead (top right), and silver (bottom right) in humidity cell leachate from Flame & Moth and Bellekeno tailings. Note log scale.**



**Figure 3-3: Change in arsenic (top left), antimony (top right), and selenium (bottom) in humidity cell leachate from Flame & Moth and Bellekeno tailings. Note log scale for arsenic.**

## 4 SUMMARY

Comparative testing of the Flame & Moth F4+F5 composite tailings and those produced by the District Mill from Bellekeno ore indicates that both share similar geochemistry, with the Flame & Moth tailings showing slightly more favourable ML/ARD characteristics in the form of lower sulphide content, higher NPR (indicative of non-acid generating status), and lower leaching of cadmium and zinc, which are the primary constituents of concern in surface waters of the District (Minnow, 2015). Given the similar and/or more favourable geochemical characteristics of the Flame & Moth tailings, they are suitable for co-disposal with Bellekeno, Lucky Queen and Onek tailings in the existing DSTF and its proposed extension.

## 5 REFERENCES

- Access Consulting Group. (2012) *Memorandum: Geochemical Characterization of the Onek and Lucky Queen Tailings*. September 5, 2012.
- Minnow Environmental Inc. (2015) *Draft Memorandum: Proposed Water Quality Goals for United Keno Hill Complex Watersheds*. February 23, 2015.
- Price, W.A. (2009) *Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials*. MEND Report 1.20.1. CANMET – Mining and Mineral Science Laboratories, Smithers, BC.

# **Attachment C**

Dry Stacked Tailings Facility Phase II Expansion Preliminary Design - Revision 1

Keno Hill District Mill Site, EBA 2015



June 2, 2015

FILE: W14103548-01

Via Email: [kwoloshyn@alexcoresource.com](mailto:kwoloshyn@alexcoresource.com)

Alexco Resource Corp  
3 Calcite Business Centre  
151 Industrial Road  
Whitehorse, YT Y1A 2V3

**Attention:** Kai Woloshyn, Environmental Manager

**Subject:** Dry Stacked Tailings Facility Phase II Expansion Preliminary Design – Revision 1  
Keno Hill District Mill Site, YT

NND EBA Land Protection Corp. operating as NELPCo Limited Partnership (NELPCo) is pleased to submit the enclosed Dry Stacked Tailings Facility Phase II Expansion Preliminary Design Report, prepared by our exclusive service provider Tetra Tech EBA Inc. (Tetra Tech EBA)

NELPCo is a limited partnership corporation owned by NND Development Corporation (NNDDC) and Tetra Tech EBA. The partnership aims to develop business and employment opportunities associated with providing Environmental and Engineering Services in the Traditional Territory of the Na-Cho Nyak Dun First Nation (NND). The NELPCo partnership serves to further working relationships between Tetra Tech EBA, NND, and companies operating in NND Traditional Territory.

Thank you for selecting NELPCo to assist with your project, we look forward to supporting you on future projects in NND Traditional Territory. If you have any questions or comments about the NELPCo partnership please contact the undersigned.

Respectfully,

Pat Titus  
NELPCo Director  
Direct Line: 867.336.4340  
[coo@nnddc.ca](mailto:coo@nnddc.ca)

June 2, 2015

Alexco Resource Corp.  
3 – 151 Industrial Road  
Whitehorse, YT Y1A 2V3

ISSUED FOR USE

FILE: W14103548-01

Via Email: kwoloshyn@alexcoresource.com

**Attention:** Kai Woloshyn, Environmental Manager

**Subject:** Dry Stacked Tailings Facility Phase II Expansion Preliminary Design – Revision I  
Keno Hill District Mill Site, YT

## 1.0 INTRODUCTION

Alexco Resource Corp. (Alexco) retained Tetra Tech EBA Inc. (Tetra Tech EBA) to complete a geotechnical investigation and provide a preliminary design for expansion of the existing Dry Stacked Tailings Facility (DSTF) at the Keno Hill District Mill Site, YT.

This report presents some background information related to the DSTF, a summary of the subsurface conditions encountered during the DSTF Phase II Expansion preliminary geotechnical investigation, and the preliminary design for the DSTF Phase II Expansion. For additional conditions regarding the use of this report, please refer to Tetra Tech EBA's General Conditions in Appendix A.

## 2.0 BACKGROUND

Tetra Tech EBA conducted geotechnical investigations on the subject site in 2009 and 2010 to determine the subsurface soil and permafrost conditions for design of the DSTF. Tetra Tech EBA submitted the current DSTF detailed design in 2011 and has been monitoring construction and performance of the facility since then. Recommendations for the DSTF Phase II Expansion presented in this letter are based on subsurface soil conditions encountered during the DSTF Phase II Expansion preliminary geotechnical investigation and the following DSTF documentation:

- “DSTF Instrumentation and Construction Monitoring” (EBA Memos, June 2011 – November 2013)
- “Dry Stacked Tailings Facility – Risk Assessment Stability Model Update Letter” (EBA Letter, February 2013)
- “Dry Stacked Tailings Facility – Detailed Design” (EBA Report, May 2011)
- “Dry Stacked Tailings Facility – Operation, Maintenance, and Surveillance Manual” (EBA Report, September 2010)
- “Dry Stacked Tailings Facility – Runoff Diversion Specifications” (EBA Report, September 2010)
- “Dry Stacked Tailings Facility – Preliminary Engineering Design and Management Plan” (EBA Report, January 2010)

## **3.0 GEOTECHNICAL INVESTIGATION**

Tetra Tech EBA completed a preliminary geotechnical investigation for the DSTF Phase II Expansion consisting of twelve testpits excavated to varying depths within the proposed expansion footprint. The investigation was completed on September 11, 2013 using a Hitachi 270 excavator supplied by Alexco. Tetra Tech EBA's representative on site was Mr. Justin Pigage, P.Eng.

The approximate testpit locations are shown on Figure 1. Disturbed samples collected from the testpit walls and excavator bucket were collected and returned to Tetra Tech EBA's Whitehorse laboratory for index property testing. A summary of the test results is shown on the testpit logs in Appendix B. The UTM (NAD 83 datum) coordinates noted on the testpit logs were obtained using a handheld GPS unit accurate to within 5 m.

### **3.1 Surface Conditions**

The proposed DSTF Phase II Expansion area lies immediately south of the existing facility and is bound by the Keno City Dump and access road to the north and east, the Duncan Creek Road to the south, and the Keno Hill District Mill to the west. The proposed footprint is shown on Figure 1. The ground surface within the proposed footprint generally slopes down from east to west at approximately 10 to 15%. Vegetation in the area consists of moss cover and small spruce trees and willow shrubs. The existing Bellekeno Haul Road alignment crosses the proposed footprint in an east-west direction.

### **3.2 Subsurface Conditions**

The subsurface conditions within the proposed DSTF Phase II Expansion footprint observed during the preliminary geotechnical investigation consist of ice-rich frozen silt till or unfrozen silty sand and gravel. The ice-rich silt till was observed in testpits excavated throughout the proposed footprint except for the south western extent (TP40 – TP43) in which the unfrozen silty sand and gravel was encountered. The thickness of the ice-rich frozen silt till is unknown as excavation of this material was not practical with the supplied equipment. The unfrozen silty sand and gravel along the south western extent extends at least 4.5 m (maximum reach of equipment) below the existing ground surface. Detailed testpit logs are included in Appendix B.

### **3.3 Groundwater**

No groundwater was encountered during the preliminary geotechnical investigation.

### **3.4 Permafrost**

Permafrost was encountered in the silt till throughout most of the proposed DSTF Phase II Expansion area. The frozen silt till contains a combination of randomly oriented ice inclusions, and non-visible excess ice. Observations in the field indicate an overall ice content of approximately 5 to 25% by volume.

### **3.5 Bedrock**

Bedrock was not encountered during the preliminary geotechnical investigation. Bedrock depth information was provided by Alexco indicating between 10 and 40 m of overburden within the proposed expansion footprint.

## **4.0 DSTF PHASE II EXPANSION PRELIMINARY DESIGN**

The preliminary design for the DSTF Phase II Expansion is based on the design of the existing facility, laboratory and field data collected from site, and the performance of the current DSTF. Visual inspections and compaction test results confirm the DSTF is being constructed and operated as specified in the design. Slope indicator and ground temperature data indicate there is no lateral movement of the foundation soils and that they have remained frozen. The following sections summarize design assumptions specific to the DSTF Phase II Expansion, the geometry of the expansion, and the stability modelling completed.

Prior to detailed design and construction of the DSTF Phase II Expansion, a detailed geotechnical drill investigation will be required to confirm subsurface assumptions in this preliminary design.

### **4.1 Design Assumptions**

#### **4.1.1 Subsurface Conditions**

The preliminary geotechnical investigation consisted of shallow testpits terminated due to refusal in frozen ice-rich silt, at an average depth of about 0.5 m below the existing ground surface. Moisture content testing on samples collected from the shallow testpits indicate properties similar to the frozen ice-rich silt till encountered during design of the existing DSTF.

Alexco provided 57 bedrock contact locations recorded during previous drilling activities around the proposed expansion footprint. Tetra Tech EBA used this bedrock contact information to create an approximate bedrock surface.

For the purpose of the DSTF Phase II Expansion preliminary design, Tetra Tech EBA has assumed the frozen ice-rich silt till encountered in the shallow testpits extends down to bedrock. This is considered a conservative assumption because the ice-content in the subsurface soils likely decreases with depth (as is the case under the existing DSTF).

#### **4.1.2 Ice-Rich Frozen Silt Strength Properties**

The DSTF design relies on a conservative approach for determining the shear strength of the frozen ice-rich silt of assuming an internal angle of friction equal to zero, and relying solely on the cohesive properties of the frozen soil.

The existing DSTF was designed using long term shear strength of 50 kPa derived from a published relationship between shear strength and ground temperature (Johnston 1981). This relationship was chosen because it is considered very conservative and limited ground temperature data for the DSTF was available at the time of design.

The DSTF Phase II Expansion is designed using a similar relationship (Weaver and Morgenstern 1981). This relationship was chosen because Tetra Tech EBA has been collecting site specific ground temperature data since 2009, furthering our understanding of the condition of the foundation soils.

The frozen ice-rich silt has been assigned a long term shear strength value of 70 kPa for the purpose of the preliminary design.

#### **4.1.3 DSTF Phase II Expansion Foundation**

The foundation for the existing DSTF consists of a gravel drainage blanket, geosynthetic clay liner (GCL), and geocomposite drain. Waste rock sourced during the development of Flame and Moth can be used for gravel drainage blanket, provided it conforms to the particle size distribution specifications. It was assumed that 10% of

the porewater in the DSTF would drain from the facility after tailings placement. The GCL and geocomposite drain were included to provide containment and a pathway for this assumed excess porewater to safely drain from the toe of the facility. However, no seepage water has been observed in the geocomposite drain of the existing DSTF facility. In August 2012, a piezometer was installed in the completed lower bench of the DSTF to determine if any free water exists within the tailings. No water from tailings porewater has been observed in the piezometer.

Based on the above observations, the DSTF Phase II Expansion Preliminary Design was originally completed without the inclusion of the GCL and geocomposite drain. The GCL and geocomposite drain have been included in this Revision I report in response to the Yukon Water Board's request (dated January 15, 2015) to provide an updated preliminary design document, which includes the GCL and geocomposite drain.

The DSTF foundation stability analysis relies on modelling the synthetic foundation components as a frictional material. Based on review of relevant literature, an internal angle of friction of  $16^\circ$  and a unit weight of  $24.0 \text{ kN/m}^3$  was used in the original DSTF design. These values are considered very conservative, the reported internal friction angle in the literature reviewed ranged from  $16^\circ$  to  $25^\circ$  for similar synthetic materials. For the DSTF Phase II Expansion Preliminary Design the unit weight of  $24.0 \text{ kN/m}^3$  was maintained but the internal angle of friction was increased to  $18^\circ$ . Shear box testing of the site specific synthetic foundation components and tailings will be undertaken as part of detailed design to confirm the internal friction angle.

## **4.2 DSTF Phase II Expansion Geometry**

The location and geometry of the DSTF Phase II Expansion are shown on Figure 1. The two sections used to conduct the slope stability assessment are shown on Figure 2. Slopes and bench elevations were carried over from the existing DSTF where possible. The approximate total storage within the expansion is  $295,000 \text{ m}^3$  (including a  $22,000 \text{ m}^3$  toe structure).

The toe structure is required to obtain the recommended factor of safety against deep rotational failures through the ice-rich silt foundation soils. It provides mass to counter the driving weight of the tailings placed further upslope. The toe structure can be constructed of waste rock or compacted tailings, both materials were analysed in the stability assessment. The toe structure must be fully constructed before placing tailings above the 936 m bench.

## **4.3 DSTF Phase II Expansion Stability Assessment**

The stability of the DSTF Phase II Expansion was determined using Geostudio 2007 – Slope/W module, which is software that uses limit equilibrium theory to compute the factor of safety of slopes. The slopes were analyzed in several different conditions, including short term (during construction) and long term (after closure) in both static and pseudo-static scenarios.

Minimum factors of safety are suggested by the BC Mine Waste Rock Pile Research Committee (Piteau 1991). The results of the stability assessment for two sections in the DSTF Phase II Expansion were compared with the recommended minimums. A summary of the stability results is presented in the following sections.

### 4.3.1 Fully Frozen Case

This scenario is intended to model the condition where the tailings have been placed and the underlying soils have remained frozen (the current state of the DSTF). A summary of the computed factors of safety and the recommended minimums for this scenario are presented below in Table 1. Detailed slope stability results are presented in Appendix C.

**Table 1: DSTF Phase II Expansion Slope Stability Results– Fully Frozen Case**

| Stability Conditions                                | Suggested Minimum Factor of Safety (Piteau 1991) | Calculated Factor of Safety Phase II Expansion |              |
|-----------------------------------------------------|--------------------------------------------------|------------------------------------------------|--------------|
|                                                     |                                                  | Section A-A'                                   | Section B-B' |
| Stability of Surface                                |                                                  |                                                |              |
| Short-term<br>(during construction – static)        | 1.0                                              | 1.4                                            | 2.6          |
| Long-term<br>(after construction – static)          | 1.1                                              | 1.1                                            | 1.7          |
| Deep Seated Stability                               |                                                  |                                                |              |
| Short-term<br>(during construction – static)        | 1.3                                              | 1.9                                            | 2.4          |
| Short-term<br>(during construction – pseudo-static) | 1.0                                              | 1.3                                            | 1.6          |
| Long-term<br>(after closure – static)               | 1.3                                              | 1.3                                            | 2.5          |
| Long-term<br>(after closure – pseudo-static)        | 1.0                                              | 1.3                                            | 1.7          |

### 4.3.2 Fully Thawed Case

This scenario is intended to model the anticipated long-term condition where the tailings are placed and the underlying soils have fully thawed and consolidated. A summary of the factors of safety and the recommended minimums for this scenario are presented in Table 2 on the following page. Detailed slope stability results are presented in Appendix D.

**Table 2: DSTF Phase II Expansion Slope Stability Results– Fully Thawed Case**

| Stability Conditions                                | Suggested Minimum Factor of Safety (Piteau 1991) | Calculated Factor of Safety Phase II Expansion |              |
|-----------------------------------------------------|--------------------------------------------------|------------------------------------------------|--------------|
|                                                     |                                                  | Section A-A'                                   | Section B-B' |
| Stability of Surface                                |                                                  |                                                |              |
| Short-term<br>(during construction – static)        | 1.0                                              | N/A <sup>1</sup>                               |              |
| Long-term<br>(after construction – static)          | 1.1                                              | 1.3                                            | 1.7          |
| Deep Seated Stability                               |                                                  |                                                |              |
| Short-term<br>(during construction – static)        | 1.3                                              | N/A <sup>1</sup>                               |              |
| Short-term<br>(during construction – pseudo-static) | 1.0                                              | N/A <sup>1</sup>                               |              |
| Long-term<br>(after closure – static)               | 1.3                                              | 2.0                                            | 2.6          |
| Long-term<br>(after closure – pseudo-static)        | 1.0                                              | 1.4                                            | 1.7          |

<sup>1</sup>Foundation will not be fully thawed during construction of the facility.

### 4.3.3 Stability of the DSTF Foundation

This scenario is intended to model the anticipated short and long-term conditions where the tailings are placed over the GCL and geocomposite drain. Failures in both static and pseudo-static conditions are then forced through the material layer representing the synthetic foundation components. A summary of the factors of safety and the recommended minimums for this scenario are presented below in Table 3. Detailed slope stability results are presented in Appendix E.

**Table 3: DSTF Phase II Expansion Slope Stability Results– Foundation Materials**

| Stability Conditions                                | Suggested Minimum Factor of Safety (Piteau 1991) | Calculated Factor of Safety Phase II Expansion |              |
|-----------------------------------------------------|--------------------------------------------------|------------------------------------------------|--------------|
|                                                     |                                                  | Section A-A'                                   | Section B-B' |
| Deep Seated Stability                               |                                                  |                                                |              |
| Short-term<br>(during construction – static)        | 1.3                                              | 1.6                                            | 1.7          |
| Short-term<br>(during construction – pseudo-static) | 1.0                                              | 1.0                                            | 1.1          |
| Long-term<br>(after closure – static)               | 1.3                                              | 1.6                                            | 1.8          |
| Long-term<br>(after closure – pseudo-static)        | 1.0                                              | 1.0                                            | 1.1          |

## 4.4 Surface Water Management

The surface water structures currently in place around the DSTF can be extended to provide surface water management for the DSTF Phase II Expansion. The following sections provide a preliminary design for the uphill runoff diversion berm, toe runoff collection ditch and sump, and the conveyance pipe.

### 4.4.1 Uphill Runoff Diversion Berm

The uphill runoff diversion berm is intended to redirect surface water away from the DSTF. The berm should be constructed in accordance with the *Runoff Diversion Structures Specs DSTF, Keno Hill District Mill, YT* (Section 1005) report issued September 2010. Construction should be completed to the dimensions and alignments shown on Figure 3.

### 4.4.2 Toe Runoff Collection Ditch

The toe runoff collection ditch should be constructed in accordance with the *Runoff Diversion Structures Specifications DSTF, Keno Hill District Mill, YT* (Section 1008) report issued September 2010. Construction should be completed to the dimensions and alignments indicated on Figure 3. The size of the ditch was determined from the maximum estimated 200-year flood discharges for Bellekeno Mine Project Area provided by Clearwater Consultants Ltd. (August 20, 2009).

### 4.4.3 Collection Sump and Conveyance Pipe

A conveyance pipe, shown in Figure 1, is required to direct water from the DSTF Phase II Expansion toe runoff collection sump to the existing surface water collection pond. The collection sump should be constructed according to the dimensions on Figure 3. The conveyance pipe was sized to match the existing 150 mm PVC pipe used for the runoff from the existing DSTF.

## 5.0 ADDITIONAL RECOMMENDATIONS

The DSTF Phase II Expansion preliminary design presents a physically stable geometry for the purposes of permitting. There are several components associated with a more detailed design that have not been included in the DSTF Phase II Expansion preliminary design. The following subjects should be addressed during the detailed design of the DSTF Phase II Expansion:

- **Synthetic Foundation Materials Strength Testing** - The DSTF foundation stability analysis relies on modelling the synthetic foundation components as a frictional material. Shear box testing of the site specific synthetic foundation components and tailings is required as part of detailed design to confirm the internal friction angle assumed in this preliminary design.
- **Construction schedule** – Construction of the DSTF Phase II Expansion will likely occur over several years. Recommendations with respect to timelines for clearing and placing foundation materials and tailings should be considered as part of the detailed design. A construction plan should be developed to limit the potential for permafrost degradation in the sensitive foundation soils beneath the expansion.
- **Closure** – A 0.5 m loose gravel cover material was assumed in the long-term stability assessment of the DSTF Phase II Expansion; cover performance is currently being evaluated on the existing DSTF and the overall cover thickness may change as a result of this testing. A detailed closure plan and schedule was not included in this preliminary design and should be addressed in the detailed design.

- **Future underground workings** – Alexco intends to develop underground workings beneath the proposed expansion footprint. Tetra Tech EBA understands the DSTF Phase II Expansion was considered and included in the preliminary mine design. If the overall footprint of the DSTF Phase II Expansion changes significantly during detailed design, the mine design should be updated accordingly.

This DSTF Phase II Expansion preliminary design was completed based on subsurface information gathered from several shallow testpits within the proposed footprint, and depth to bedrock information provided by Alexco. Prior to detailed design and construction of the DSTF Phase II Expansion, a geotechnical drill investigation to confirm the assumptions in this preliminary design is necessary.

Tetra Tech EBA recommends the drill investigation consist of at least a dozen holes advanced to bedrock within the footprint of the proposed expansion. The boreholes should be advanced with a drill capable of recovering undisturbed frozen overburden samples for the purpose of laboratory based strength testing. Instrumentation consisting of several slope indicator and ground temperature cable installations to monitor performance of the proposed expansion should be completed during the investigation. Tetra Tech EBA would be pleased to provide a proposal to complete the investigation, if requested.

## 6.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Alexco Resource Corp. and their agents. Tetra Tech EBA Inc. 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 Alexco Resource Corp., 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 report is subject to the terms and conditions stated in Tetra Tech EBA's Services Agreement. Tetra Tech EBA's General Conditions are provided in Appendix A of this report.

## 7.0 CLOSURE

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

Respectfully submitted,  
Tetra Tech EBA Inc.

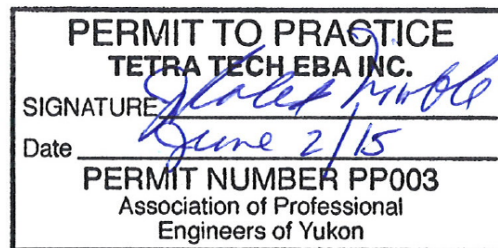


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Attachments:    Figures (3)  
                    Appendix A        Tetra Tech EBA's General Conditions  
                    Appendix B        Testpit Logs  
                    Appendix C        Slope Stability Results – Fully Frozen  
                    Appendix D        Slope Stability Results – Fully Thawed  
                    Appendix E        Slope Stability Results – Foundation Materials



### REVISION I SUMMARY:

Added synthetic foundation components to stability analysis  
Added preliminary design of surface water management structures

## REFERENCES

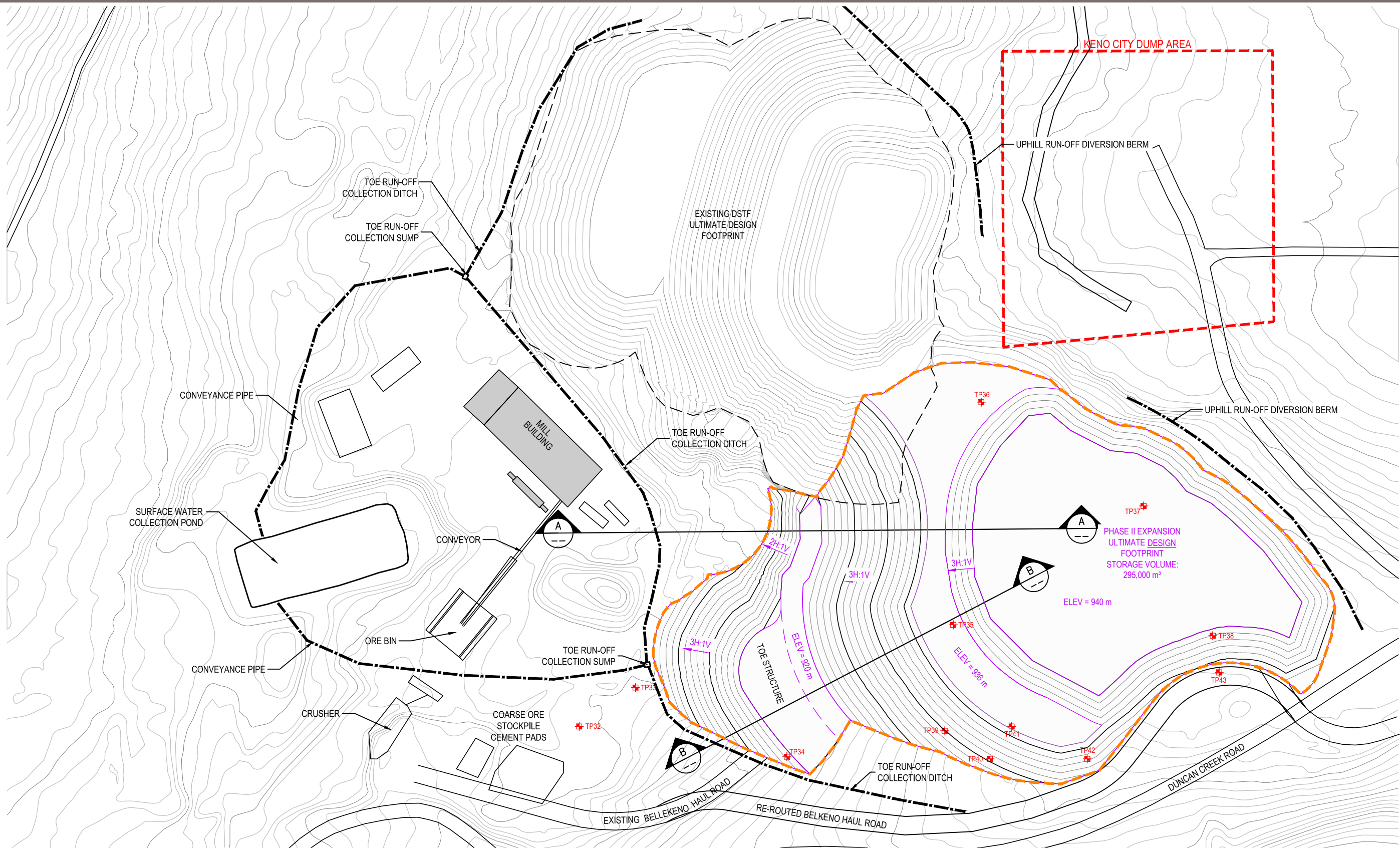
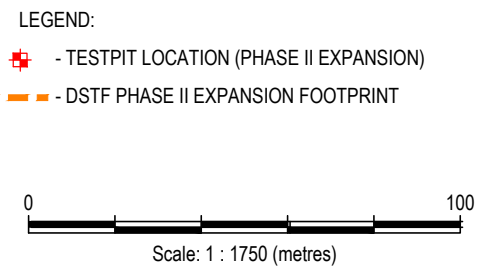
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- Weaver J.S. and Morgenstern N.R., 1981. “Pile Design in Permafrost.” *Canadian Geotechnical Journal* Vol 18 (1981): 357-370.

# FIGURES

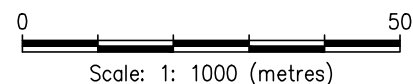
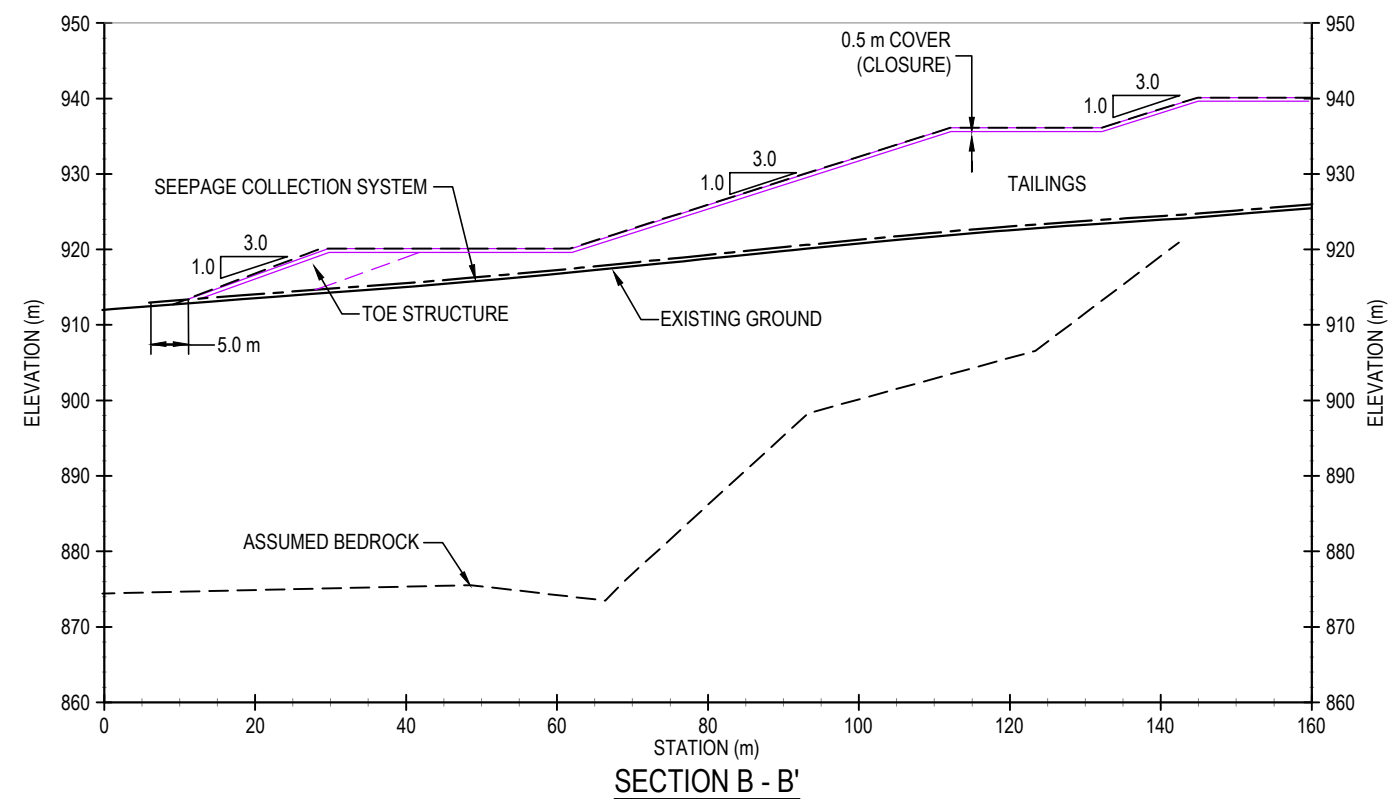
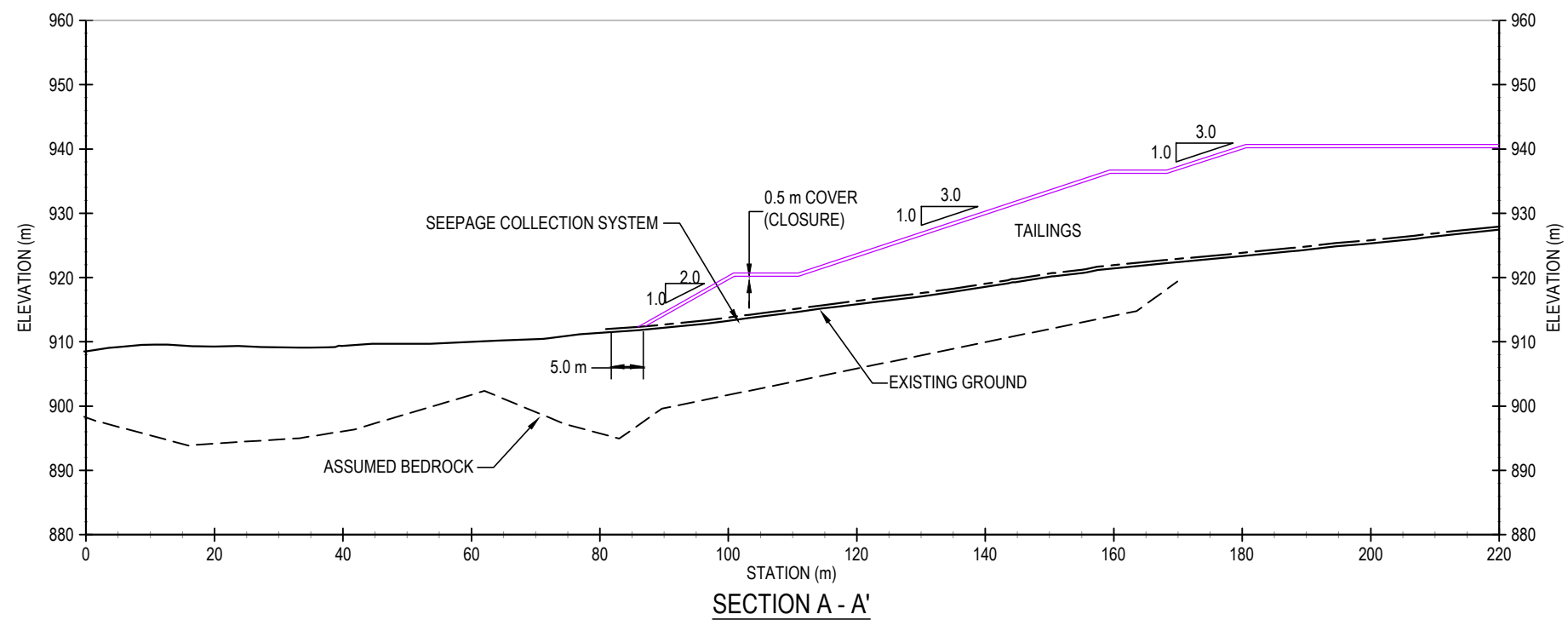
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|----------|------------------------------------------------|
| Figure 1 | Site Plan Showing Proposed Expansion Footprint |
| Figure 2 | DSTF Sections                                  |
| Figure 3 | Surface Water Management Structures            |

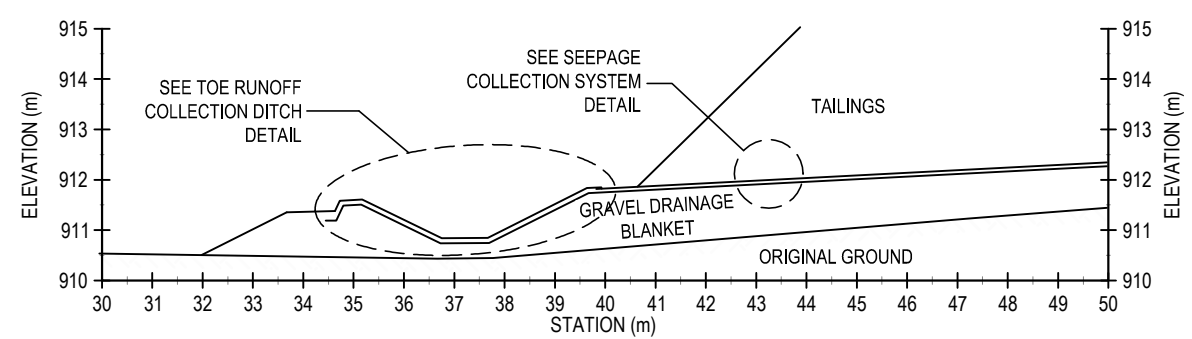
Q:\WhitehorseData\0201\Drawings\Keno\W14103548-01.DSTF Phase II Liner Stability\W14103548-01 Figs 1-3 R0.dwg [FIGURE 1] May 20, 2015 - 3:25:16 pm (BY: BUCHAN, CAMERON)



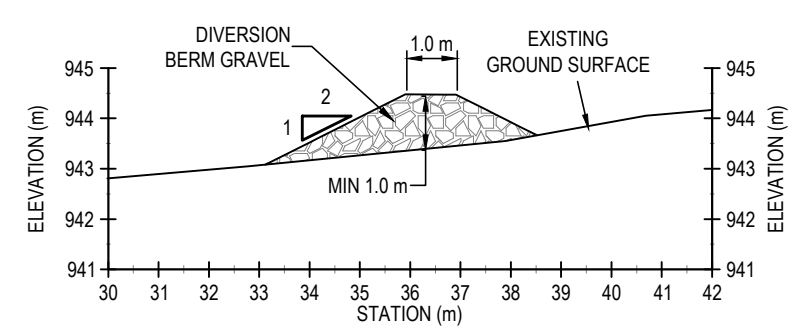
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|                    |  | SITE PLAN SHOWING<br>PROPOSED EXPANSION FOOTPRINT                                         |           |            |          |
|                    |  | PROJECT NO.<br>W14103548-01                                                               | DWN<br>CB | CKD<br>JTP | REV<br>1 |
| OFFICE<br>EBA-WHSE |  | DATE<br>May 15, 2015                                                                      |           | Figure 1   |          |



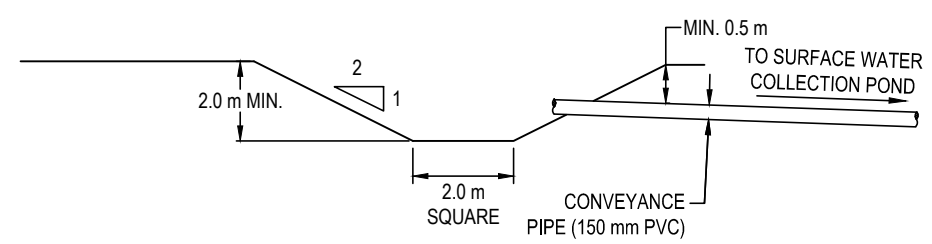
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|  |              | DSTF SECTIONS                                                                             |     |     |          |  |
|  | PROJECT NO.  | DWN                                                                                       | CKD | REV | Figure 2 |  |
|                                                                                       | W14103548-01 | CB                                                                                        | JTP | 1   |          |  |
|                                                                                       | OFFICE       | DATE                                                                                      |     |     |          |  |
| EBA-WHSE                                                                              | May 15, 2015 |                                                                                           |     |     |          |  |



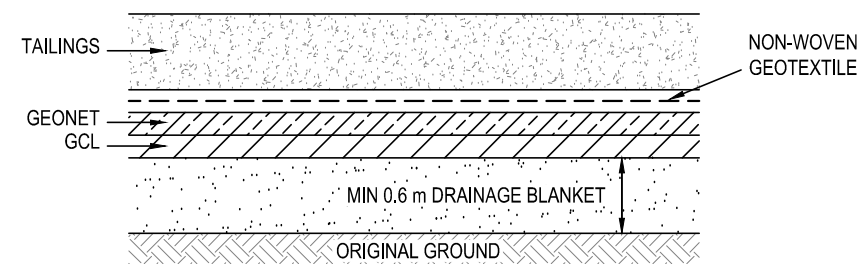
**TOE RUNOFF COLLECTION DITCH - TYPICAL SECTION**



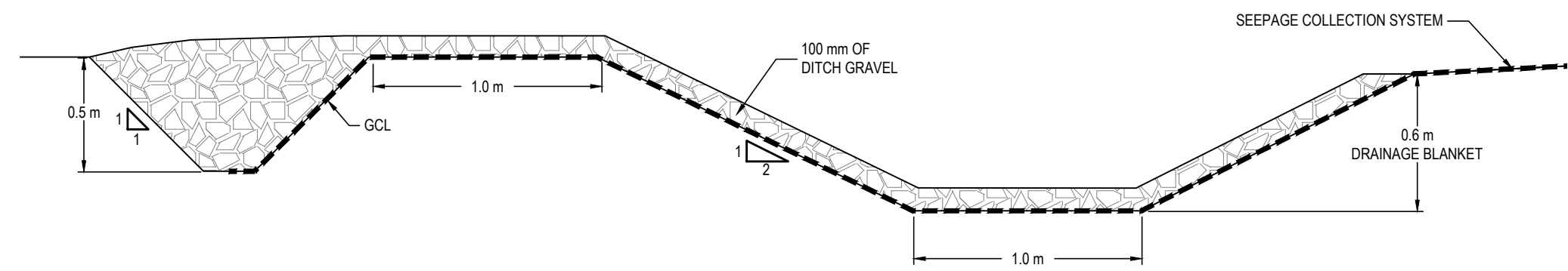
**UPHILL DIVERSION BERM DETAIL**



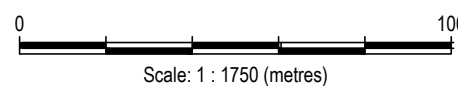
**COLLECTION SUMP & CONVEYANCE PIPE**



**SEEPAGE COLLECTION SYSTEM DETAIL**



**TOE RUNOFF COLLECTION DITCH DETAIL**



|                                                                                                                    |  |                                                                                                              |                                         |                               |                             |                     |
|--------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------|-----------------------------------------|-------------------------------|-----------------------------|---------------------|
| <div>CLIENT</div> <div></div> |  | <div>DRY-STACKED TAILINGS FACILITY EXPANSION - PHASE II</div> <div>KENO HILL DISTRICT MILL SITE, YUKON</div> |                                         |                               |                             |                     |
|                                                                                                                    |  | <div>SURFACE WATER MANAGEMENT STRUCTURES</div>                                                               |                                         |                               |                             |                     |
| <div>TETRA TECH EBA</div>     |  | <div>PROJECT NO.</div> <div>W14103303-01</div>                                                               | <div>DWN</div> <div>CB</div>            | <div>CKD</div> <div>JTP</div> | <div>REV</div> <div>1</div> | <div>Figure 3</div> |
|                                                                                                                    |  | <div>OFFICE</div> <div>EBA-WHSE</div>                                                                        | <div>DATE</div> <div>May 15, 2015</div> |                               |                             |                     |

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# APPENDIX A

## TETRA TECH EBA'S GENERAL CONDITIONS

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# GENERAL CONDITIONS

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## GEOTECHNICAL REPORT

This report incorporates and is subject to these “General Conditions”.

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### 1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of Tetra Tech EBA's Client. Tetra Tech EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than Tetra Tech EBA's Client unless otherwise authorized in writing by Tetra Tech EBA. Any unauthorized use of the report is at the sole risk of the user.

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### 2.0 ALTERNATE REPORT FORMAT

Where Tetra Tech EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed Tetra Tech EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by Tetra Tech EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of Tetra Tech EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Tetra Tech EBA. Tetra Tech EBA's instruments of professional service will be used only and exactly as submitted by Tetra Tech EBA.

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

### 3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, Tetra Tech EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

### 4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods 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 EBA 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.

### 5.0 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.

### 6.0 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 historic environment. Tetra Tech EBA 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 investigation and review may be necessary.

## **7.0 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.

## **8.0 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.

## **9.0 INFLUENCE OF CONSTRUCTION ACTIVITY**

There is a direct correlation between construction activity and 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 are known.

## **10.0 OBSERVATIONS DURING CONSTRUCTION**

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as 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.

## **11.0 DRAINAGE SYSTEMS**

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. 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.

## **12.0 BEARING CAPACITY**

Design bearing capacities, loads and allowable stresses 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 assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

## **13.0 SAMPLES**

Tetra Tech EBA 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.

## **14.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS**

During the performance of the work and the preparation of the report, Tetra Tech EBA may rely on information provided by persons other than the Client. While Tetra Tech EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

# APPENDIX B

## TESTPIT LOGS

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| Dry Stack Tailings Facility Phase II Expansion                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                | CLIENT: Alexco Keno Hill Mining Corp |                                     | TESTPIT NO: W14103303-TP32                                                                                                |                                                                                                                            |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------------|
| Keno Hill District Mill Site                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                | EXCAVATOR: Hitachi 270 Excavator     |                                     | PROJECT NO: W14103303-01                                                                                                  |                                                                                                                            |            |
| Keno City, YT                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                | 7086670N; 483945E; Zone 8            |                                     |                                                                                                                           |                                                                                                                            |            |
| SAMPLE TYPE <input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE<br>BACKFILL TYPE <input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND |                                                |                                      |                                     |                                                                                                                           |                                                                                                                            |            |
| Depth (m)                                                                                                                                                                                                                                                                                                                                                                                                                                                                | SOIL DESCRIPTION                               | SAMPLE TYPE                          | GROUND ICE DESCRIPTION AND COMMENTS | <input checked="" type="checkbox"/> SPT (N) <input type="checkbox"/><br>20 40 60 80<br>PLASTIC M.C. LIQUID<br>20 40 60 80 | ◆ CLAY (%) ◆<br>20 40 60 80<br>● SILT (%) ●<br>20 40 60 80<br>▲ SAND (%) ▲<br>20 40 60 80<br>■ GRAVEL (%) ■<br>20 40 60 80 | Depth (ft) |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | PEAT - woody, roots, organics                  |                                      | FROZEN, Nbe                         |                                                                                                                           |                                                                                                                            | 0          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | END OF TESTPIT @ 0.3 m (refusal in permafrost) |                                      |                                     |                                                                                                                           |                                                                                                                            |            |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                |                                      |                                     |                                                                                                                           |                                                                                                                            |            |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                |                                      |                                     |                                                                                                                           |                                                                                                                            |            |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                |                                      |                                     |                                                                                                                           |                                                                                                                            |            |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                |                                      |                                     |                                                                                                                           |                                                                                                                            |            |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                |                                      |                                     |                                                                                                                           |                                                                                                                            |            |
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| <br>A TETRA TECH COMPANY | LOGGED BY: JTP   | COMPLETION DEPTH: 0.3m |
|                                                                                                             | REVIEWED BY: CPC | COMPLETE: 9/11/2013    |
|                                                                                                             | DRAWING NO:      | Page 1 of 1            |

| Dry Stack Tailings Facility Phase II Expansion                                                                                                                                                                                                                                                                                                                                                                                                     |                                                | CLIENT: Alexco Keno Hill Mining Corp |                                     | TESTPIT NO: W14103303-TP33                                                                                            |                                                                                                                                                          |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Keno Hill District Mill Site                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                | EXCAVATOR: Hitachi 270 Excavator     |                                     | PROJECT NO: W14103303-01                                                                                              |                                                                                                                                                          |            |
| Keno City, YT                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                | 7086688N; 783971E; Zone 8            |                                     |                                                                                                                       |                                                                                                                                                          |            |
| SAMPLE TYPE <input type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE<br>BACKFILL TYPE <input type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND |                                                |                                      |                                     |                                                                                                                       |                                                                                                                                                          |            |
| Depth (m)                                                                                                                                                                                                                                                                                                                                                                                                                                          | SOIL DESCRIPTION                               | SAMPLE TYPE                          | GROUND ICE DESCRIPTION AND COMMENTS | <input type="checkbox"/> SPT (N) <input type="checkbox"/> PLASTIC M.C. <input type="checkbox"/> LIQUID<br>20 40 60 80 | <input type="checkbox"/> CLAY (%) <input type="checkbox"/> SILT (%) <input type="checkbox"/> SAND (%) <input type="checkbox"/> GRAVEL (%)<br>20 40 60 80 | Depth (ft) |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                  | PEAT - woody, roots, organics                  |                                      | FROZEN, Nbe                         |                                                                                                                       |                                                                                                                                                          | 0          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                    | END OF TESTPIT @ 0.4 m (refusal in permafrost) |                                      |                                     |                                                                                                                       |                                                                                                                                                          |            |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                |                                      |                                     |                                                                                                                       |                                                                                                                                                          |            |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                |                                      |                                     |                                                                                                                       |                                                                                                                                                          |            |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                |                                      |                                     |                                                                                                                       |                                                                                                                                                          |            |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                |                                      |                                     |                                                                                                                       |                                                                                                                                                          |            |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                |                                      |                                     |                                                                                                                       |                                                                                                                                                          |            |
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| <br>A TETRA TECH COMPANY | LOGGED BY: JTP   | COMPLETION DEPTH: 0.4m |
|                                                                                                             | REVIEWED BY: CPC | COMPLETE: 9/11/2013    |
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| Dry Stack Tailings Facility Phase II Expansion                                                                                                                                                                                       |                                                                            | CLIENT: Alexco Keno Hill Mining Corp |               | TESTPIT NO: W14103303-TP34          |                                                              |                                                                                                            |            |
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| Keno Hill District Mill Site                                                                                                                                                                                                         |                                                                            | EXCAVATOR: Hitachi 270 Excavator     |               | PROJECT NO: W14103303-01            |                                                              |                                                                                                            |            |
| Keno City, YT                                                                                                                                                                                                                        |                                                                            | 7086656N; 484041E; Zone 8            |               |                                     |                                                              |                                                                                                            |            |
| SAMPLE TYPE <input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE     |                                                                            |                                      |               |                                     |                                                              |                                                                                                            |            |
| BACKFILL TYPE <input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND |                                                                            |                                      |               |                                     |                                                              |                                                                                                            |            |
| Depth (m)                                                                                                                                                                                                                            | SOIL DESCRIPTION                                                           | SAMPLE TYPE                          | SAMPLE NUMBER | GROUND ICE DESCRIPTION AND COMMENTS | SPT (N)<br>20 40 60 80<br>PLASTIC M.C. LIQUID<br>20 40 60 80 | CLAY (%)<br>20 40 60 80<br>SILT (%)<br>20 40 60 80<br>SAND (%)<br>20 40 60 80<br>GRAVEL (%)<br>20 40 60 80 | Depth (ft) |
| 0                                                                                                                                                                                                                                    | PEAT - woody, roots, organics                                              |                                      |               | FROZEN, Nbe                         |                                                              |                                                                                                            | 0          |
|                                                                                                                                                                                                                                      | SILT - some gravel, some sand, non-plastic, olive grey, cobbles throughout |                                      |               | FROZEN, Vr, Vc, 5%                  |                                                              |                                                                                                            |            |
| 1                                                                                                                                                                                                                                    | END OF TESTPIT @ 1.0 m (refusal in permafrost)                             | SA01                                 |               |                                     |                                                              |                                                                                                            | 5          |
| 2                                                                                                                                                                                                                                    |                                                                            |                                      |               |                                     |                                                              |                                                                                                            | 10         |
| 3                                                                                                                                                                                                                                    |                                                                            |                                      |               |                                     |                                                              |                                                                                                            | 15         |
| 4                                                                                                                                                                                                                                    |                                                                            |                                      |               |                                     |                                                              |                                                                                                            | 16         |
| 5                                                                                                                                                                                                                                    |                                                                            |                                      |               |                                     |                                                              |                                                                                                            |            |

| Dry Stack Tailings Facility Phase II Expansion                                                                                                                                                                                       |                                                                            | CLIENT: Alexco Keno Hill Mining Corp |               | TESTPIT NO: W14103303-TP35          |                                                                                                                                                                            |            |
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| Keno Hill District Mill Site                                                                                                                                                                                                         |                                                                            | EXCAVATOR: Hitachi 270 Excavator     |               | PROJECT NO: W14103303-01            |                                                                                                                                                                            |            |
| Keno City, YT                                                                                                                                                                                                                        |                                                                            | 7086717N; 484118E; Zone 8            |               |                                     |                                                                                                                                                                            |            |
| SAMPLE TYPE <input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE     |                                                                            |                                      |               |                                     |                                                                                                                                                                            |            |
| BACKFILL TYPE <input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND |                                                                            |                                      |               |                                     |                                                                                                                                                                            |            |
| Depth (m)                                                                                                                                                                                                                            | SOIL DESCRIPTION                                                           | SAMPLE TYPE                          | SAMPLE NUMBER | GROUND ICE DESCRIPTION AND COMMENTS | SPT (N)<br>20 40 60 80<br>PLASTIC M.C. LIQUID<br>20 40 60 80<br>CLAY (%)<br>20 40 60 80<br>SILT (%)<br>20 40 60 80<br>SAND (%)<br>20 40 60 80<br>GRAVEL (%)<br>20 40 60 80 | Depth (ft) |
| 0                                                                                                                                                                                                                                    | PEAT - woody, roots, organics                                              |                                      |               | FROZEN, Nbe                         |                                                                                                                                                                            | 0          |
|                                                                                                                                                                                                                                      | SILT - some gravel, some sand, non-plastic, olive grey, cobbles throughout |                                      |               | FROZEN, Vr, Vc, 25%                 |                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                      |                                                                            | SA02                                 |               |                                     |                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                      | END OF TESTPIT @ 0.6 m (refusal in permafrost)                             |                                      |               |                                     |                                                                                                                                                                            |            |
| 1                                                                                                                                                                                                                                    |                                                                            |                                      |               |                                     |                                                                                                                                                                            |            |
| 2                                                                                                                                                                                                                                    |                                                                            |                                      |               |                                     |                                                                                                                                                                            |            |
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| <br>A TETRA TECH COMPANY | LOGGED BY: JTP   | COMPLETION DEPTH: 0.6m |
|                                                                                                             | REVIEWED BY: CPC | COMPLETE: 9/11/2013    |
|                                                                                                             | DRAWING NO:      | Page 1 of 1            |

| Dry Stack Tailings Facility Phase II Expansion                                                                                                                                                                                       |                                                                            | CLIENT: Alexco Keno Hill Mining Corp |                                     | TESTPIT NO: W14103303-TP36                                   |                                                                                                            |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|------------|
| Keno Hill District Mill Site                                                                                                                                                                                                         |                                                                            | EXCAVATOR: Hitachi 270 Excavator     |                                     | PROJECT NO: W14103303-01                                     |                                                                                                            |            |
| Keno City, YT                                                                                                                                                                                                                        |                                                                            | 7086820N; 484131E; Zone 8            |                                     |                                                              |                                                                                                            |            |
| SAMPLE TYPE <input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE     |                                                                            |                                      |                                     |                                                              |                                                                                                            |            |
| BACKFILL TYPE <input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND |                                                                            |                                      |                                     |                                                              |                                                                                                            |            |
| Depth (m)                                                                                                                                                                                                                            | SOIL DESCRIPTION                                                           | SAMPLE TYPE                          | GROUND ICE DESCRIPTION AND COMMENTS | SPT (N)<br>20 40 60 80<br>PLASTIC M.C. LIQUID<br>20 40 60 80 | CLAY (%)<br>20 40 60 80<br>SILT (%)<br>20 40 60 80<br>SAND (%)<br>20 40 60 80<br>GRAVEL (%)<br>20 40 60 80 | Depth (ft) |
| 0                                                                                                                                                                                                                                    | PEAT - woody, roots, organics                                              |                                      | FROZEN, Nbe                         |                                                              |                                                                                                            | 0          |
|                                                                                                                                                                                                                                      | SILT - some gravel, some sand, non-plastic, olive grey, cobbles throughout |                                      | FROZEN, Vr, Vc, 25%                 |                                                              |                                                                                                            |            |
|                                                                                                                                                                                                                                      | END OF TESTPIT @ 0.5 m (refusal in permafrost)                             |                                      |                                     |                                                              |                                                                                                            |            |
| 1                                                                                                                                                                                                                                    |                                                                            |                                      |                                     |                                                              |                                                                                                            |            |
| 2                                                                                                                                                                                                                                    |                                                                            |                                      |                                     |                                                              |                                                                                                            |            |
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| <br>A TETRA TECH COMPANY | LOGGED BY: JTP   | COMPLETION DEPTH: 0.5m |
|                                                                                                             | REVIEWED BY: CPC | COMPLETE: 9/11/2013    |
|                                                                                                             | DRAWING NO:      | Page 1 of 1            |

| Dry Stack Tailings Facility Phase II Expansion                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                            | CLIENT: Alexco Keno Hill Mining Corp |                                     | TESTPIT NO: W14103303-TP37                                                                                                |                                                                                                                                                                                                                                                                                                                                                                |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|--------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Keno Hill District Mill Site                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                            | EXCAVATOR: Hitachi 270 Excavator     |                                     | PROJECT NO: W14103303-01                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                |            |
| Keno City, YT                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                            | 7086772N; 484206E; Zone 8            |                                     |                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                |            |
| SAMPLE TYPE <input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE<br>BACKFILL TYPE <input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND |                                                                            |                                      |                                     |                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                |            |
| Depth (m)                                                                                                                                                                                                                                                                                                                                                                                                                                                                | SOIL DESCRIPTION                                                           | SAMPLE TYPE                          | GROUND ICE DESCRIPTION AND COMMENTS | <input checked="" type="checkbox"/> SPT (N) <input type="checkbox"/><br>20 40 60 80<br>PLASTIC M.C. LIQUID<br>20 40 60 80 | <input checked="" type="checkbox"/> CLAY (%) <input type="checkbox"/><br>20 40 60 80<br><input checked="" type="checkbox"/> SILT (%) <input type="checkbox"/><br>20 40 60 80<br><input checked="" type="checkbox"/> SAND (%) <input type="checkbox"/><br>20 40 60 80<br><input checked="" type="checkbox"/> GRAVEL (%) <input type="checkbox"/><br>20 40 60 80 | Depth (ft) |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | PEAT - woody, roots, organics                                              |                                      | FROZEN, Nbe                         |                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                | 0          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | SILT - some gravel, some sand, non-plastic, olive grey, cobbles throughout |                                      | FROZEN, Vr, Vc, 25%                 |                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | END OF TESTPIT @ 0.5 m (refusal in permafrost)                             |                                      |                                     |                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                |            |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                            |                                      |                                     |                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                |            |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                            |                                      |                                     |                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                |            |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                            |                                      |                                     |                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                |            |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                            |                                      |                                     |                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                |            |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                            |                                      |                                     |                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                |            |
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| <br>A TETRA TECH COMPANY | LOGGED BY: JTP   | COMPLETION DEPTH: 0.5m |
|                                                                                                             | REVIEWED BY: CPC | COMPLETE: 9/11/2013    |
|                                                                                                             | DRAWING NO:      | Page 1 of 1            |

| Dry Stack Tailings Facility Phase II Expansion                                                                                                                                                                                       |                                                                                          | CLIENT: Alexco Keno Hill Mining Corp |               | TESTPIT NO: W14103303-TP38          |                                                              |                                                                                                            |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------|---------------|-------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|------------|
| Keno Hill District Mill Site                                                                                                                                                                                                         |                                                                                          | EXCAVATOR: Hitachi 270 Excavator     |               | PROJECT NO: W14103303-01            |                                                              |                                                                                                            |            |
| Keno City, YT                                                                                                                                                                                                                        |                                                                                          | 7086712N; 484238E; Zone 8            |               |                                     |                                                              |                                                                                                            |            |
| SAMPLE TYPE <input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE     |                                                                                          |                                      |               |                                     |                                                              |                                                                                                            |            |
| BACKFILL TYPE <input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND |                                                                                          |                                      |               |                                     |                                                              |                                                                                                            |            |
| Depth (m)                                                                                                                                                                                                                            | SOIL DESCRIPTION                                                                         | SAMPLE TYPE                          | SAMPLE NUMBER | GROUND ICE DESCRIPTION AND COMMENTS | SPT (N)<br>20 40 60 80<br>PLASTIC M.C. LIQUID<br>20 40 60 80 | CLAY (%)<br>20 40 60 80<br>SILT (%)<br>20 40 60 80<br>SAND (%)<br>20 40 60 80<br>GRAVEL (%)<br>20 40 60 80 | Depth (ft) |
| 0                                                                                                                                                                                                                                    | PEAT - woody, roots, organics                                                            |                                      |               | FROZEN, Nbe                         |                                                              |                                                                                                            | 0          |
|                                                                                                                                                                                                                                      | SILT - some gravel, trace sand, non-plastic, olive grey, cobbles and boulders throughout |                                      | SA03          | FROZEN, Vr, Vc, 10%                 | ●                                                            |                                                                                                            |            |
|                                                                                                                                                                                                                                      | END OF TESTPIT @ 0.4 m (refusal in permafrost)                                           |                                      |               |                                     |                                                              |                                                                                                            |            |
| 1                                                                                                                                                                                                                                    |                                                                                          |                                      |               |                                     |                                                              |                                                                                                            |            |
| 2                                                                                                                                                                                                                                    |                                                                                          |                                      |               |                                     |                                                              |                                                                                                            |            |
| 3                                                                                                                                                                                                                                    |                                                                                          |                                      |               |                                     |                                                              |                                                                                                            |            |
| 4                                                                                                                                                                                                                                    |                                                                                          |                                      |               |                                     |                                                              |                                                                                                            |            |
| 5                                                                                                                                                                                                                                    |                                                                                          |                                      |               |                                     |                                                              |                                                                                                            |            |
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| <br>A TETRA TECH COMPANY | LOGGED BY: JTP   | COMPLETION DEPTH: 0.4m |
|                                                                                                             | REVIEWED BY: CPC | COMPLETE: 9/11/2013    |
|                                                                                                             | DRAWING NO:      | Page 1 of 1            |

| Dry Stack Tailings Facility Phase II Expansion                                                                                                                                                                                       |                                                                                                                                                                    | CLIENT: Alexco Keno Hill Mining Corp |               | TESTPIT NO: W14103303-TP39          |                                                              |                                                                                                            |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------|-------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|------------|
| Keno Hill District Mill Site                                                                                                                                                                                                         |                                                                                                                                                                    | EXCAVATOR: Hitachi 270 Excavator     |               | PROJECT NO: W14103303-01            |                                                              |                                                                                                            |            |
| Keno City, YT                                                                                                                                                                                                                        |                                                                                                                                                                    | 7086668N; 484114E; Zone 8            |               |                                     |                                                              |                                                                                                            |            |
| SAMPLE TYPE <input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE     |                                                                                                                                                                    |                                      |               |                                     |                                                              |                                                                                                            |            |
| BACKFILL TYPE <input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND |                                                                                                                                                                    |                                      |               |                                     |                                                              |                                                                                                            |            |
| Depth (m)                                                                                                                                                                                                                            | SOIL DESCRIPTION                                                                                                                                                   | SAMPLE TYPE                          | SAMPLE NUMBER | GROUND ICE DESCRIPTION AND COMMENTS | SPT (N)<br>20 40 60 80<br>PLASTIC M.C. LIQUID<br>20 40 60 80 | CLAY (%)<br>20 40 60 80<br>SILT (%)<br>20 40 60 80<br>SAND (%)<br>20 40 60 80<br>GRAVEL (%)<br>20 40 60 80 | Depth (ft) |
| 0                                                                                                                                                                                                                                    | PEAT - woody, roots, organics<br>SILT - some gravel, trace sand, non-plastic, olive grey, cobbles throughout<br><br>END OF TESTPIT @ 0.6 m (refusal in permafrost) |                                      | SA04          | FROZEN, Nbe<br>FROZEN, Vr, Vc, 10%  | ●                                                            |                                                                                                            | 0          |
| 1                                                                                                                                                                                                                                    |                                                                                                                                                                    |                                      |               |                                     |                                                              |                                                                                                            | 5          |
| 2                                                                                                                                                                                                                                    |                                                                                                                                                                    |                                      |               |                                     |                                                              |                                                                                                            | 10         |
| 3                                                                                                                                                                                                                                    |                                                                                                                                                                    |                                      |               |                                     |                                                              |                                                                                                            | 15         |
| 4                                                                                                                                                                                                                                    |                                                                                                                                                                    |                                      |               |                                     |                                                              |                                                                                                            | 16         |
| 5                                                                                                                                                                                                                                    |                                                                                                                                                                    |                                      |               |                                     |                                                              |                                                                                                            |            |

|                                                                                                             |                  |                        |
|-------------------------------------------------------------------------------------------------------------|------------------|------------------------|
| <br>A TETRA TECH COMPANY | LOGGED BY: JTP   | COMPLETION DEPTH: 0.6m |
|                                                                                                             | REVIEWED BY: CPC | COMPLETE: 9/11/2013    |
|                                                                                                             | DRAWING NO:      | Page 1 of 1            |

| Dry Stack Tailings Facility Phase II Expansion                            |                                                                                                                       | CLIENT: Alexco Keno Hill Mining Corp |               | TESTPIT NO: W14103303-TP40          |                                             |                                                         |            |
|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------|-------------------------------------|---------------------------------------------|---------------------------------------------------------|------------|
| Keno Hill District Mill Site                                              |                                                                                                                       | EXCAVATOR: Hitachi 270 Excavator     |               | PROJECT NO: W14103303-01            |                                             |                                                         |            |
| Keno City, YT                                                             |                                                                                                                       | 7086655N; 484135E; Zone 8            |               |                                     |                                             |                                                         |            |
| SAMPLE TYPE  DISTURBED  NO RECOVERY  SPT  A-CASING  SHELBY TUBE  CORE     |                                                                                                                       |                                      |               |                                     |                                             |                                                         |            |
| BACKFILL TYPE  BENTONITE  PEA GRAVEL  SLOUGH  GROUT  DRILL CUTTINGS  SAND |                                                                                                                       |                                      |               |                                     |                                             |                                                         |            |
| Depth (m)                                                                 | SOIL DESCRIPTION                                                                                                      | SAMPLE TYPE                          | SAMPLE NUMBER | GROUND ICE DESCRIPTION AND COMMENTS | SPT (N)  PLASTIC M.C. LIQUID<br>20 40 60 80 | CLAY (%)  SILT (%)  SAND (%)  GRAVEL (%)<br>20 40 60 80 | Depth (ft) |
| 0                                                                         | ORGANIC COVER                                                                                                         |                                      |               |                                     |                                             |                                                         | 0          |
|                                                                           | SILT - some gravel, trace sand, firm (est.), damp, non-plastic, olive grey, cobbles throughout                        |                                      |               |                                     |                                             |                                                         |            |
| 1                                                                         |                                                                                                                       |                                      | SA05          |                                     |                                             |                                                         |            |
|                                                                           | SAND and GRAVEL - trace silt, well graded, medium grained, sub-rounded, loose (est.), damp, brown, cobbles throughout |                                      |               |                                     |                                             |                                                         | 5          |
| 2                                                                         |                                                                                                                       |                                      | SA06          |                                     |                                             |                                                         |            |
| 3                                                                         |                                                                                                                       |                                      |               |                                     |                                             |                                                         | 10         |
| 4                                                                         |                                                                                                                       |                                      |               |                                     |                                             |                                                         |            |
|                                                                           | END OF TESTPIT @ 4.5 m (machine extent)                                                                               |                                      |               |                                     |                                             |                                                         | 15         |
| 5                                                                         |                                                                                                                       |                                      |               |                                     |                                             |                                                         | 16         |
| eba<br>A TETRA TECH COMPANY                                               |                                                                                                                       | LOGGED BY: JTP                       |               | COMPLETION DEPTH: 4.5m              |                                             |                                                         |            |
|                                                                           |                                                                                                                       | REVIEWED BY: CPC                     |               | COMPLETE: 9/11/2013                 |                                             |                                                         |            |
|                                                                           |                                                                                                                       | DRAWING NO:                          |               | Page 1 of 1                         |                                             |                                                         |            |

| Dry Stack Tailings Facility Phase II Expansion                                                                                                                                                                                       |                                                                                                                       | CLIENT: Alexco Keno Hill Mining Corp |               | TESTPIT NO: W14103303-TP41          |                                                              |                                                                                                            |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------|-------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|------------|
| Keno Hill District Mill Site                                                                                                                                                                                                         |                                                                                                                       | EXCAVATOR: Hitachi 270 Excavator     |               | PROJECT NO: W14103303-01            |                                                              |                                                                                                            |            |
| Keno City, YT                                                                                                                                                                                                                        |                                                                                                                       | 7086670N; 484145E; Zone 8            |               |                                     |                                                              |                                                                                                            |            |
| SAMPLE TYPE <input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE     |                                                                                                                       |                                      |               |                                     |                                                              |                                                                                                            |            |
| BACKFILL TYPE <input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND |                                                                                                                       |                                      |               |                                     |                                                              |                                                                                                            |            |
| Depth (m)                                                                                                                                                                                                                            | SOIL DESCRIPTION                                                                                                      | SAMPLE TYPE                          | SAMPLE NUMBER | GROUND ICE DESCRIPTION AND COMMENTS | SPT (N)<br>20 40 60 80<br>PLASTIC M.C. LIQUID<br>20 40 60 80 | CLAY (%)<br>20 40 60 80<br>SILT (%)<br>20 40 60 80<br>SAND (%)<br>20 40 60 80<br>GRAVEL (%)<br>20 40 60 80 | Depth (ft) |
| 0                                                                                                                                                                                                                                    | ORGANIC COVER                                                                                                         |                                      |               |                                     |                                                              |                                                                                                            | 0          |
|                                                                                                                                                                                                                                      | SILT - some gravel, trace sand, firm (est.), damp, non-plastic, olive grey, cobbles throughout                        |                                      |               |                                     |                                                              |                                                                                                            |            |
| 1                                                                                                                                                                                                                                    |                                                                                                                       |                                      |               |                                     |                                                              |                                                                                                            |            |
| 2                                                                                                                                                                                                                                    |                                                                                                                       |                                      | SA07          |                                     |                                                              |                                                                                                            |            |
|                                                                                                                                                                                                                                      | SAND and GRAVEL - trace silt, well graded, medium grained, sub-rounded, loose (est.), damp, brown, cobbles throughout |                                      |               |                                     |                                                              |                                                                                                            |            |
| 3                                                                                                                                                                                                                                    |                                                                                                                       |                                      |               |                                     |                                                              |                                                                                                            |            |
| 4                                                                                                                                                                                                                                    |                                                                                                                       |                                      | SA08          |                                     |                                                              |                                                                                                            |            |
|                                                                                                                                                                                                                                      | END OF TESTPIT @ 4.5 m (machine extent)                                                                               |                                      |               |                                     |                                                              |                                                                                                            |            |
| 5                                                                                                                                                                                                                                    |                                                                                                                       |                                      |               |                                     |                                                              |                                                                                                            | 16         |

| Dry Stack Tailings Facility Phase II Expansion                                                                                                                                                                            |                                                                                           | CLIENT: Alexco Keno Hill Mining Corp |                                     | TESTPIT NO: W14103303-TP42                                   |                                                                                                            |            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|------------|
| Keno Hill District Mill Site                                                                                                                                                                                              |                                                                                           | EXCAVATOR: Hitachi 270 Excavator     |                                     | PROJECT NO: W14103303-01                                     |                                                                                                            |            |
| Keno City, YT                                                                                                                                                                                                             |                                                                                           | 7086655N; 484180E; Zone 8            |                                     |                                                              |                                                                                                            |            |
| SAMPLE TYPE <input type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE     |                                                                                           |                                      |                                     |                                                              |                                                                                                            |            |
| BACKFILL TYPE <input type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND |                                                                                           |                                      |                                     |                                                              |                                                                                                            |            |
| Depth (m)                                                                                                                                                                                                                 | SOIL DESCRIPTION                                                                          | SAMPLE TYPE                          | GROUND ICE DESCRIPTION AND COMMENTS | SPT (N)<br>20 40 60 80<br>PLASTIC M.C. LIQUID<br>20 40 60 80 | CLAY (%)<br>20 40 60 80<br>SILT (%)<br>20 40 60 80<br>SAND (%)<br>20 40 60 80<br>GRAVEL (%)<br>20 40 60 80 | Depth (ft) |
| 0                                                                                                                                                                                                                         | ORGANIC COVER                                                                             |                                      |                                     |                                                              |                                                                                                            | 0          |
|                                                                                                                                                                                                                           | SILT - sandy, some gravel, firm (est.), damp, non-plastic, olive grey, cobbles throughout |                                      |                                     |                                                              |                                                                                                            |            |
| 1                                                                                                                                                                                                                         |                                                                                           |                                      |                                     |                                                              |                                                                                                            |            |
|                                                                                                                                                                                                                           | - becomes some sand, some gravel, cobbles and boulders throughout                         |                                      |                                     |                                                              |                                                                                                            |            |
| 2                                                                                                                                                                                                                         |                                                                                           |                                      |                                     |                                                              |                                                                                                            |            |
| 3                                                                                                                                                                                                                         | END OF TESTPIT @ 3.0 m (desired depth)                                                    |                                      |                                     |                                                              |                                                                                                            | 10         |
| 4                                                                                                                                                                                                                         |                                                                                           |                                      |                                     |                                                              |                                                                                                            |            |
| 5                                                                                                                                                                                                                         |                                                                                           |                                      |                                     |                                                              |                                                                                                            | 16         |



| Dry Stack Tailings Facility Phase II Expansion                                                                                                                                                                                       |                                                                                                                    | CLIENT: Alexco Keno Hill Mining Corp |               | TESTPIT NO: W14103303-TP43          |                                                              |                                                                                                            |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------|-------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|------------|
| Keno Hill District Mill Site                                                                                                                                                                                                         |                                                                                                                    | EXCAVATOR: Hitachi 270 Excavator     |               | PROJECT NO: W14103303-01            |                                                              |                                                                                                            |            |
| Keno City, YT                                                                                                                                                                                                                        |                                                                                                                    | 7086695N; 484241E; Zone 8            |               |                                     |                                                              |                                                                                                            |            |
| SAMPLE TYPE <input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE     |                                                                                                                    |                                      |               |                                     |                                                              |                                                                                                            |            |
| BACKFILL TYPE <input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND |                                                                                                                    |                                      |               |                                     |                                                              |                                                                                                            |            |
| Depth (m)                                                                                                                                                                                                                            | SOIL DESCRIPTION                                                                                                   | SAMPLE TYPE                          | SAMPLE NUMBER | GROUND ICE DESCRIPTION AND COMMENTS | SPT (N)<br>20 40 60 80<br>PLASTIC M.C. LIQUID<br>20 40 60 80 | CLAY (%)<br>20 40 60 80<br>SILT (%)<br>20 40 60 80<br>SAND (%)<br>20 40 60 80<br>GRAVEL (%)<br>20 40 60 80 | Depth (ft) |
| 0                                                                                                                                                                                                                                    | ORGANIC COVER                                                                                                      |                                      |               |                                     |                                                              |                                                                                                            | 0          |
|                                                                                                                                                                                                                                      | SAND and GRAVEL - silty, well graded, medium grained, sub-rounded, compact (est.), damp, brown, cobbles throughout |                                      |               |                                     |                                                              |                                                                                                            |            |
| 1                                                                                                                                                                                                                                    |                                                                                                                    |                                      |               |                                     |                                                              |                                                                                                            |            |
| 2                                                                                                                                                                                                                                    |                                                                                                                    |                                      | SA09          |                                     |                                                              |                                                                                                            |            |
| 3                                                                                                                                                                                                                                    | END OF TESTPIT @ 3.0 m (desired depth)                                                                             |                                      |               |                                     |                                                              |                                                                                                            | 10         |
| 4                                                                                                                                                                                                                                    |                                                                                                                    |                                      |               |                                     |                                                              |                                                                                                            | 15         |
| 5                                                                                                                                                                                                                                    |                                                                                                                    |                                      |               |                                     |                                                              |                                                                                                            | 16         |
|                                                                                                                                                   |                                                                                                                    | LOGGED BY: JTP                       |               | COMPLETION DEPTH: 3m                |                                                              |                                                                                                            |            |
|                                                                                                                                                                                                                                      |                                                                                                                    | REVIEWED BY: CPC                     |               | COMPLETE: 9/11/2013                 |                                                              |                                                                                                            |            |
|                                                                                                                                                                                                                                      |                                                                                                                    | DRAWING NO:                          |               | Page 1 of 1                         |                                                              |                                                                                                            |            |

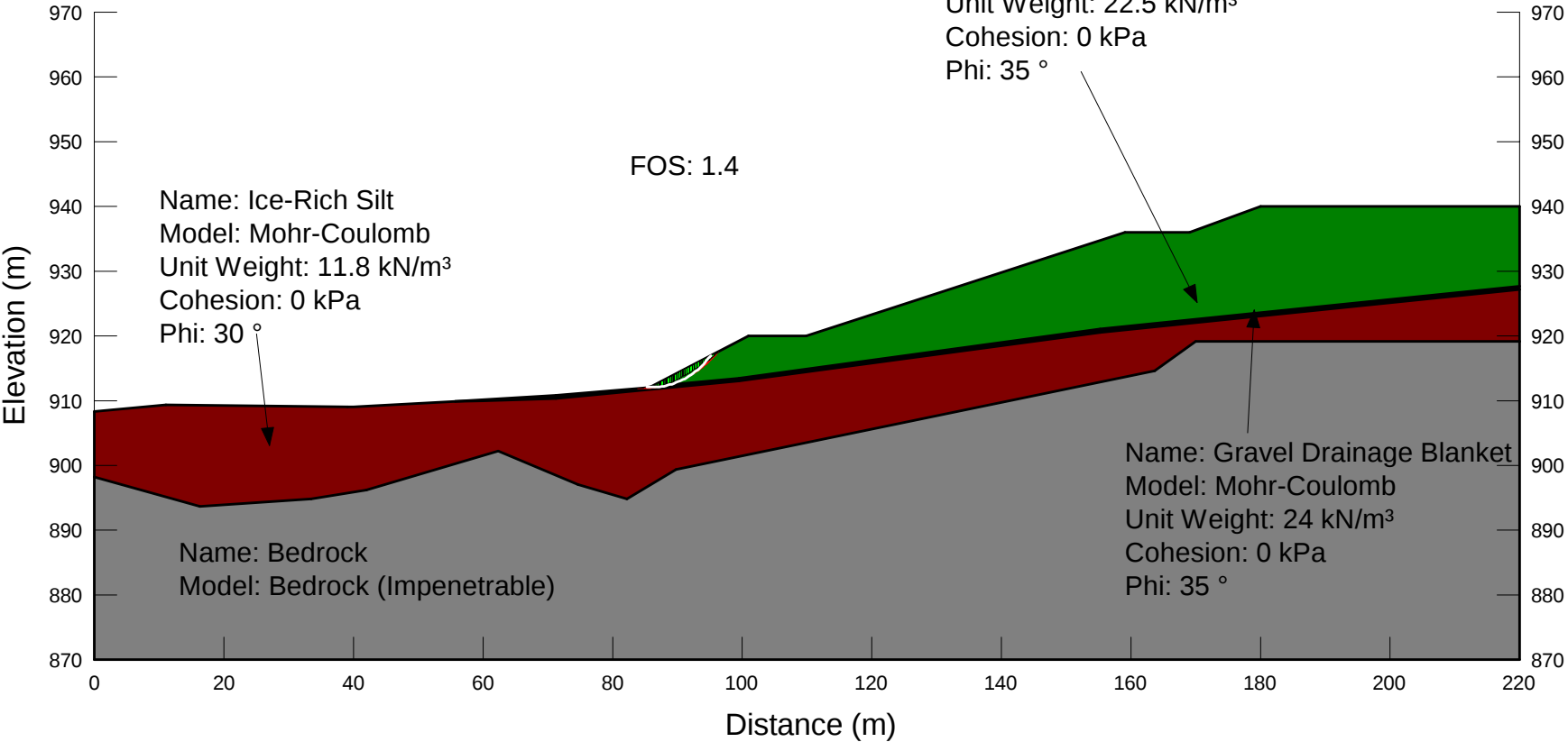
# APPENDIX C

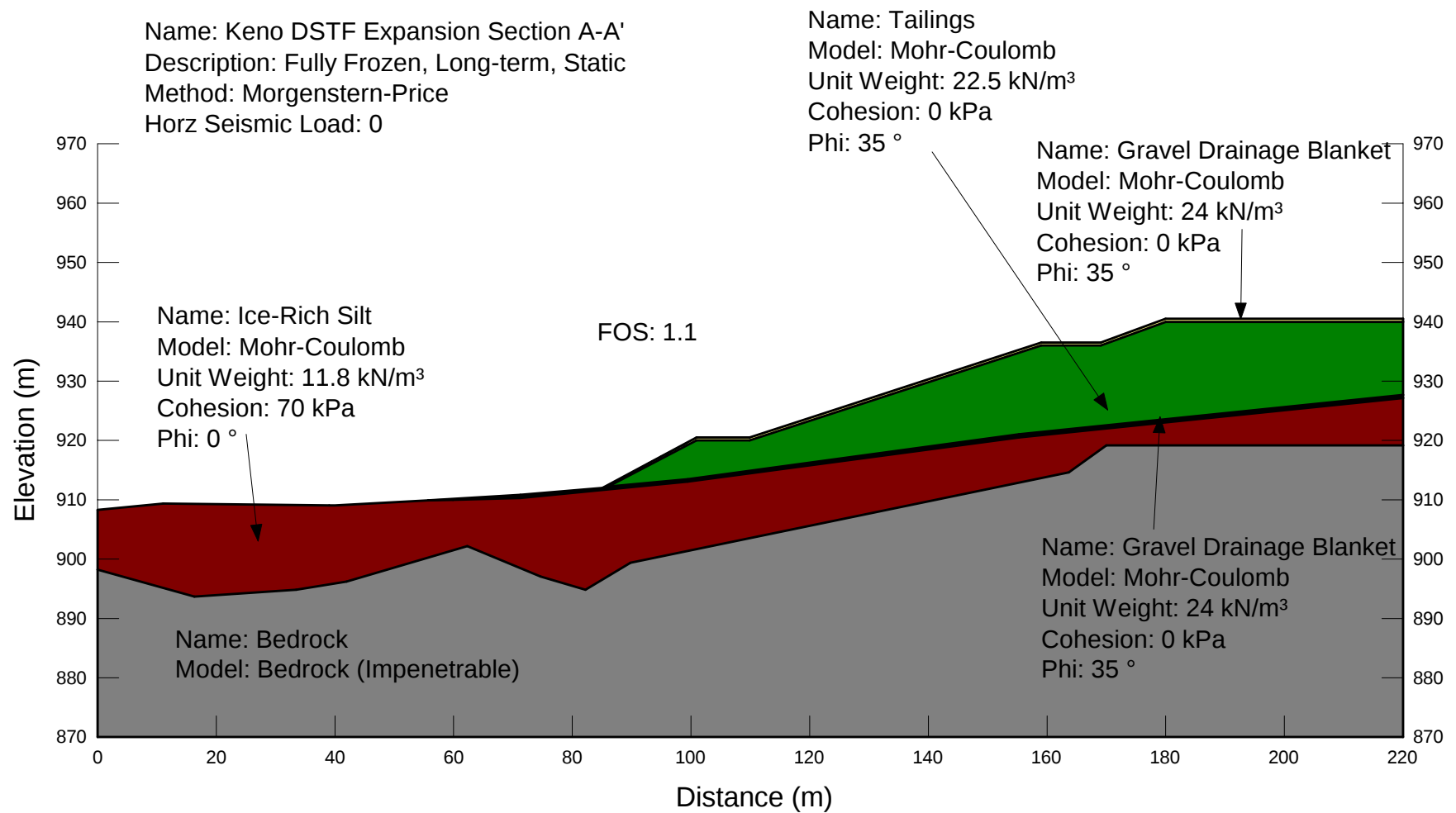
## SLOPE STABILITY RESULTS – FULLY FROZEN

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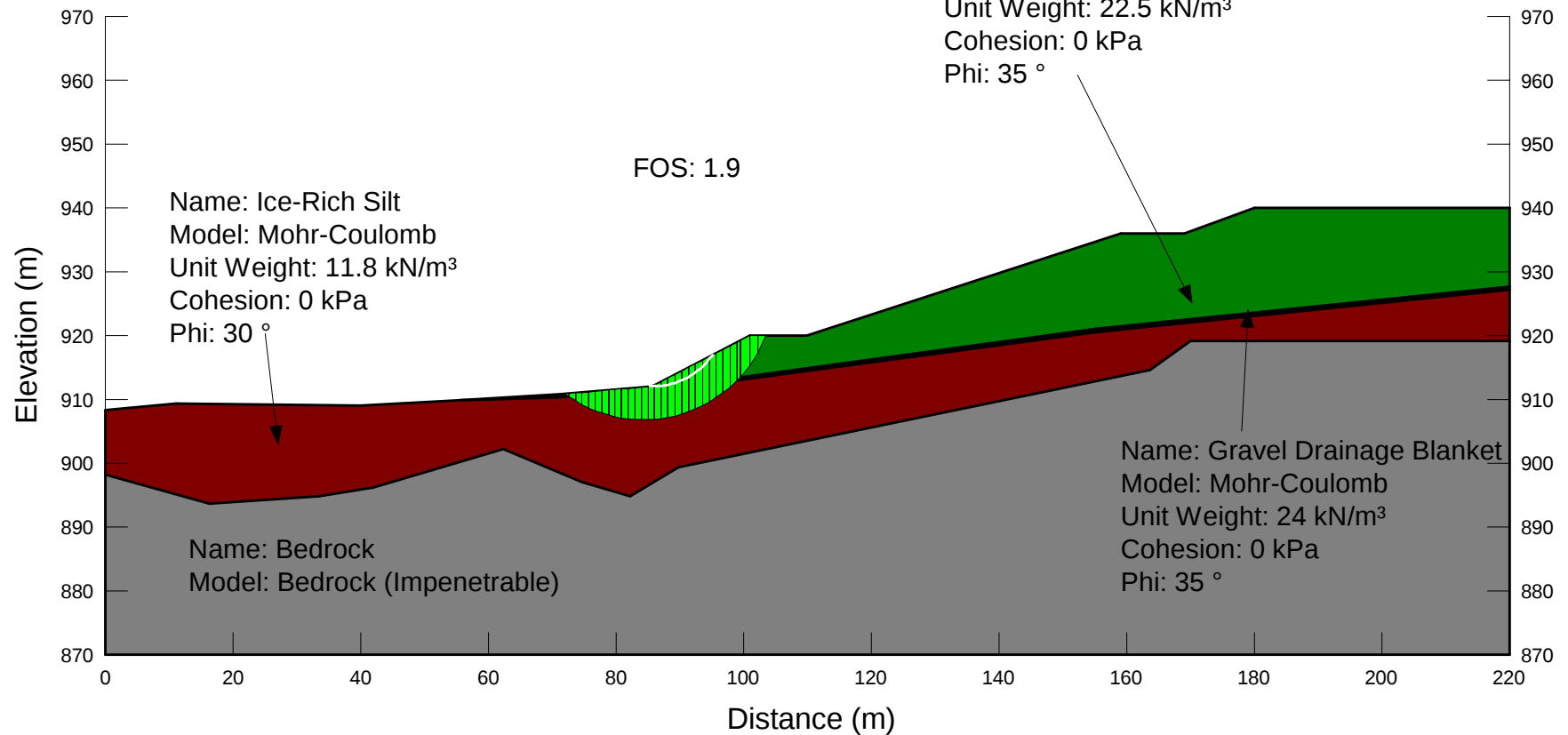
Name: Keno DSTF Expansion Section A-A'  
Description: Fully Frozen, Short-term, Static  
Method: Morgenstern-Price  
Horz Seismic Load: 0

Name: Tailings  
Model: Mohr-Coulomb  
Unit Weight: 22.5 kN/m<sup>3</sup>  
Cohesion: 0 kPa  
Phi: 35 °



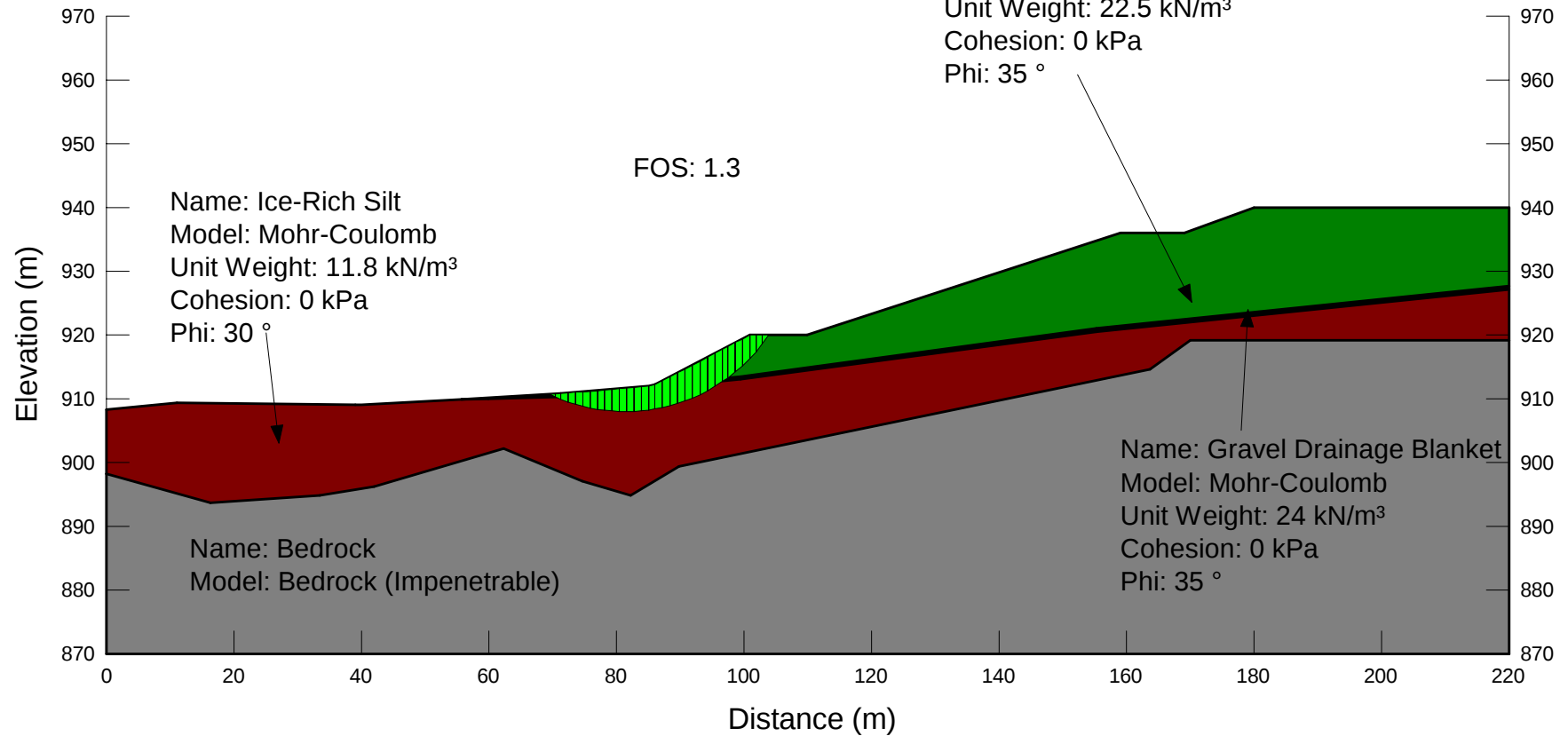


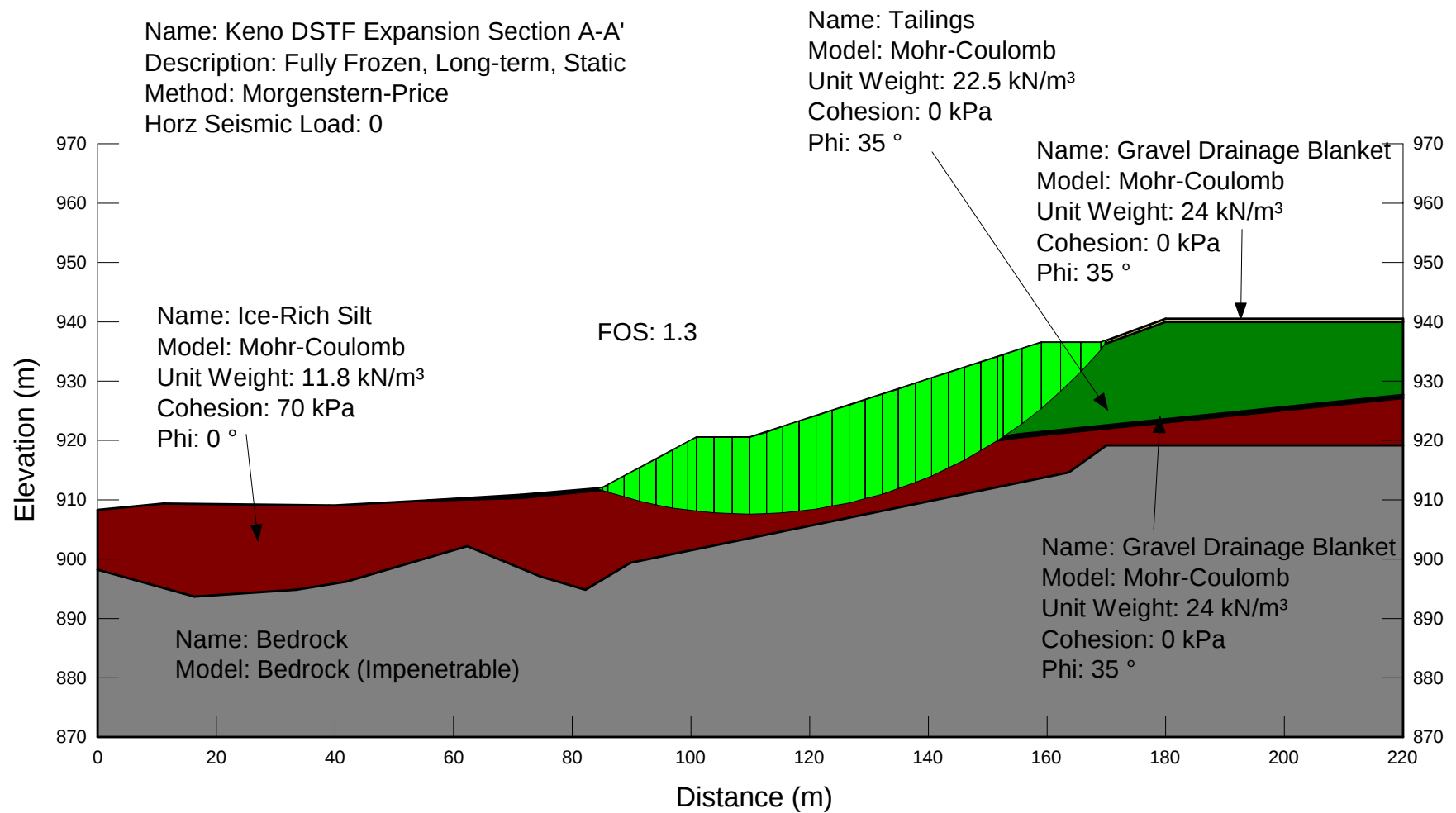
Name: Keno DSTF Expansion Section A-A'  
Description: Fully Frozen, Short-term, Static  
Method: Morgenstern-Price  
Horz Seismic Load: 0

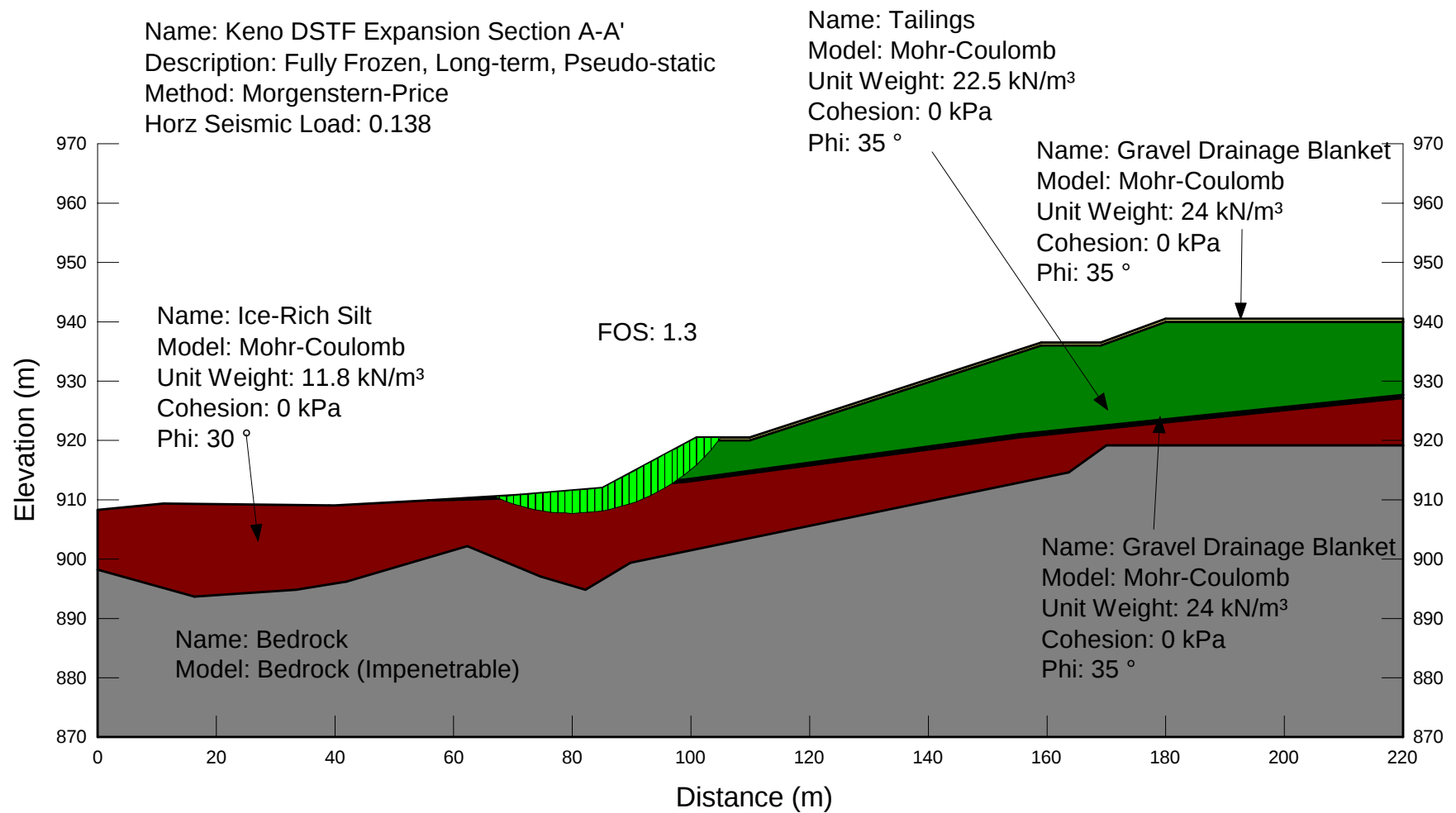


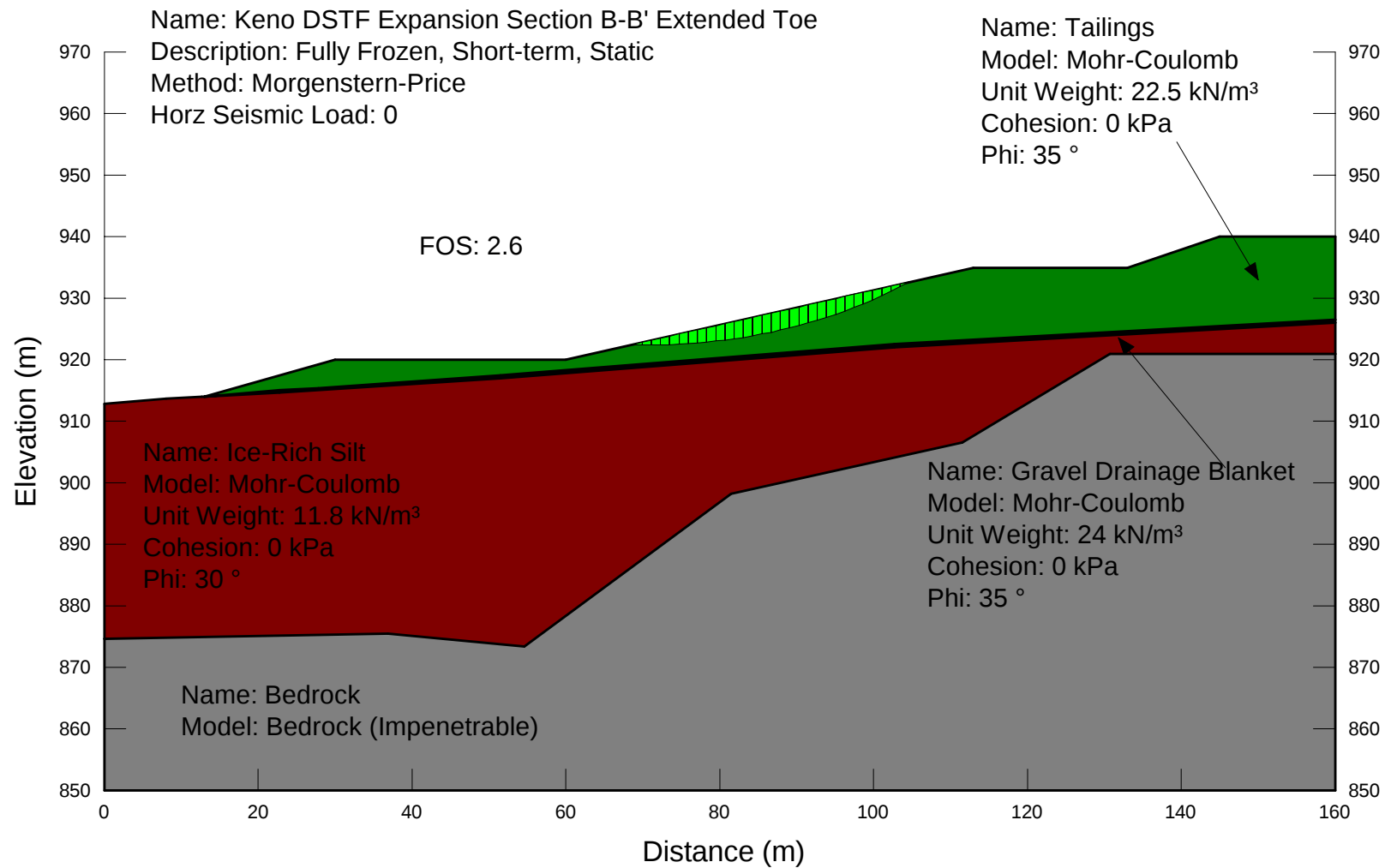
Name: Keno DSTF Expansion Section A-A'  
Description: Fully Frozen, Short-term, Pseudo-static  
Method: Morgenstern-Price  
Horz Seismic Load: 0.138

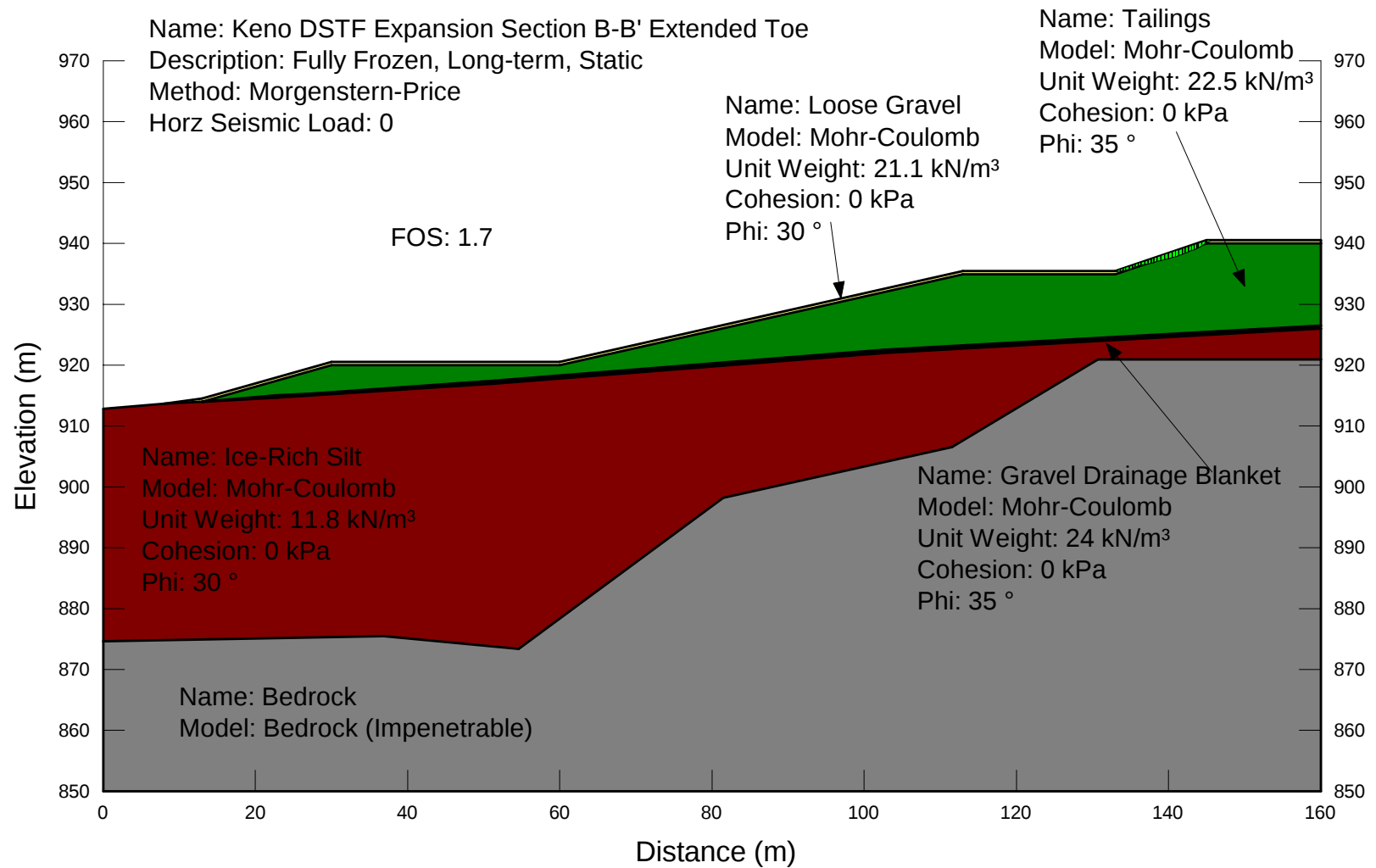
Name: Tailings  
Model: Mohr-Coulomb  
Unit Weight: 22.5 kN/m<sup>3</sup>  
Cohesion: 0 kPa  
Phi: 35 °

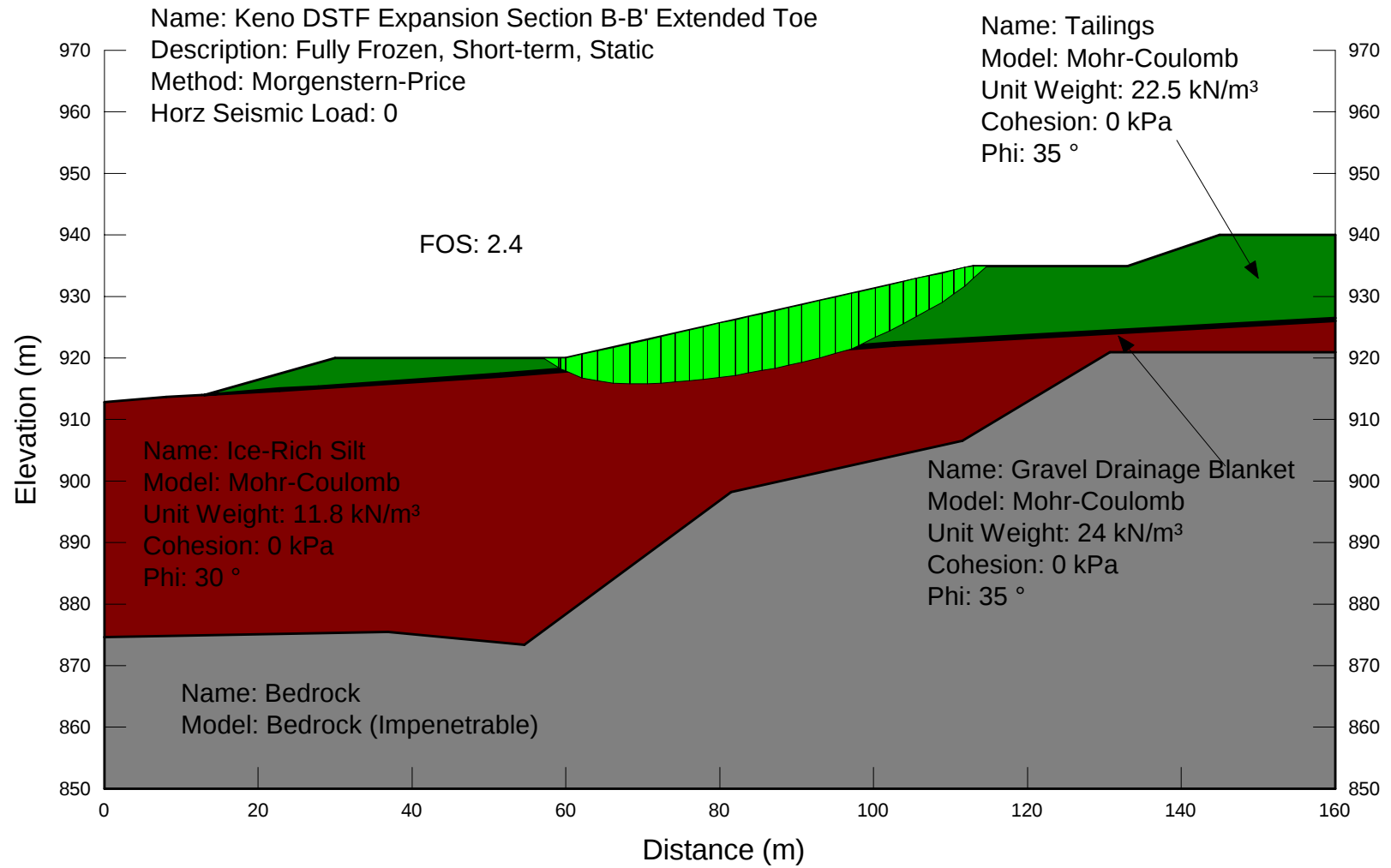


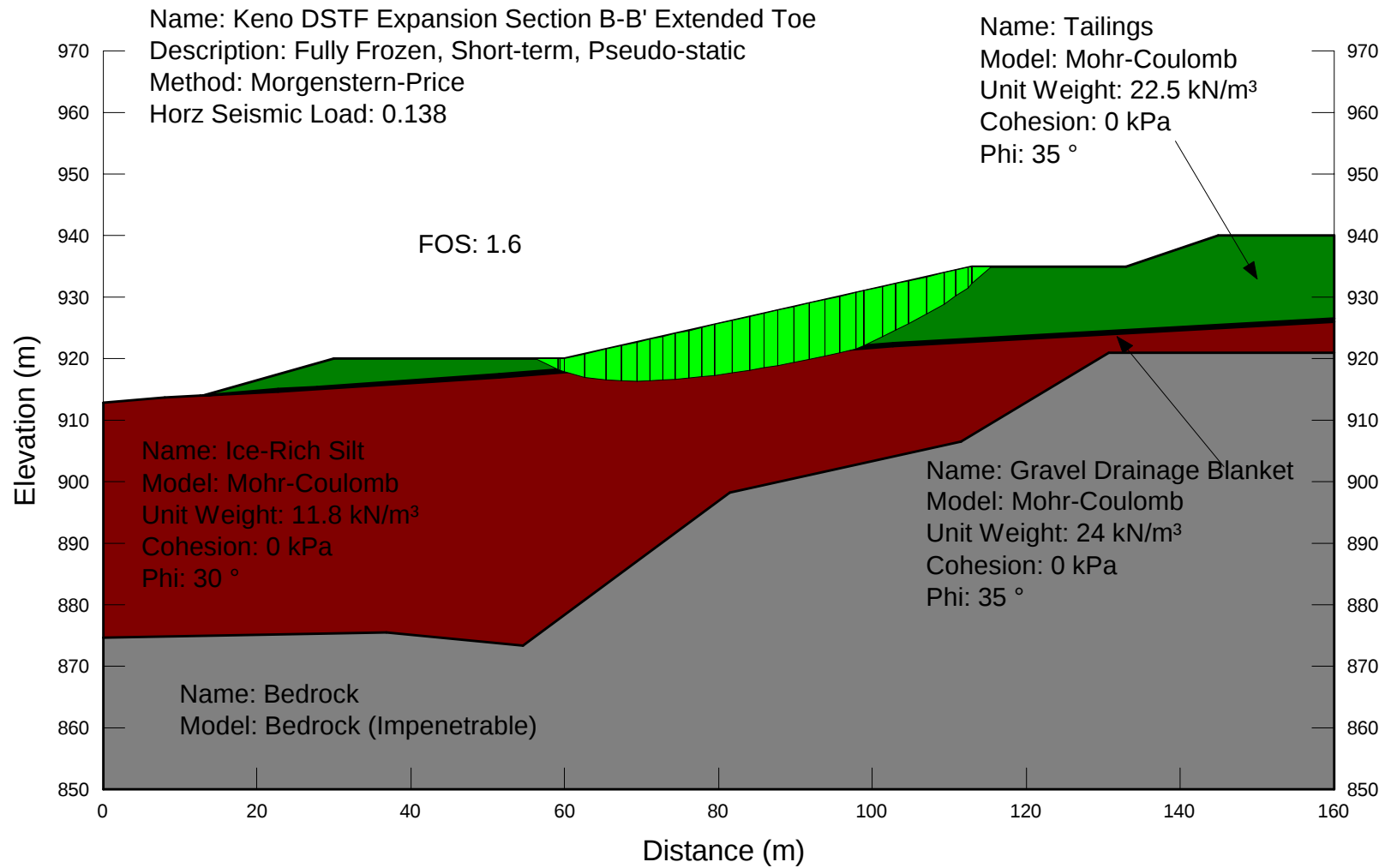


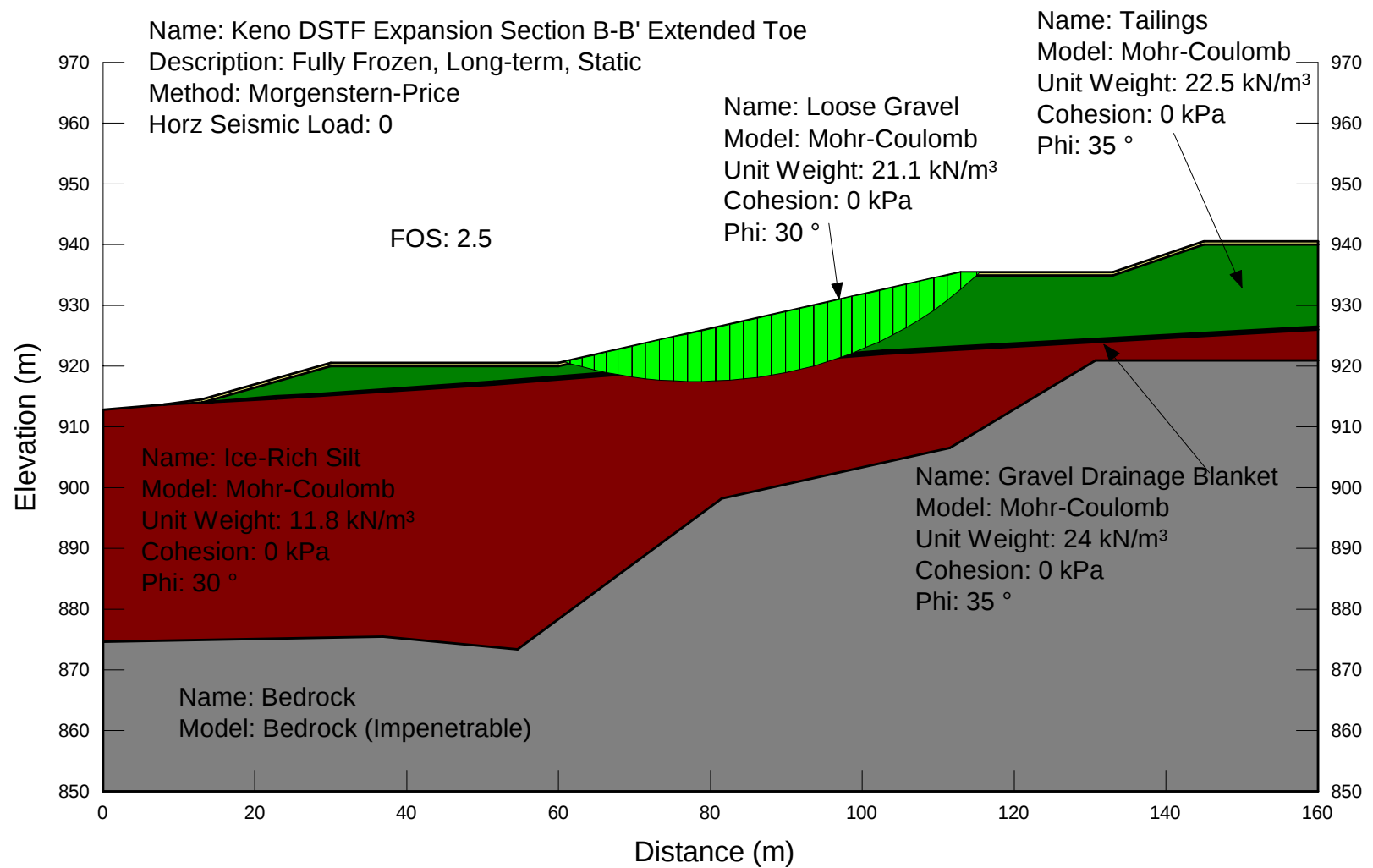


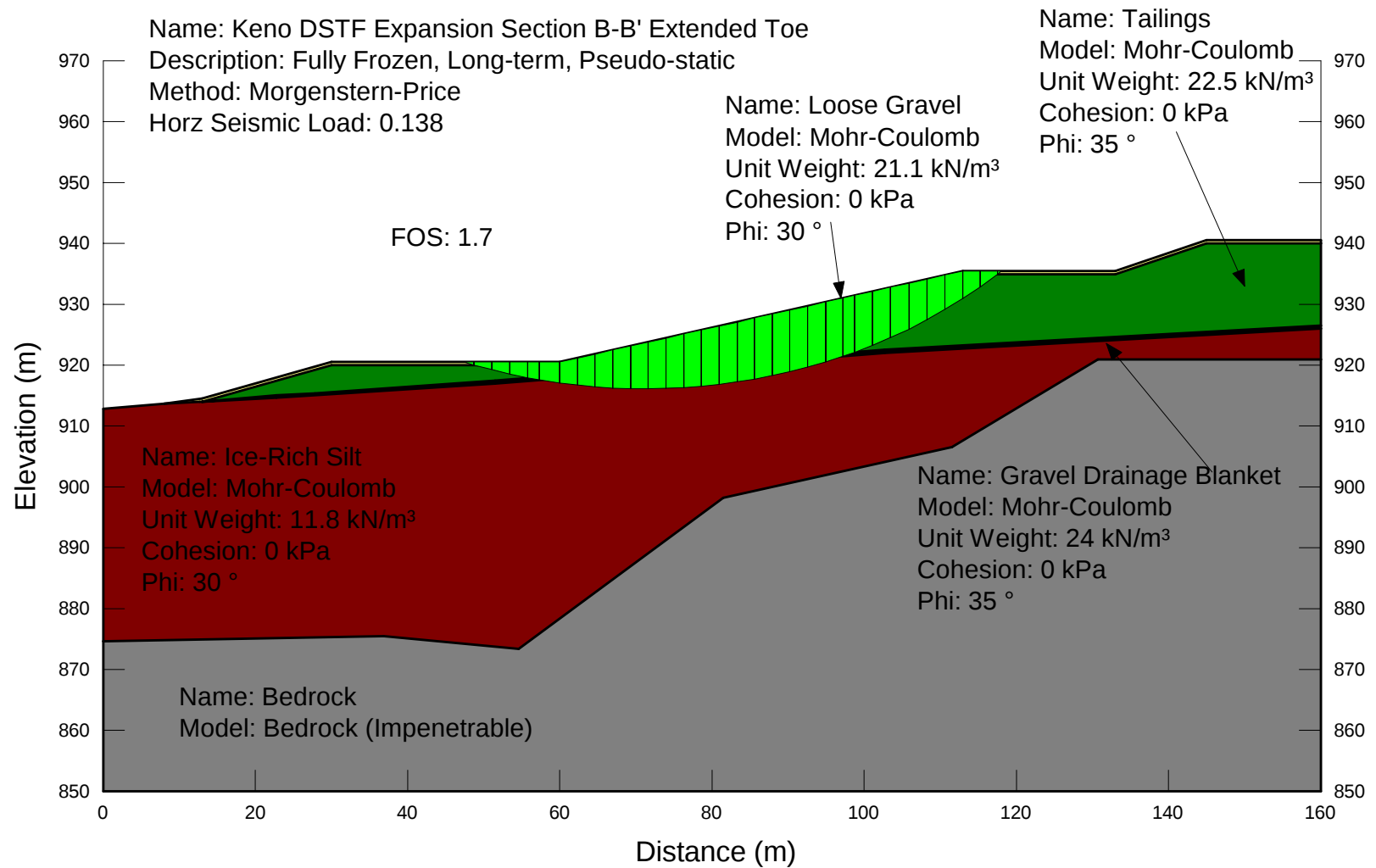








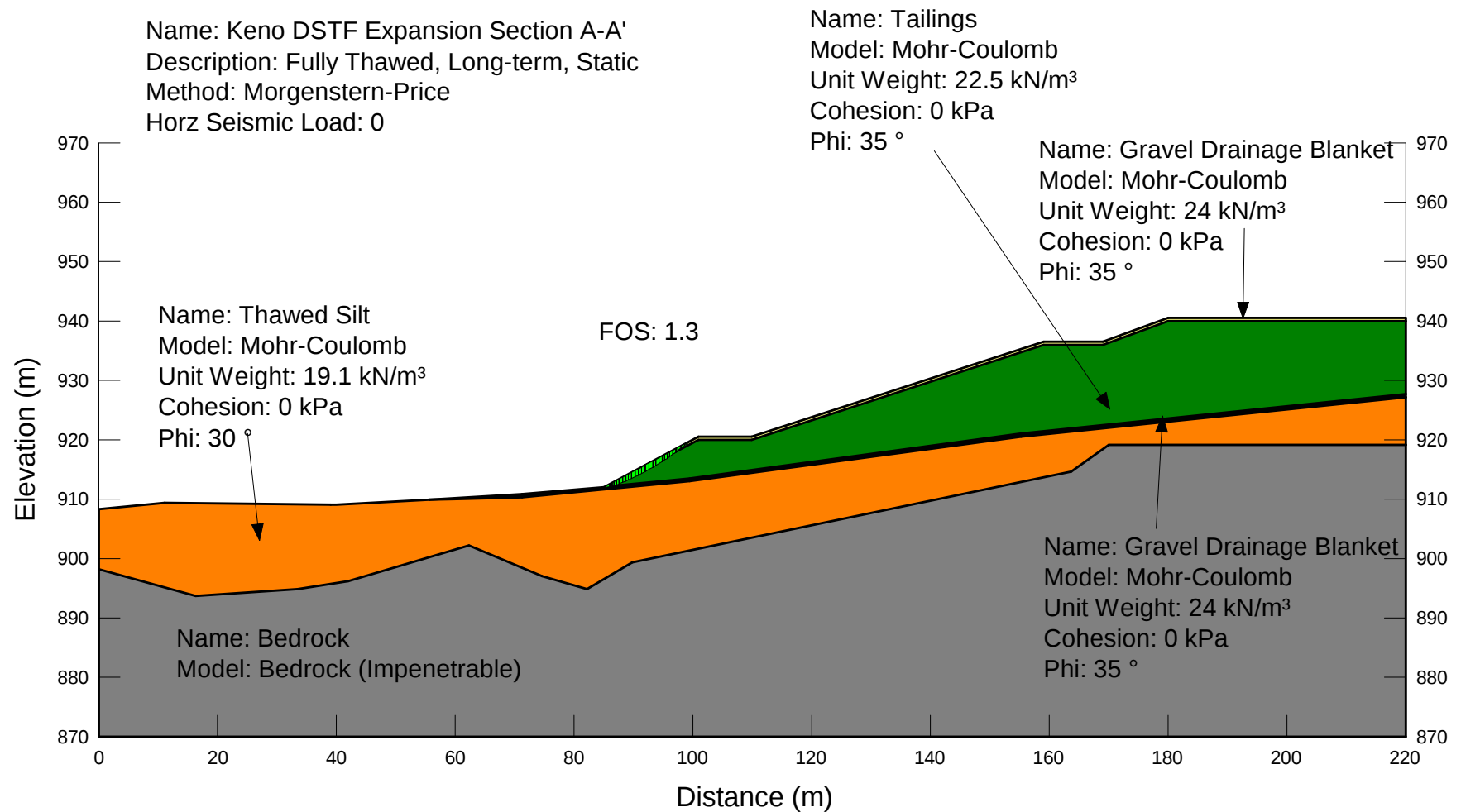


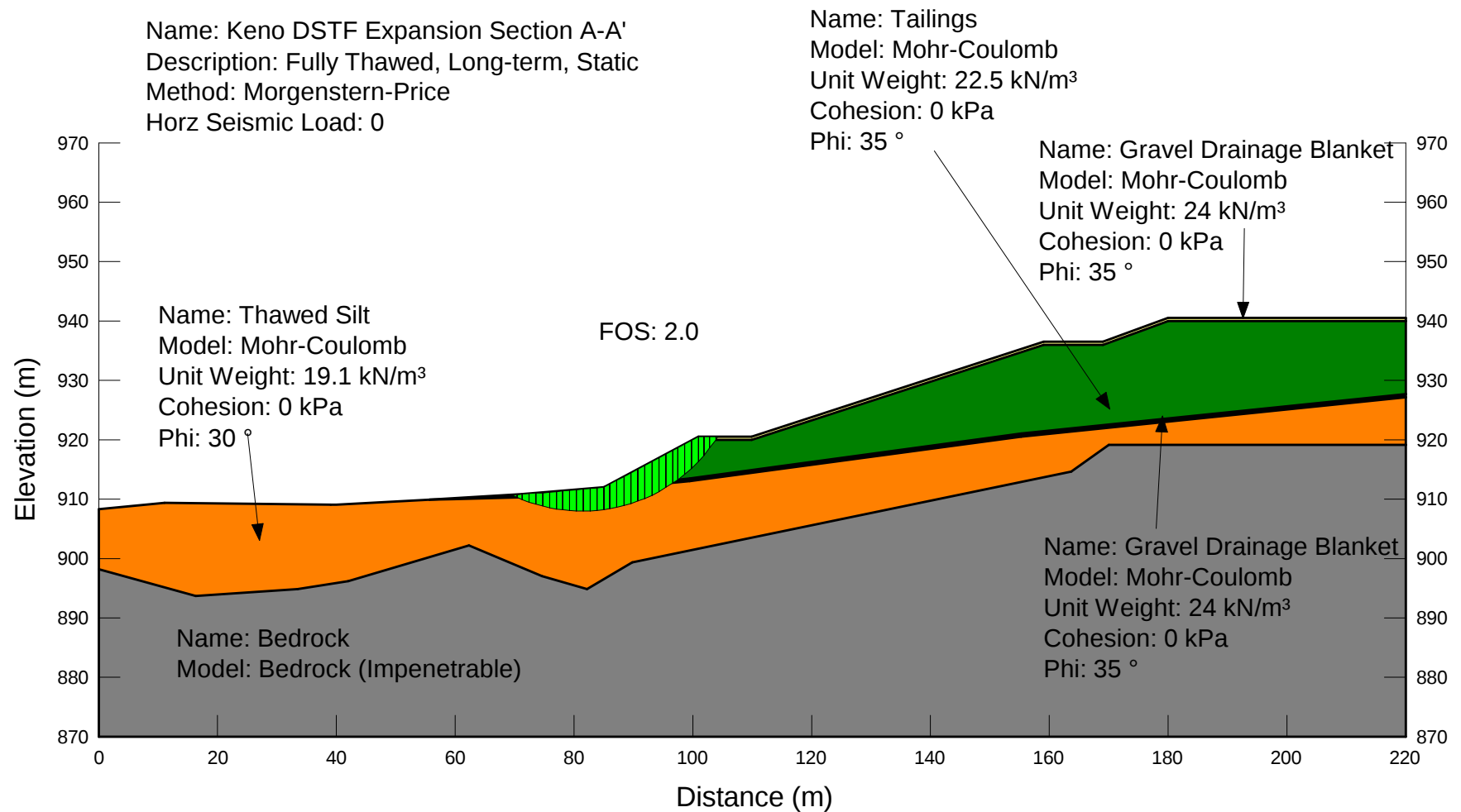


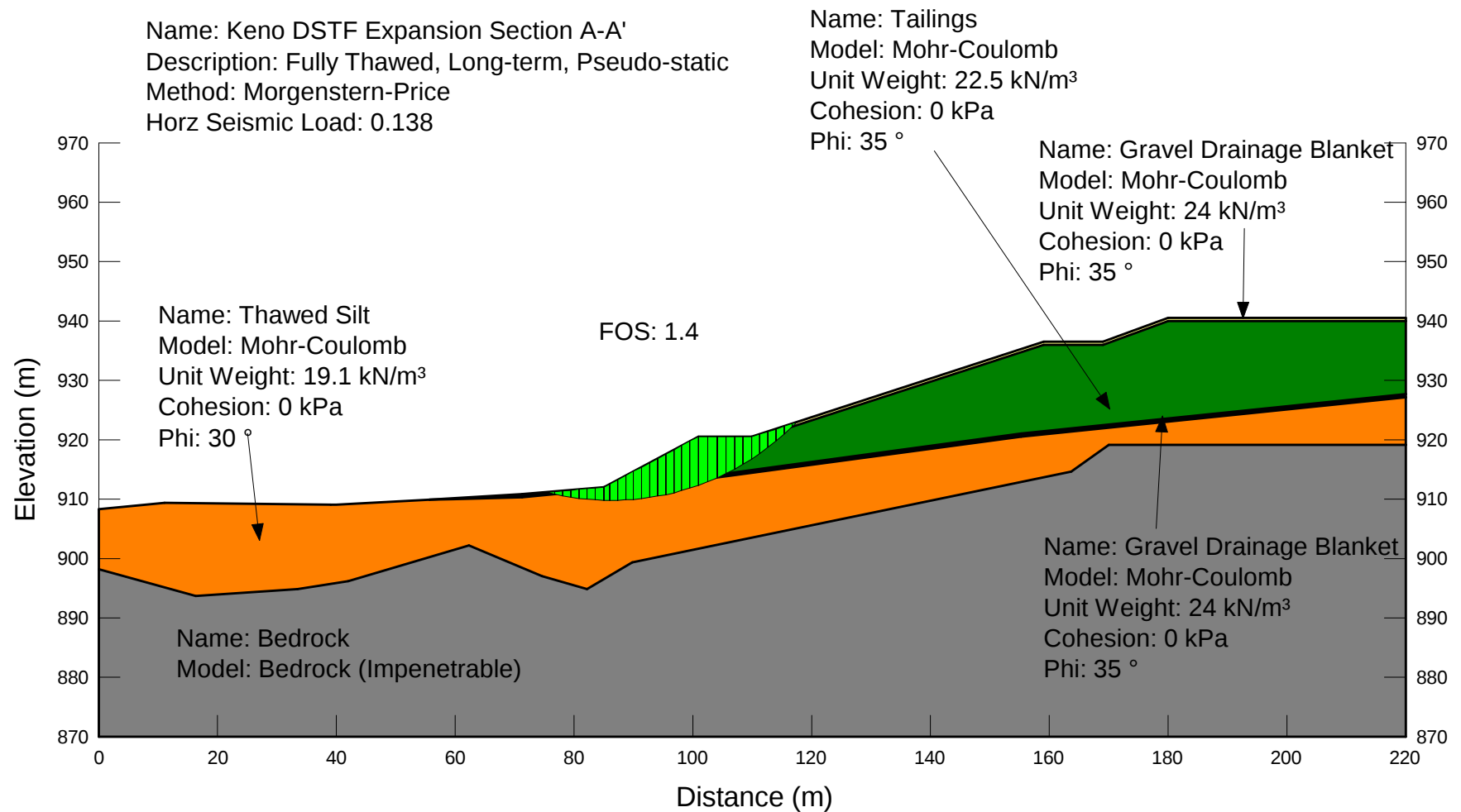
# APPENDIX D

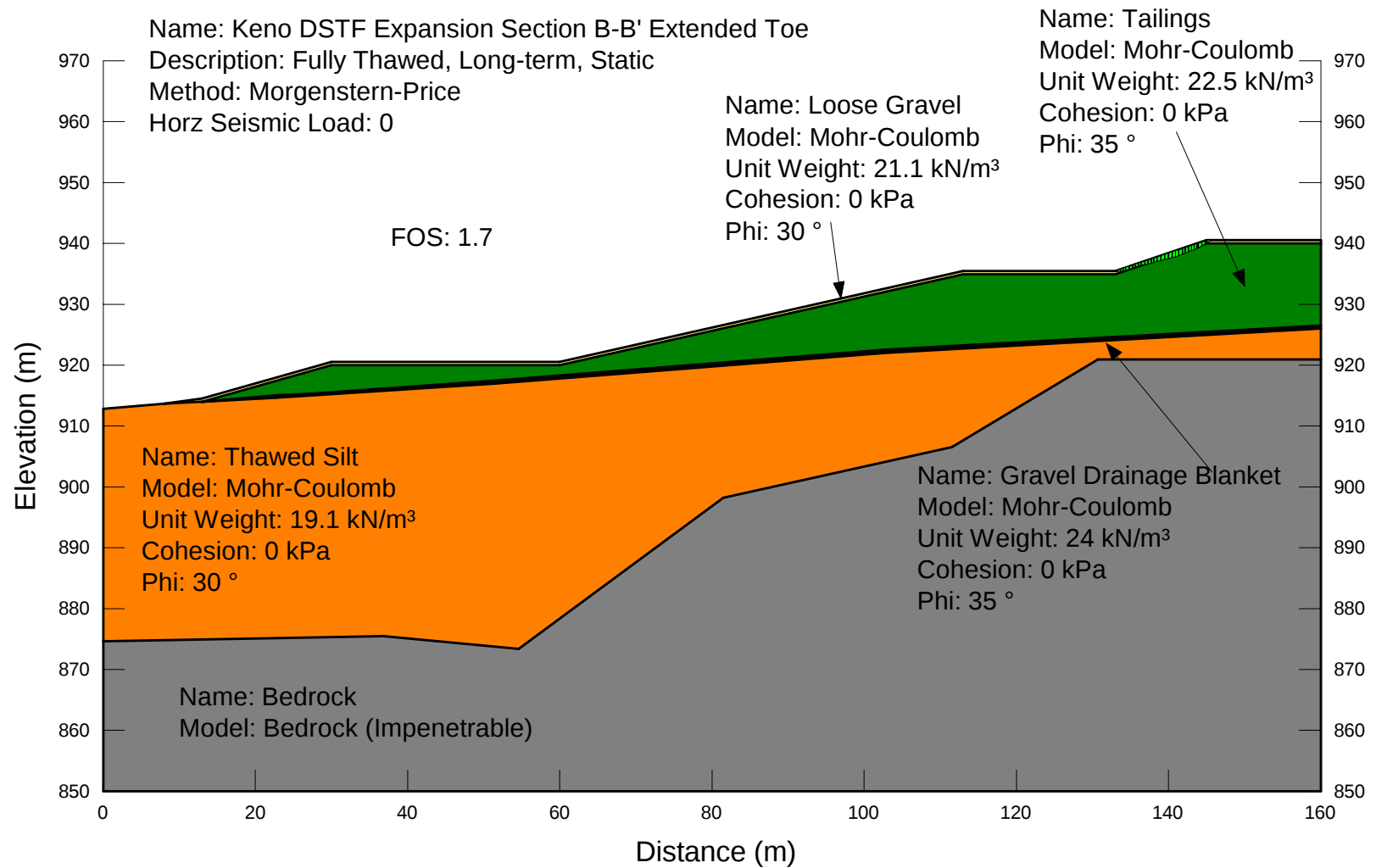
## SLOPE STABILITY RESULTS – FULLY THAWED

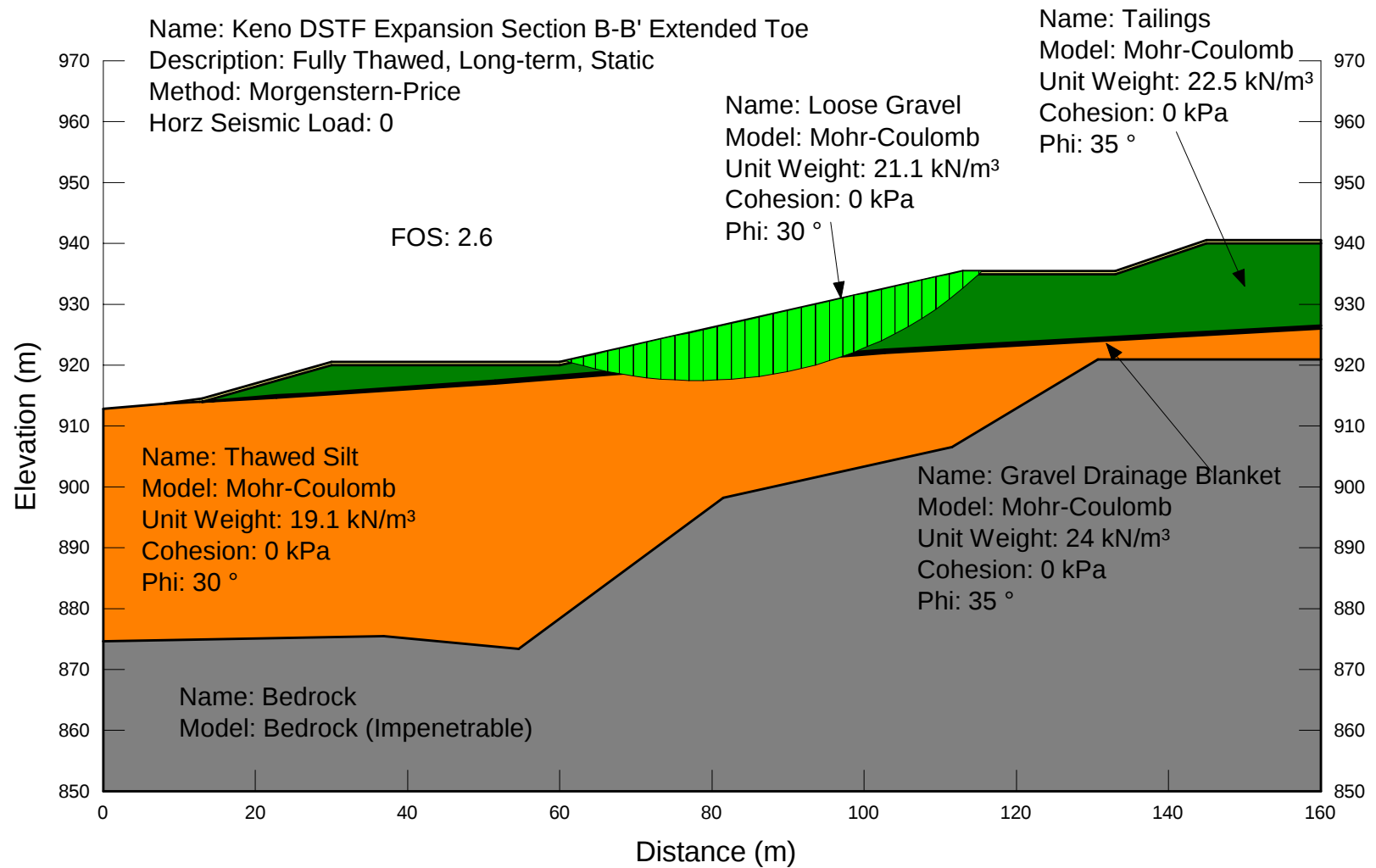
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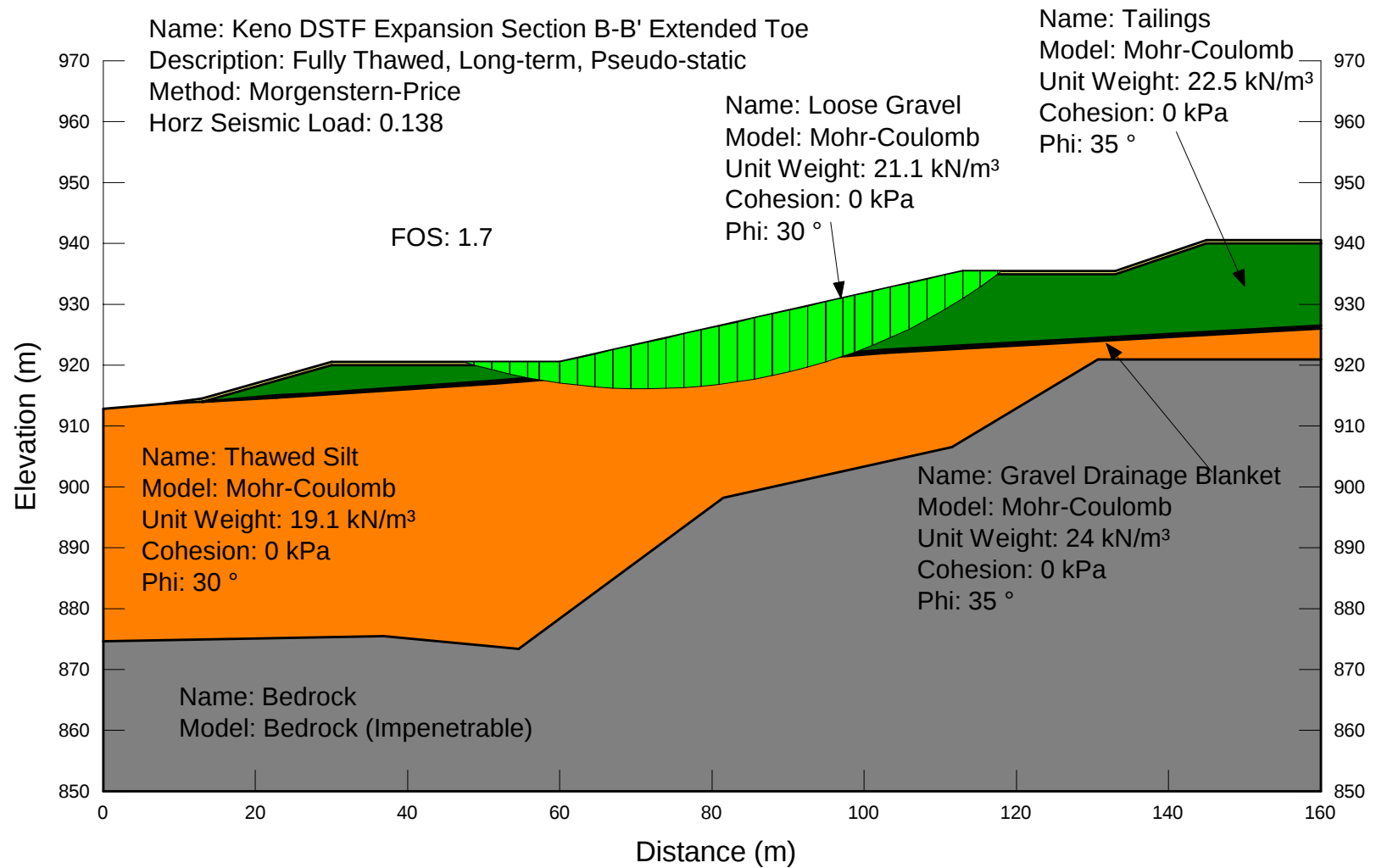










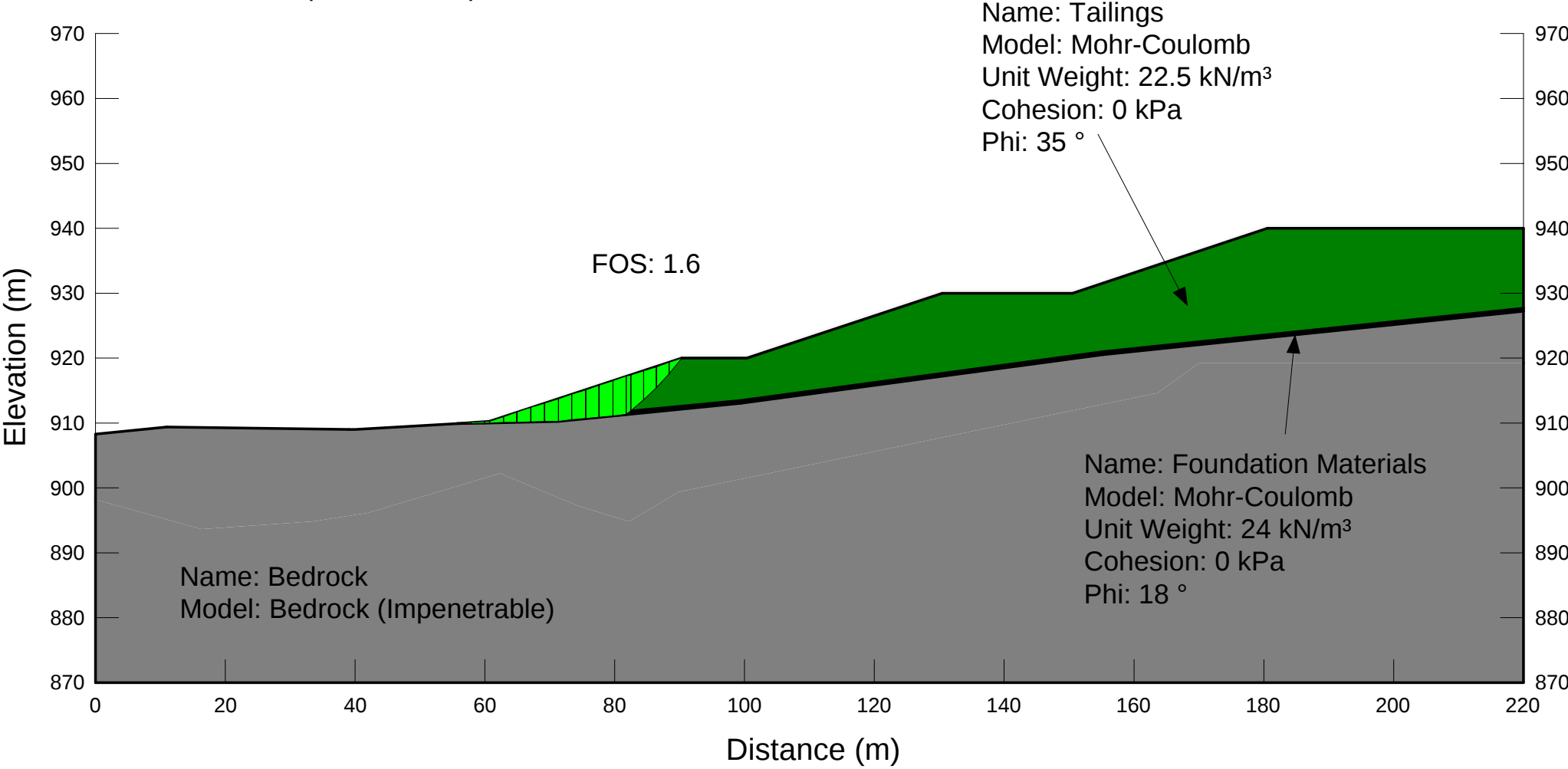


# APPENDIX E

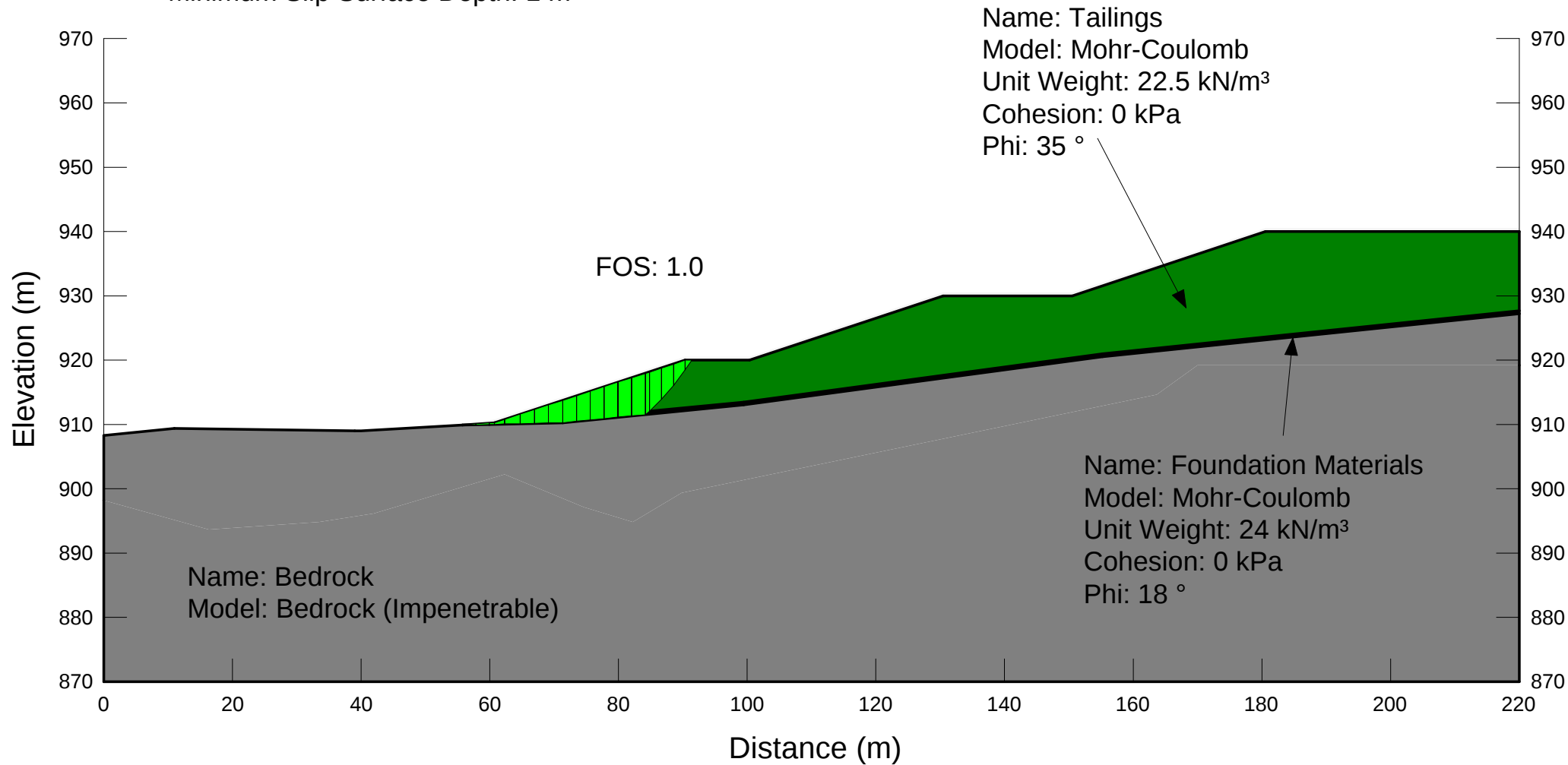
## SLOPE STABILITY RESULTS – FOUNDATION MATERIALS

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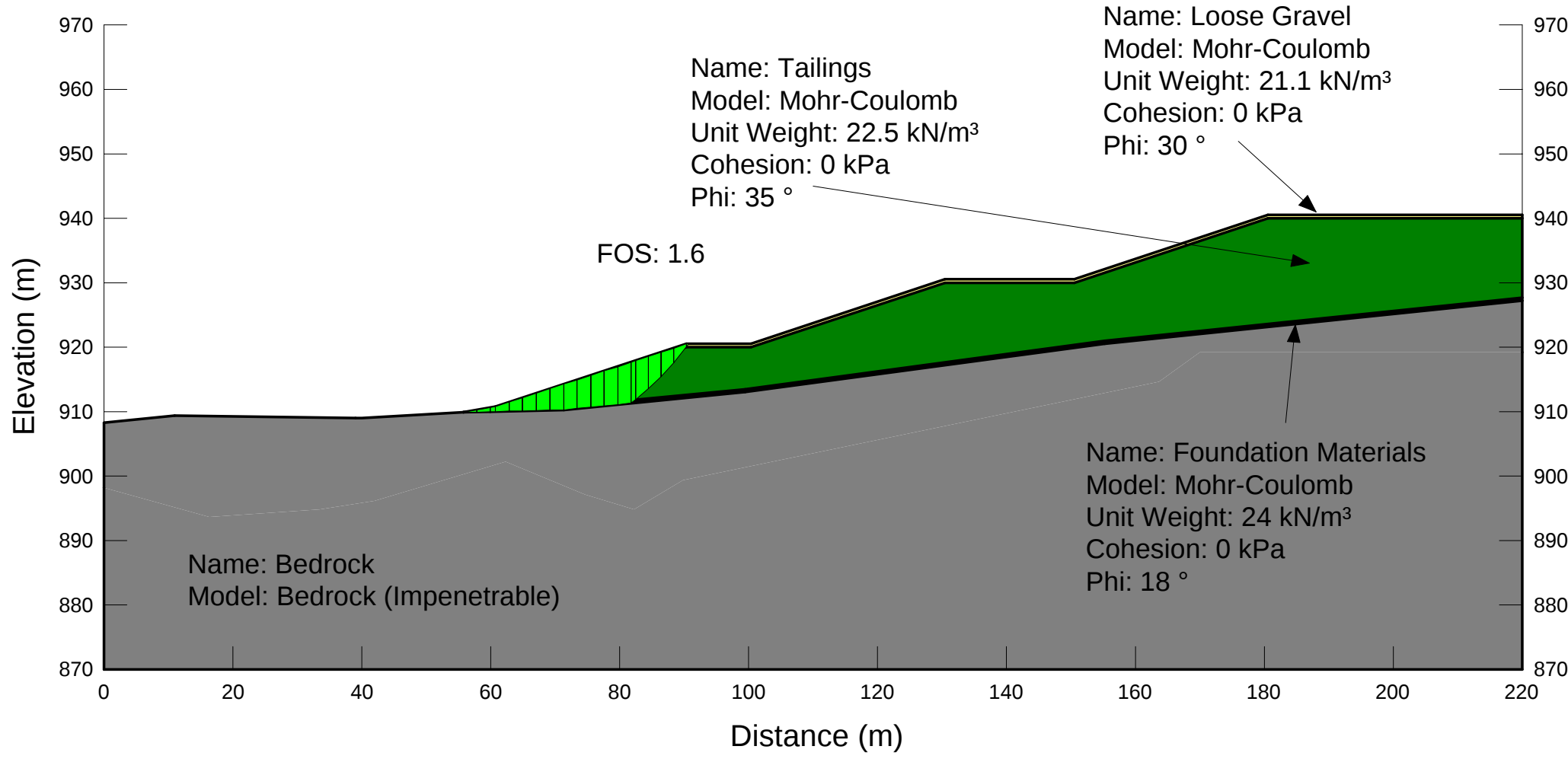
File Name: Section A-A'.gsz  
Name: Keno DSTF Expansion With Geosynthetic Clay Liner Short Term  
Description: Short Term Static  
Method: Morgenstern-Price  
Horz Seismic Load: 0  
Minimum Slip Surface Depth: 1 m



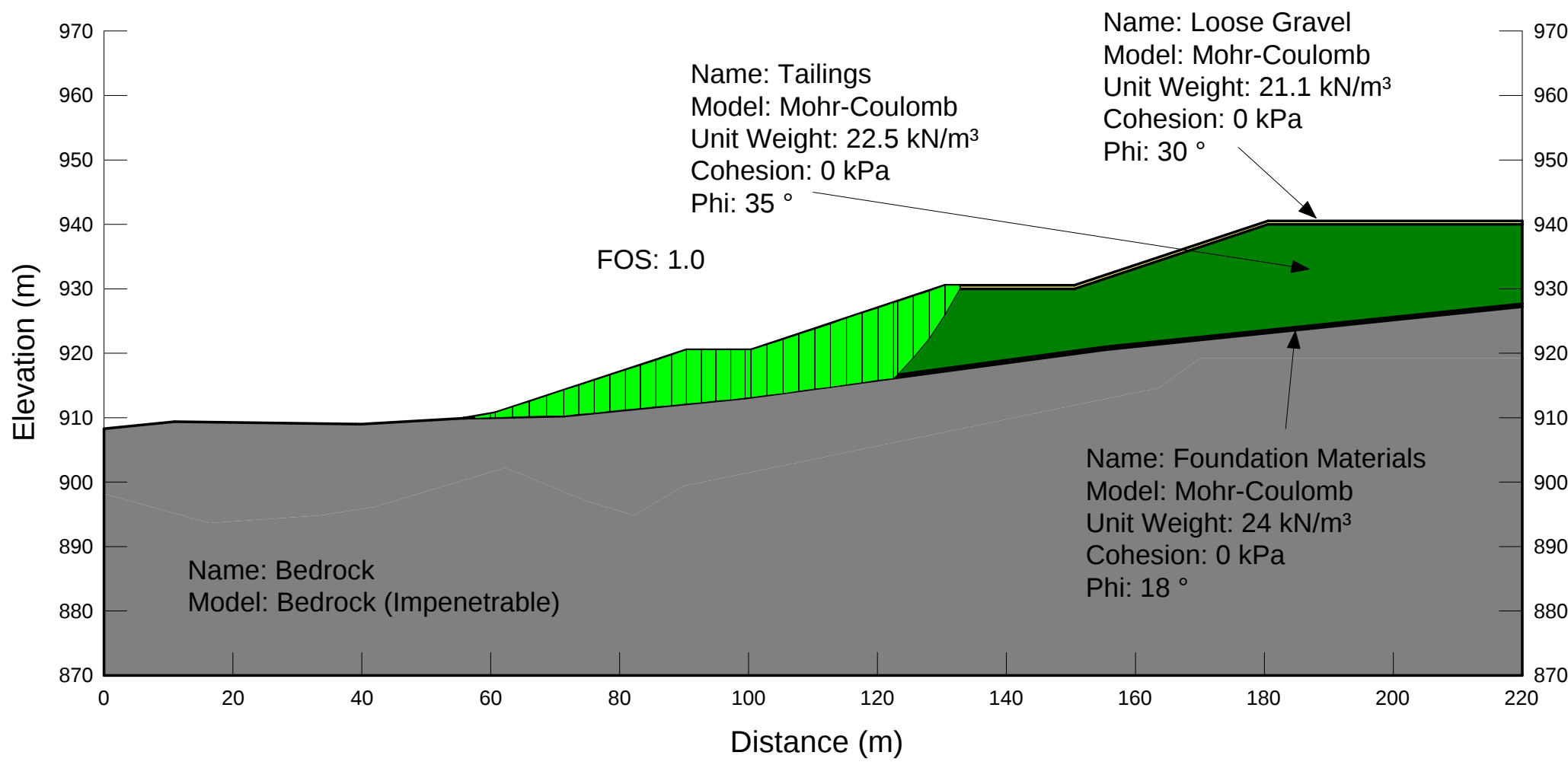
File Name: Section A-A'.gsz  
Name: Keno DSTF Expansion With Geosynthetic Clay Liner Short Term  
Description: Short Term Pseudo-static  
Method: Morgenstern-Price  
Horz Seismic Load: 0.138  
Minimum Slip Surface Depth: 1 m



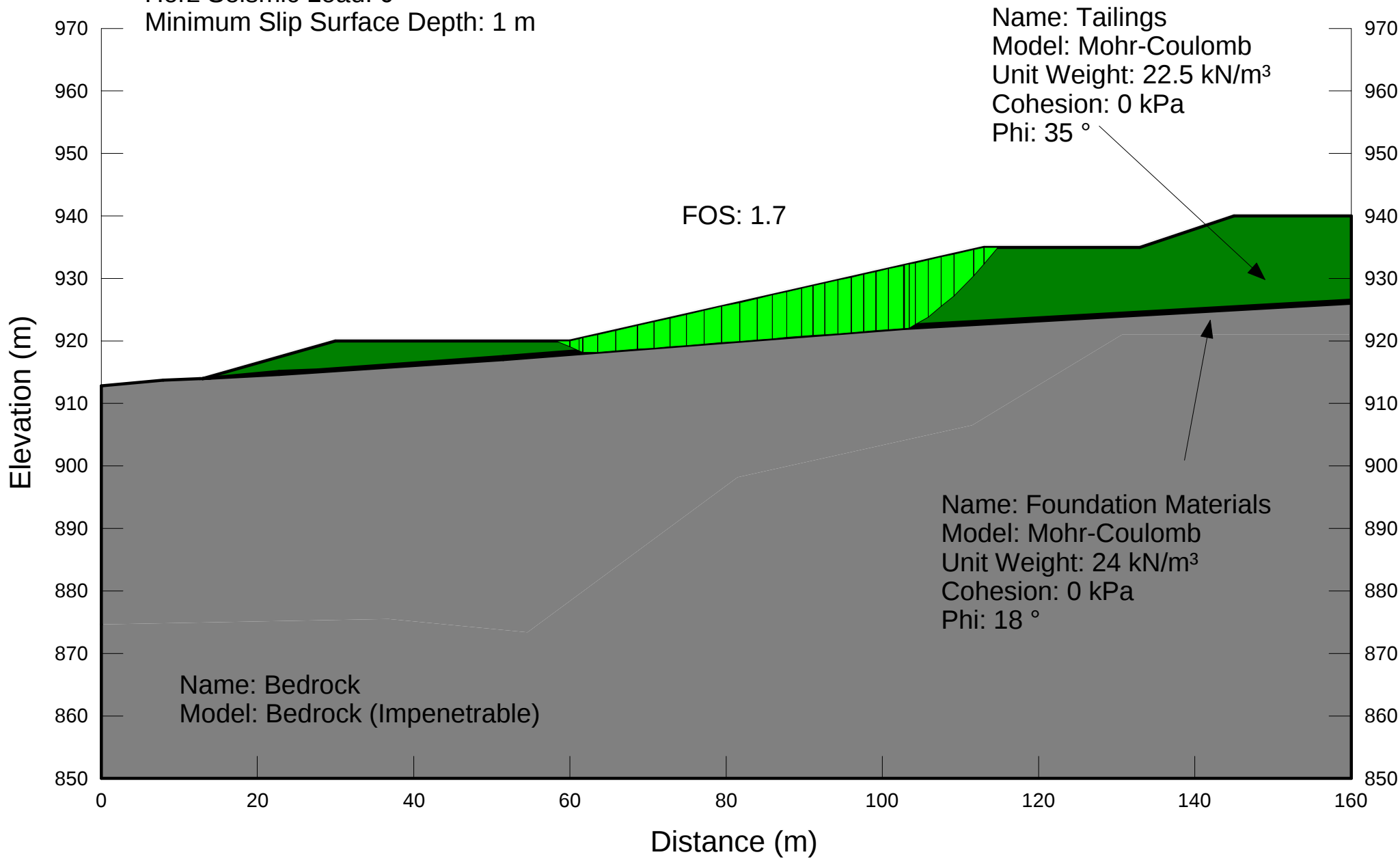
File Name: Section A-A'.gsz  
Name: Keno DSTF Expansion With Geosynthetic Clay Liner Long Term  
Description: Long Term Static  
Method: Morgenstern-Price  
Horz Seismic Load: 0  
Minimum Slip Surface Depth: 1 m



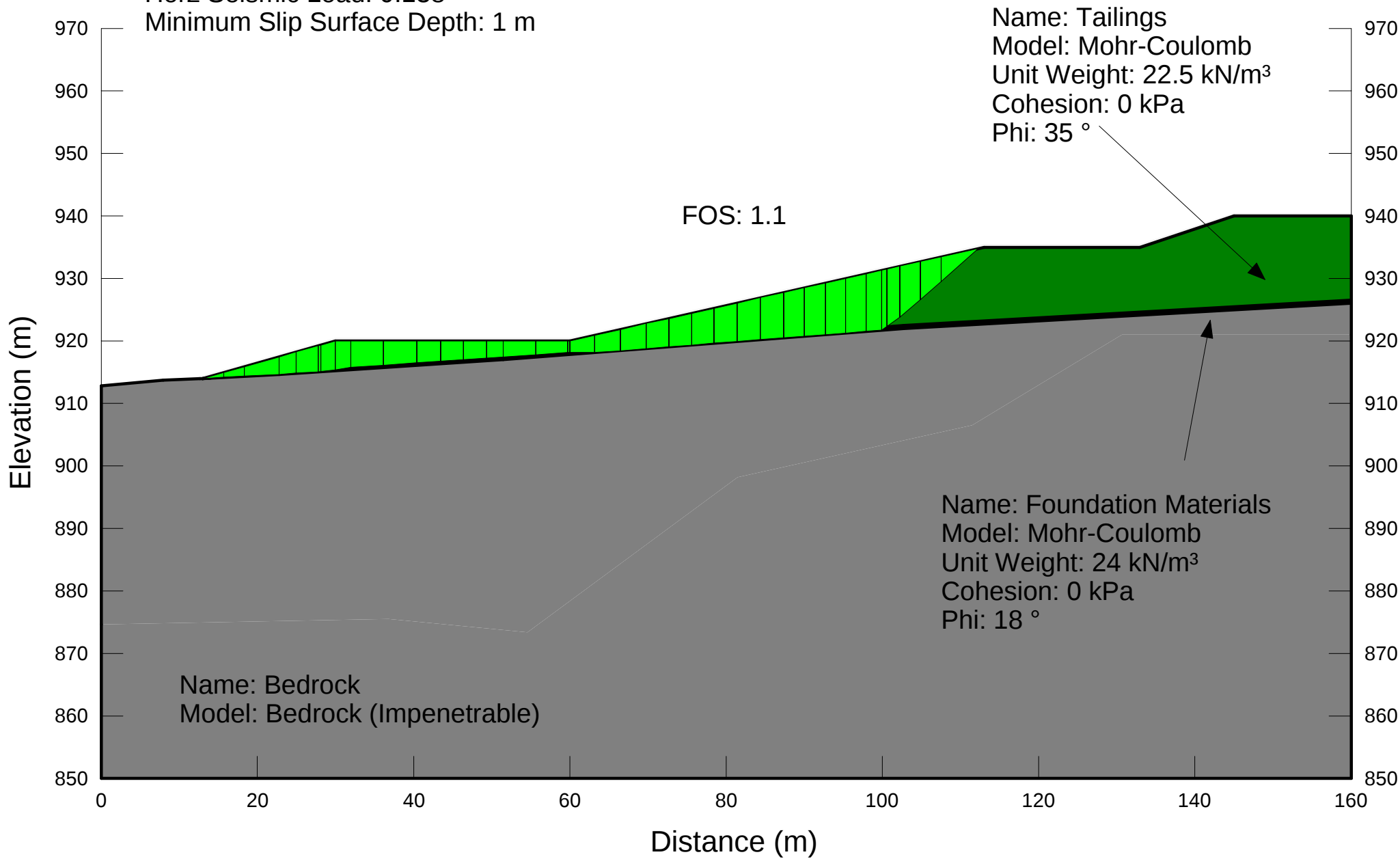
File Name: Section A-A'.gsz  
Name: Keno DSTF Expansion With Geosynthetic Clay Liner Long Term  
Description: Long Term Pseudo-static  
Method: Morgenstern-Price  
Horz Seismic Load: 0.138  
Minimum Slip Surface Depth: 1 m



File Name: Section B-B'.gsz  
Name: Keno DSTF Expansion With Geosynthetic Clay Liner Short Term  
Description: Short Term Static  
Method: Morgenstern-Price  
Horz Seismic Load: 0  
Minimum Slip Surface Depth: 1 m



File Name: Section B-B'.gsz  
Name: Keno DSTF Expansion With Geosynthetic Clay Liner Short Term  
Description: Short Term Pseudo-static  
Method: Morgenstern-Price  
Horz Seismic Load: 0.138  
Minimum Slip Surface Depth: 1 m

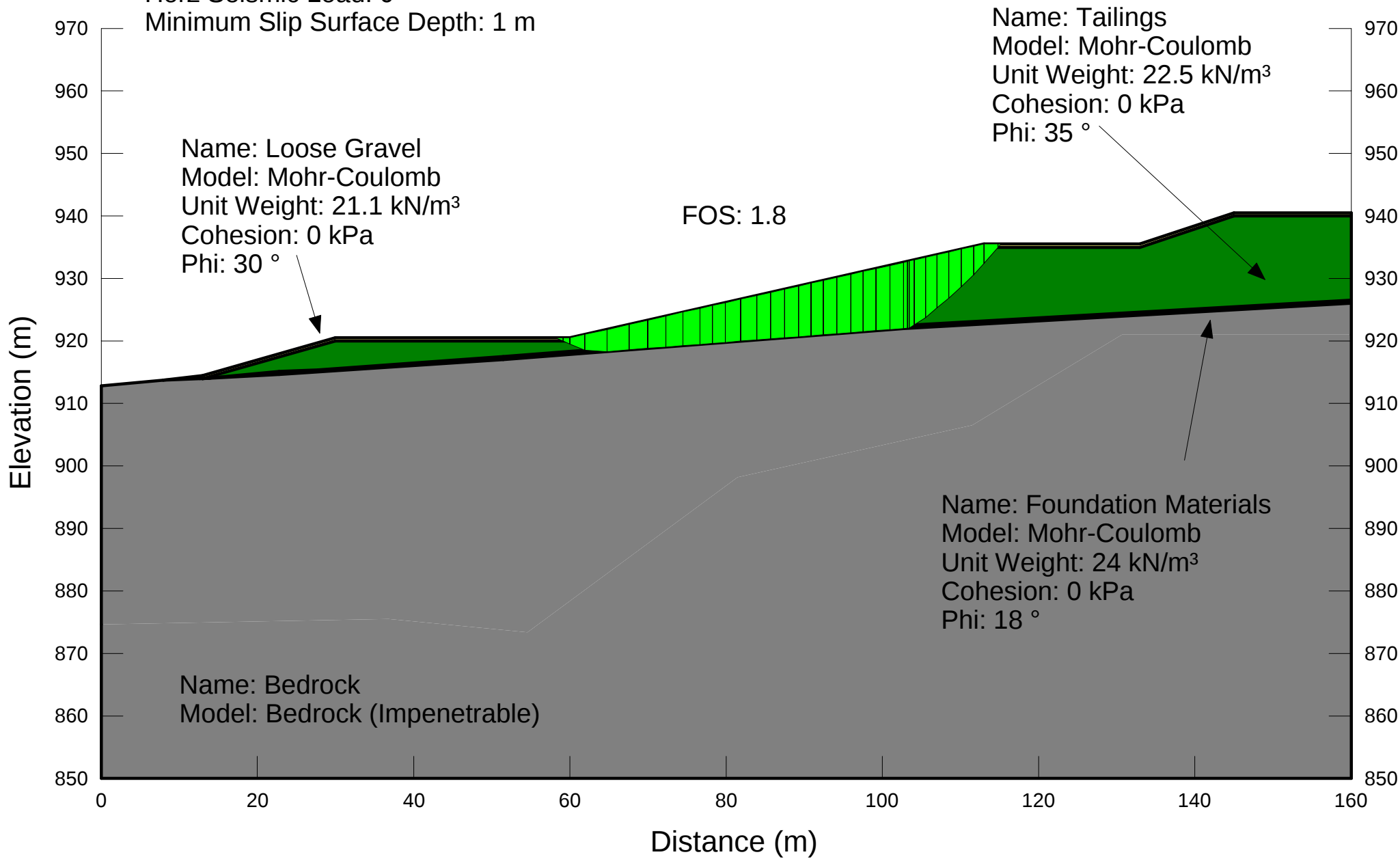


Name: Tailings  
Model: Mohr-Coulomb  
Unit Weight: 22.5 kN/m<sup>3</sup>  
Cohesion: 0 kPa  
Phi: 35 °

Name: Foundation Materials  
Model: Mohr-Coulomb  
Unit Weight: 24 kN/m<sup>3</sup>  
Cohesion: 0 kPa  
Phi: 18 °

Name: Bedrock  
Model: Bedrock (Impenetrable)

File Name: Section B-B'.gsz  
Name: Keno DSTF Expansion With Geosynthetic Clay Liner Long Term  
Description: Long Term Static  
Method: Morgenstern-Price  
Horz Seismic Load: 0  
Minimum Slip Surface Depth: 1 m



File Name: Section B-B'.gsz  
Name: Keno DSTF Expansion With Geosynthetic Clay Liner Long Term  
Description: Long Term Pseudo-static  
Method: Morgenstern-Price  
Horz Seismic Load: 0.138  
Minimum Slip Surface Depth: 1 m

